RELLIS Campus Facility Design Guidelines

RELLIS Campus Administration
The Texas A&M University System

Updated September 2026

REVISIONS TO DESIGN GUIDELINES

Revision #	Date	Location/Section	Notes
1	6/13/2025	Division 27	Modified conduit size requirements for data drops and exterior WAPs.
2	9/1/2026	General	2025 Comprehensive update/rewrite.
2	9/1/2026	Divisions 00/01 – General Requirements	Added reference to SSC EDCS for minor projects. Removed references to specific specification sections and documents and added note to confirm current versions with FP&C or SSC project manager.
2	9/1/2026	Division 04 – Masonry	Updated RELLIS standard brick and stone selections.
2	9/1/2026	Division 07 – Thermal & Moisture Protection	Removed outdated sprayed polyurethane foam roofing guideline spec and added reference to SSC EDCS foam roofing guidelines.
2	9/1/2026	Division 08 – Openings	Added reference to TAMU Building Access hardware/keying standards. Updated RELLIS campus approved glazing products.
2	9/1/2026	Division 10 - Specialties	Relocated exterior campus signage and wayfinding guidelines from Campus Master Plan to this document.
2	9/1/2026	Division 11 – Equipment	Consolidated and relocated audio visual equipment and video surveillance equipment requirements to Divisions 27 and 28, respectively. Added new sections for Food Service Equipment, Vending Equipment, and Appliances.
2	9/1/2026	Division 21 – Fire Suppression	Comprehensive update reviewed in coordination with FP&C Engineering.
2	9/1/2026	Division 22 - Plumbing	Comprehensive update reviewed in coordination with FP&C Engineering.
2	9/1/2026	Division 23 – HVAC	Comprehensive update reviewed in coordination with FP&C Engineering.
2	9/1/2026	Division 26 – Electrical	Comprehensive update reviewed in coordination with FP&C Engineering.
2	9/1/2026	Division 27 – Communications	Comprehensive guideline update reviewed and issued by RELLIS IT.
2	9/1/2026	Division 28 – Fire Alarm	Deleted redundant fire alarm guidelines and added link to TAMU EHS Fire and Life Safety Design Guidelines.
2	9/1/2026	Division 31 – Soil Treatment	Added requirement for chemical termite soil treatment at all slabs-on-void forms.
2	9/1/2026	Division 32 – Exterior Improvements	Added new RELLIS standards for site furnishings and fencing/gates.

2	9/1/2026	Division 32 – Landscaping	Comprehensive guideline update reviewed in coordination with SSC Grounds. Added approved plant list from RELLIS Campus Master Plan.
2	9/1/2026	Division 32 – Irrigation	Comprehensive guideline update reviewed in coordination with SSC Grounds.
2	9/1/2026	Division 33 – Site Utilities	Comprehensive update reviewed in coordination with FP&C Engineering.

INTRODUCTION

GENERAL INFORMATION / APPLICABILITY

The “RELLIS Campus Facility Design Guidelines” are to be used as guidance for the architect/engineer (A/E), construction manager at risk (CMAR), design-builder (D-B), general contractor (GC), and/or related subcontractors (collectively referred to as “the design and construction team”) during the design and construction process for all building projects located on the RELLIS Campus.

This document covers specific design criteria both for new permanent buildings and major renovations or additions to existing buildings. Subsets of this document will also pertain to civil and/or infrastructure type projects.

The information provided in this document is generally prescriptive in nature while attempting to give the design and construction team sufficient latitude to develop creative solutions that represent the best interests of the Texas A&M University System (TAMUS), the RELLIS Campus, and the facility user group. In some cases, specific products or groups of products are referenced when required to maintain consistency of campus appearance and future serviceability.

These guidelines are not intended to prohibit the use of alternative methods, systems, products, or devices not specifically mentioned within. All alternatives shall be documented by the design and construction team and submitted to the assigned Project Manager with either Facilities Planning and Construction (FP&C) or SSC Engineering, Design, and Construction Services (EDCS) for approval by RELLIS Campus Administration prior to implementation.

In the event of conflict between this document and specific project requirements indicated elsewhere, the design and construction team shall contact FP&C or SSC EDCS for clarification.

PROJECT ADMINISTRATION

TAMUS Policy *51.04 General Requirements and Delegations of Authority on Construction Projects* and TAMUS Regulation *51.04.01 Chancellor’s Delegation of Authority on Construction Projects* define thresholds for both major construction projects (scope ≥ $4M in cost) and minor construction projects (scope < $4M in cost) as well as responsibility for administration of these projects.

The System Office of Facilities Planning and Construction (FP&C) administers all projects with scope ≥ $10M in cost and may, at the request of the applicable System Member, administer projects <$10M in cost. Projects <$10M in cost may also be administered by SSC Services, the current TAMUS Building Maintenance Contract Vendor, on behalf of the applicable System Member with facilities located on the RELLIS Campus.

Due to the collaborative nature of the campus as a System level asset, Public Private Partnership (P3) projects may also be located on the RELLIS Campus via ground lease agreements. These guidelines may also apply to P3 projects if or when referenced specifically in the applicable ground lease agreement.

Regardless of whether the project is administered by FP&C or SSC EDCS, the design and construction team shall also refer to items covered in their applicable Services Agreement and in the project's Program of Requirements (POR) or Statement of Work (SOW) if one exists.

CAMPUS CONTEXT

The Texas A&M RELLIS Campus is located on approximately 3,300 acres eight miles from the Texas A&M University main campus in College Station, Texas. RELLIS is a Texas A&M University System (TAMUS) asset focused on education/workforce development and applied research, uniquely enhanced by its ability to connect as a gateway to the greater Texas A&M University System's twelve member universities and eight state agencies.

All development on the RELLIS Campus is governed by the approved RELLIS Campus Master Plan (CMP) in effect at the time of project initiation. Required project review and approval processes are administered by the RELLIS Planning & Design Review Board (PDRB). The PDRB reviews all projects at major design phases including initial land use/site approval, POR development, schematic design, design development, and for confirmation and approval of material selections and mockups during construction. Refer to the separate official RELLIS Procedure RP.4.1 for additional information.

CAMPUS UTILITY INFRASTRUCTURE

Utility infrastructure on the RELLIS Campus has undergone rapid development and improvement since the official rebranding of the campus in 2016. While some portions of the campus are served by new or recently installed utility infrastructure, many areas of the campus are still connected to aging infrastructure dating to the construction of the original Army Airfield base in the 1940's and 1950's.

Texas A&M University Utilities and Energy Services (UES) operates and maintains both the campus Central Utility Plant (CUP) and all utility service distribution lines to buildings within the campus through an intra-system cooperation agreement. RELLIS Campus Administration maintains and updates a Campus Utility Infrastructure Master Plan and continues to plan and execute utility infrastructure upgrade projects in various areas of the campus as needs dictate and funding allows.

Design and construction teams shall coordinate with RELLIS Campus Administration regarding available utilities and capacity prior to and throughout the project design phase. If utilities of sufficient capacity are not available at the specific proposed site, each discrete project shall be required to fund utility upgrades and/or extensions to support its determined need as a part of the base project scope. Refer to division specific sections of this document for more detailed requirements regarding project related extension of or connection to the campus utility infrastructure.

HISTORICALLY UNDERUTILIZED BUSINESS PROGRAM

The Texas A&M University System is committed to promoting the participation of Historically Underutilized Businesses (HUBs) for the procurement of goods and/or services. The procurement

process utilized by TAMUS seeks to provide equal opportunity and equal access in the design and construction opportunities on all projects.

Refer to TAMUS Policy *25.06 Participation by Historically Underutilized Business* and TAMUS Regulation *25.06.01 Historically Underutilized Business Program* for additional information and requirements.

ADDITIONAL LINKS AND REFERENCES

RELLIS Campus Administration
Building 8081
1484 Avenue A
Bryan, TX 77807
(979) 317-3410
http://rellis.tamus.edu

TAMUS Facilities Planning and Construction (FP&C)
Moore-Connally Building
301 Tarrow Street
College Station, TX 77840
(979) 485-7700
https://www.tamus.edu/business/facilities-planning-construction/

SSC Services for Education
Facilities Services Building 1156
600 Agronomy Road
College Station, TX 77843
(979) 845-4311
http://ssc.tamu.edu

- Maintenance
- Custodial
- Grounds
- Engineering, Design and Construction Services (EDCS)

TAMU Utilities and Energy Services (UES)
http://utilities.tamu.edu

- Electricity
- Campus Thermals (Chilled and Heating Water)
- Domestic Water
- Sanitary Sewer
- Storm Drainage
- Solid Waste

Natural Gas Provider – Atmos Energy
http://atmosenergy.com
(888) 286-6700

TAMU Facility Analytics and Mapping (FAM)
https://facilities.tamu.edu/departments-committees/fac-analytics-mapping.html

- 9-1-1 Addressing
- Building Numbering
- Room Numbering
- Facility Space Inventory
- Texas Higher Education Coordinating Board (THECB) Reporting

University Police Department (UPD)
(979) 845-2345
http://upd.tamu.edu

City of Bryan Fire Department
(979) 209-5000
http://www.bryantx.gov/fire

DESIGN PHILOSOPHY

DESIGN QUALITY

The Texas A&M University System (A&M System) is committed to excellence in the design and construction of all facilities on the RELLIS Campus. New projects should seek to create the highest quality of aesthetics while at the same time delivering a project that is cost effective to operate and maintain throughout its useful life.

All buildings shall be designed with flexibility in mind. Over the life of all major campus buildings the functions will change, and the spaces will be reconfigured.

CAMPUS DESIGN STANDARDS

The building design shall follow the guidelines established in the RELLIS Campus Master Plan as well as the guidelines in this document. In the event of a conflict between standards established in the RELLIS Master Plan and this document, the Master Plan shall govern. The master plan document does not outline specific architectural design guidelines, instead the Facility Design Guidelines are intended to serve as these instruments. All design shall blend with campus standards and neighboring buildings. The design shall also conform to neighboring building setbacks, roof lines, etc.

OPERATING & BUILDING MAINTENANCE

Systems and materials incorporated into buildings should be selected on the basis of minimizing long-term operating and maintenance costs. The design should incorporate ease and efficiency of operation and allow for easy and cost-effective maintenance and repair. Standardization of equipment and parts is also the key to reducing maintenance costs. The Project A/E should obtain constant feedback from the RELLIS Administration during design. Detailed instructions from the Project A/E stating the design intent for all building systems and the operating/maintenance procedures are required during the design process.

SUSTAINABILITY & ENERGY PERFORMANCE

The design of all buildings shall incorporate established principles of sustainable design and energy efficiency. Design following these principles improves the building's performance while enhancing the occupant’s health, satisfaction and performance. Sustainable design is an integrated approach in which all phases of the building life cycle are considered. The energy performance of the building should meet or exceed any requirements per applicable codes.

CODES AND STANDARDS

Comply with all state and federal laws applicable to construction. The Project A/E and the Owner's Project Manager shall also cooperate with municipalities when tying into local utilities. Codes shall be those adopted by other state agencies, the Authority Having Jurisdiction (AHJ) or latest edition.

GENERAL REQUIREMENTS

The Project A/E shall design A&M System projects to comply with the current editions of the following codes and standards and advise the Owner of code revisions having impact on the project design.

The State Fire Marshal is the code Authority Having Jurisdiction (AHJ) for all issues pertaining to NFPA 1, Fire Code and 101 Life Safety Codes. Texas A&M University Environmental Health and Safety Department has been delegated the "Local AHJ" for projects on the RELLIS campus. The Owner's Project Manager is responsible for facilitating resolution of conflicts and interpretations after a thorough and joint discussion.

The Project A/E shall prepare a written codes and standards analysis, "Building Code Analysis," for each project for review by the AHJ and the Owner's Project Manager. This analysis shall provide a side-by-side comparison of the requirements of the listed codes and standards. The comparison shall include all code items, and an indication of which code requirement is being applied to the project. In the absence of a careful and thorough discussion by the design team of a specific conflict between the codes, the default is to design to the more stringent or robust code. These code discussions are project-specific and on an item-by-item basis within the codes. The final approved Building Code Analysis shall be included in the construction documents for future reference.

In the event of the need for interpretation among the codes and standards, the Project A/E shall inform the Owner's Project Manager of the need for an interpretation and FP&C or SSC will establish the requirements for compliance.

Local municipal building codes are not applicable to construction on State of Texas properties, which includes all properties owned by The Texas A&M University System. However, if it is necessary for a local authority to review any aspect of the project, such review shall be arranged.

FP&C may also require the Project A/E to comply with certain provisions from the local fire department that provides fire protection services. These provisions may include locations and dimensions for firefighting access, including fire lanes; locations and specifications for standpipes, fire hose cabinets, fire control room, and fire hose connections; elevator requirements; and other similar matters.

The following statement shall be included on the general information page adjacent to the project building code summary:

"Life Safety Code Compliance: The Architect/Engineer of Record acknowledges that construction projects for the Texas A&M University System must, at a minimum, be designed in accordance with the requirements of National Fire Protection Association (NFPA) 101, Life Safety Code, as currently adopted by the State Fire Marshal, Texas Government Code sec. 417.008(e). Therefore, the Architect/Engineer of Record affirms that, to the best of his/her professional judgment,

knowledge, and belief, the design of this project satisfies the requirements of NFPA 101, Life Safety Code, as well as any other codes or standards made applicable to the project by the professional services agreement."

DESIGN BASIS

1. National Fire Protection Association National Fire Codes, with emphasis on NFPA 1 and NFPA 101 - latest edition as identified by "Local AHJ", Life Safety Code (LSC) and including all referenced standards

2. International Building Code - latest edition

ARCHITECTURAL DESIGN

1. NFPA 45 Standard on Fire Protection for Laboratories Using Chemicals as applicable

2. Texas Department of Licensing and Regulation (TDLR)

3. Elimination of Architectural Barriers Act, Article 9102, Texas Civil Statutes and Texas Accessibility Standards (TAS)

4. Elevators and Escalators, Health & Safety Code chapter 754 and 16TAC § 74

5. ASME 17.1, 17.2, 17.3 and 18.1

6. Boilers, Health & Safety Code chapter 755 and 16TAC § 65

7. ASME Boiler and Pressure Vessel Code

8. Americans with Disabilities Act, 28 CFR Part 35 Nondiscrimination on the Basis of Disability in State and Local Government Services, Final Rule, as published in the Federal Register Friday, July 26, 1991

9. Fair Housing Act accessibility requirements for housing units.

CIVIL/STRUCTURAL DESIGN

1. ACI – 318, building code requirements for reinforced concrete

2. AISC, specification for the Design, Fabrication and Erection of Structural Steel

3. Texas Department of Insurance wind load criteria

4. FEMA 100-year flood plain designation

5. TCEQ SWPPP Requirements

6. TCEQ Water (290) and Sewer (217) Requirements

MECHANICAL AND PLUMBING DESIGN

1. International Mechanical Code latest edition
2. International Plumbing Code latest edition
3. NFPA 54 latest edition
4. ASHRAE 62.1 Indoor Air Quality Standard
5. Reference the POR for user designated Disposal Requirements and policies of Environmental Health and Safety.

ELECTRICAL DESIGN

1. National Electric Code latest edition
2. National Electrical Contractors Association Standards latest edition
3. Institute of Electrical and Electronic Engineers Standards latest edition

COMMUNICATIONS DESIGN

1. TIA/EIA Standards

ENERGY AND WATER CONSERVATION DESIGN

1. Energy Conservation Design Standard for New State Buildings (including major renovation projects), State Comptroller's Office, Government Code sec. 447.004 and 34 TAC § 19.32
2. ASHRAE / IESNA 90.1 latest adopted Edition
3. International Energy Conservation Code (IECC) latest adopted edition (Residential/ Apartments)
4. SECO Alternative Energy Evaluation Requirements
5. SECO Water Efficiency Standards for State Buildings and Institutions of Higher Education Facilities

ACOUSTIC DESIGN

Design in accordance with good practice to achieve conventional ambient noise levels qualified in Noise Criteria (NC) defined in current ASHRAE Applications Volume, Chapter 48 and ANSI S1.8 Reference Quantities for Acoustical Levels.

The ambient sound level of an occupied space is not to exceed the following NC listed for its respective typical occupancy unless specifically directed otherwise by the System Member representative or the project Program of Requirements (POR). Spatial forms, materials, assemblies, systems, and equipment selections are to be designed as required to achieve a standard quality level of maximum background noise. Key adjacencies are to be studied to provide levels of sound isolation for floor to floor and room to room. Continuous background noise from building systems will need to be evaluated for effects on speech, privacy, and occupant comfort. Transient noise events from occupant activities, corridor traffic, and impacts need to be considered regarding disturbance, distraction, and annoyance.

Typical Occupancy	Maximum Noise Criteria (NC)
Apartments/Dorms	
Individual Rooms/Suites	35
Meeting/Banquet Rooms	35
Halls, Corridors and Lobbies	40
Service/Support Areas	45
Office/Administrative	
Offices	30
Conference Rooms	30
Open Plan Areas	40
Business Machine Areas	45
Public Circulation	45
Research, Hospital and Clinics	
Private Rooms	30
Wards	35
Operating Rooms	25
Research Laboratories	35
Teaching Laboratories	30
Corridors	35
Public Areas	40
Lecture and Classrooms	30

These conventional standards of the level of ambient noise in a space are independent of and prior to the installation of any Owner-furnished equipment, furniture and furnishings unless specified otherwise.

ACCESSIBILITY REVIEW

The Project A/E is required to submit sealed documents for an accessibility review. The required review should be accomplished by a Registered Accessibility Specialist located near the project site. The same Registered Accessibility Specialist (RAS) will be utilized for the plan review and the post construction inspection.

OTHER REQUIREMENTS

The A/E will be required to secure permits from state and federal government agencies, when necessary, such as Texas Department of Highways and Public Transportation, Health Department, etc. The cost of any permits will be borne by the Owner.

The Project A/E will complete and submit the Energy Conservation Design Standard Certification form for Nonresidential Buildings and compliance forms required by SECO as part of the required Energy Report to the FP&C or SSC Project Manager.

ENVIRONMENTAL PRACTICES

SUSTAINABLE DESIGN

The design shall employ sustainable design principles based on LEED (latest edition) as established by the U.S. Green Building Council. Specifically employ those principles pertaining to energy and water conservation and indoor environmental quality. Refer to the project POR to determine if the building shall be certified through the U.S. Green Building Council. The A/E shall prepare a checklist to determine the theoretical level of certification. The A/E is responsible for updating this checklist and providing updates at project milestones to the project team. These updates shall include explanations of the point changes. All buildings shall be designed to maximize daylighting, maximize human comfort and minimize energy use.

DAYLIGHTING

In order to maintain a relationship between the building occupants and the outdoors, direct views of the outside should be provided for most of the regularly occupied areas unless the needs of the spaces dictate otherwise. The building design should strive to provide outside views for 100% of all offices in the building.

BUILDING MATERIALS

Wherever possible, products and materials with recycled-content and no volatile organic compounds (VOC) should be specified in the building design.

COMMISIONING

All building projects shall employ commissioning practices to assure delivery of program goals and related performance requirements. The Project A/E shall coordinate commissioning practices with the Owner’s Project Manager, Utility & Energy Services, the Commissioning Authority (if contracted separately) and the Contractor (if the delivery method is construction manager at risk or design-build) during design.

LIFE CYCLE COST ANALYSIS (LCCA)

PURPOSE

The Texas A&M University System has a long tradition of designing and constructing high-quality buildings. Continuing this tradition, the RELLIS Campus seeks to ensure that all buildings meet student, faculty, and staff needs as efficiently and cost effectively as possible. Cost effectiveness of a design is therefore a key component and Life Cycle Cost Analysis (LCCA) is a design process for evaluating and controlling the initial and future cost of building ownership. Life Cycle Cost Analysis (LCCA) is defined by the National Institute of Standards and Technology (NIST) Handbook 135 as the total discounted dollar cost of owning, operating, maintaining, and disposing of a building or building system over a period of time.

LCCA is based on the premise that multiple building design options can meet programmatic needs and achieve acceptable performance, and that these options have differing initial costs, operating costs, maintenance costs, as well as different life cycle costs. By comparing the life cycle costs, LCCA can show the trade-offs between low initial first cost and long-term cost savings. Thus, the most cost-effective system for a given use can be identified, and the length of time it will take to "pay back" the incremental cost for this system can also be determined. In keeping with the A&M System's sustainability practices, LCCA can identify environmentally desirable solutions. Careful design choices that result in efficient use of energy, water and other resources often yield long-term cost savings. In addition, if environmentally friendly choices do not save money over time, LCCA may reveal that their additional cost over time is minimal. These guidelines define the LCCA process and establish the standards and metrics to ensure accurate and consistent life cycle data collection and evaluation across projects.

GENERAL REQUIREMENTS

During the Schematic Design (SD) and Design Development (DD) phases of a project, the A/E is required to perform a minimum of three (3) LCCA comparative analyses from several building system categories. Two of the three analyses shall relate to energy conservation. Each LCCA comparative analysis can have up to four alternatives (one base case plus three alternate cases). Building system categories are as follows, but are not limited to:

Energy Systems

1. Central plant vs. stand-alone chillers and boilers
2. Equipment options for stand-alone systems (air cooled chillers vs. refrigerant-based direct expansion [DX] units)
3. Additional pipe or duct insulation
4. Alternative energy systems
5. Use of heat recovery systems and other energy saving systems and equipment

Mechanical Systems

1. Air distribution systems (variable volume vs. constant volume, overhead vs. underfloor)
2. Water distribution systems (various piping systems and pumping options)

Electrical Systems

1. Indoor lighting sources and controls
2. Use of natural lighting and daylighting controls
3. Outdoor lighting sources and controls
4. Power distribution (transformers, bus ducts, power-factor correction systems)
5. Alternate/redundant power systems (Central UPS, Emergency generator)

Building Envelope Systems

1. Building skin options (masonry, precast, metal panels)
2. Additional building insulation
3. Roofing systems (types, materials, insulation methods)
4. Glazing, daylight, and shading options

Building Interior Construction

1. Floor covering (carpet, terrazzo, tile, vinyl tile)
2. Interior partitions (movable vs. fixed)

Building Siting/Massing

1. Orientation, floor to floor height, and overall building height
2. Landscape, irrigation, and hardscape options

Structural Systems

1. Systems/materials selection (wood vs. steel vs. concrete, cast-in-place vs. pre-cast)
2. Foundation system (slab on grade, structural, crawl space, drilled piers, auger cast, pilings, spread footings)

SELECTING COST EFFECTIVE ALTERNATIVES

Alternatives that result in a payback of 5 years or less should be incorporated into the project. Alternatives that result in a payback of 6 to 10 years are strongly encouraged to be incorporated into the project. Alternatives with a payback greater than 10 years are optional. RELLIS Administration has final decision on alternatives selection.

LCCA SOFTWARE

Project A/E shall use either of the following software programs for LCCA analysis:

- BLCC: available online from NIST
- User Friendly Life-Cycle Costing: A spreadsheet implementation of BLCC available online from Department of Energy

THE LCCA PROCESS

The LCCA process involves the Project A/E, Owner's Representative, and the User Coordinator (Project Team) and requires that they establish clear objectives, determine the criteria for evaluating alternatives, identify and develop design alternatives, gather cost information, and develop a life cycle cost for each alternative.

The Project Team should establish clear objectives in evaluating alternatives. LCCA can capture dollar cost variations between alternatives and show which option has the overall lowest cost.

The two metrics to be used and calculated in the LCCA are the Life Cycle Cost of each alternative and its payback over an agreed upon study life. Consideration is given to total costs and the time it takes to recover an incremental initial investment incorporating the time value of money. As mentioned above, Life Cycle Cost is defined as the total discounted dollar cost of owning, operating, maintaining, and disposing of a building or building system over a period of time.

The Project Team should develop up to four alternative designs. The first alternative design is the "base case" and is the standard design or minimum requirement for a project. The base case is typically identified as having the lowest initial cost of all the alternatives. The remaining three alternative designs are developed to evaluate against the "base case." The Project Team should use their experiences and judgment in selecting relevant building and system component alternative designs.

For each alternative design, the Project A/E should gather cost information. Cost information should include, but not be limited to, the following:

Initial Costs

1. Construction costs (labor, materials, equipment, etc.)
2. Soft costs (design fees, permit fees, etc.).

Annual Future Costs

1. Operating Costs (utility costs such as electricity, gas, water, steam, chilled water, etc. and service costs such as custodial, etc.)

2. Maintenance Costs (preventative and reactive)

Non-Annual Future Costs

1. Replacement Costs (planned maintenance, renovation at a future date, etc.)

2. Demolition Costs (if required)

Note: Residual Value default is set at zero ($0) for all studies and not included in LCCA unless otherwise directed.

For each alternative, including the base case, the Project A/E should calculate the LCC and payback metrics. Each alternative should be evaluated using these two metrics, and recommendations should be made as to which alternative design should be incorporated into the project.

All LCCA efforts should be completed in the Design Development phase of the project. If the design changes during Construction Documents the LCCA shall be modified to reflect the change.

BUILDING ELEMENTS LIFESPAN

	Institutional	Commercial	Apartments
Structural Foundation	80 yrs		
Slab on Grade Foundation		50 yrs	30 yrs
Subgrade Waterproofing/Drainage	40 yrs		
Building Structure	80 yrs	50 yrs	30 yrs
Exterior Walls	80 yrs	50 yrs	30 yrs
Exterior Windows	40 yrs	40 yrs	30 yrs
Exterior Doors	40 yrs	40 yrs	30 yrs
Roofing	20 yrs	20 yrs	20 yrs
Interior Partitions	20 yrs	15 yrs	15 yrs
Interior Doors	20 yrs	20 yrs	15 yrs
Interior Finishes	15 yrs	10 yrs	5 yrs
Elevators	25 yrs	20 yrs	20 yrs
Equipment	25 yrs	20 yrs	15 yrs
Furnishings	20 yrs	15 yrs	10 yrs
Plumbing Rough-in	80 yrs	50 yrs	30 yrs
Plumbing Fixtures	30 yrs	30 yrs	30 yrs
HVAC Boilers/Chillers	30 yrs	30 yrs	15 yrs
HVAC Equipment	20 yrs	20 yrs	15 yrs
HVAC Distribution	40 yrs	40 yrs	30 yrs
Fire Protection System	40 yrs	40 yrs	30 yrs
Fire Detection System	20 yrs	20 yrs	20 yrs
Electrical Medium Voltage Equipment	30 yrs	30 yrs	30 yrs
Electrical Duct Bank	80 yrs	80 yrs	80 yrs
Low Voltage Electrical Rough-in	80 yrs	50 yrs	30 yrs
Low Voltage Electrical Equipment	30 yrs	30 yrs	30 yrs
Lighting	30 yrs	30 yrs	20 yrs
Communications	20 yrs	20 yrs	15 yrs

Institutional – Permanent campus buildings

Commercial – Non-educational support buildings or developer buildings

Apartments - Wood frame student housing

SPACE STANDARDS

CALCULATION OF BUILDING AREAS

The method used to calculate the assignable square feet and gross square feet in a building is based on guidelines from The Texas Higher Education Coordinating Board (THECB). These guidelines are intended to establish common standards for building inventory for all state institutions of higher education. In large part these guidelines are also based on those from the U.S. Department of Education, National Center for Education Statistics.

Gross area should be computed by measuring from the outside face of exterior walls, disregarding cornices, pilasters, buttresses, etc., which extend beyond the wall face. The gross area includes all floor spaces from ground level through top floor. It includes basements (except unexcavated portions), attics, garages, enclosed porches, penthouses, mechanical equipment floors, lobbies, mezzanines, balconies (inside and outside) utilized for operational functions, and corridors (provided they are within the outside face lines of the building).

The sum of floor areas of a building included within the exterior walls for all stories or areas that house floor surfaces including attics, basements, sub-basements, penthouses, mechanical rooms, etc. These are areas with six-foot six-inch clear headroom or areas with lower ceilings that are usable for storage or other purposes.

Gross area does not include open courts and light wells, or portions of upper floors eliminated by rooms or lobbies which rise above single floor ceiling height.

Net Assignable Area is defined as the sum of all areas within the interior walls of rooms on all floors of a building assigned to or available for assignment to an occupant or use, excluding unassignable space.

Unassignable area of a building is the sum of space within a building not assigned to directly support academic programs. Included in this are building support areas used for protection, care and maintenance of a building, circulation areas such as corridors and stairwells, mechanical areas which are designed to house mechanical equipment, utility services and shaft areas, inactive areas in a building that once were assignable but are permanently no longer in use, shell space or unfinished space designed to be converted into usable space at a later date, and public restrooms.

Additional information can be found on the THECB website: https://www.highered.texas.gov/.

BUILDING CORE ELEMENTS

FINISH FLOOR ELEVATION

The finish floor elevation of all new buildings where possible shall be equivalent to the 500-yr predicted flood elevations, plus 2ft. (FEMA flood level predictions are based on a statistical average, with standard deviation of +/-2ft).

Where new buildings cannot be located above the 500-yr or 500-yr +2ft flood levels, the finish floor elevation shall at least 1 to 2 feet above the 100-yr flood elevation, and high-value equipment, ornate interior finishes and critical operations or research laboratories should be located on a level above the 500-yr +2ft flood elevations.

The storm-water management system shall use grading and drainage sufficient to route predicted stormwater for the 100-yr, 24-hr rainfall event. The system should primarily rely on grading to direct water away from the building, with limited reliance on storm-water drainage systems directly adjacent to building openings or outside equipment. Building designs with below-grade spaces such as basements, service tunnels, etc. are discouraged in areas subject to flooding. Should below-grade service areas or basements be required, they should not have openings located below the 500-yr +2ft in areas subject to flooding, or below grade of the surrounding terrain in areas not subject to flooding.

BUILDING ENTRANCES

At main entry points to a building, it is recommended to provide a vestibule that performs as an air lock and have walk-off mats acceptable to the RELLIS Administration. Weather protection must also be provided for the exterior doors at a minimum this shall consist of door sweeps, weather seals at the door head and jambs, drips at the bottom of the door, and overhead rain drips above the door that extend at least 8” beyond the jambs of the door.

BUILDING CIRCULATION

The building circulation system (corridors) should be clearly designed to lead building occupants from entrances to their destination. It is desirable to introduce as much natural light as possible into corridors, through windows, transoms or borrowed light. Utility systems should be routed in circulation pathways to provide access to utilities without disrupting occupied spaces.

Doors on opposite sides of corridors shall be offset to prevent direct viewing from one room to another. Classroom and laboratory doors opening into corridors shall be recessed the width of the door to eliminate corridor obstructions.

Building corridors are to have sufficient above ceiling space to accommodate all the required equipment and provide maintenance access and code required clearances to that equipment. The A/E shall establish and distribute for review the above ceiling stratification. The A/E shall also establish routing strategies for equipment that may run at the same elevation in the ceiling plenum on opposite sides of the corridor.

The A/E shall model clearances required for all above ceiling equipment for coordination purposes and perform clash detection as part of the BIM Execution plan.

CRAWL SPACE UNDER SUSPENDED STRUCTURAL FOUNDATIONS

Where plumbing access or future flexibility is required provide an accessible crawl space with 2 inch thick, 2500 psi unreinforced mud slab, properly sloped and drained. Crawl space must be provided with lighting, weatherproof electrical outlets, and code minimum ventilation along with adequately sized access hatches and access ladders. Access to the crawl can be through floor hatches in the mechanical room or an area way on the perimeter of the building. Access shall not be through electrical rooms, telecommunications rooms, or custodial rooms. Switches for crawl space lighting shall be located near access hatches so that the lighting can be turned on prior to entry. The minimum clearance in crawl space shall be determined by RELLIS Administration and the crawl space shall maintain negative pressure relative to the first floor. Provide staged drainage pump systems with audible alarm and visual strobe. The alarm equipment will be located outside of the crawl space and in the ground floor area where it can be monitored.

EGRESS STAIRS

The location and design of egress stairs within buildings should encourage their use for everyday vertical circulation. Magnetic door hold open devices, interconnected to the building fire alarm system, are allowed to keep interior doors to egress stairs in an open position to encourage their use.

EQUIPMENT ROOMS

All mechanical and electrical equipment rooms must be designed with adequate aisle space and clearances around equipment to accommodate maintenance from the floor and replacement of items. There must be a defined pathway from all equipment rooms to the building exterior of adequate size to permit the replacement of equipment. Means of removal of equipment shall be by the most cost-efficient path approved by RELLIS Administration. Include emergency lighting and adequate infrastructure for onsite maintenance. Plans and elevations for all equipment rooms, at a scale not less than 1/4” = 1’-0”, shall be prepared for each room to indicate that adequate circulation and maintenance areas are provided. The A/E shall model all required clearances and pulls required for maintenance and repair of equipment for coordination purposes. All equipment rooms must be designed to control noise transmission to adjacent spaces including corridors. Depress the floor of all mechanical rooms 1-1/2 inches and uniformly slope the entire floor to minimum 4-inch floor drains connected to the building sanitary sewer system.

ELECTRICAL ROOMS AND CLOSETS

Electrical closets must be designed so that three walls stack vertically and NO wall is centered on a structural beam that would interfere with vertical risers. Do not route building utilities capable of conveying liquids through or above electrical rooms. The only exception allowed is the branch sprinkler line serving only the sprinkler head in an electrical closet, do not route above electrical equipment. Provide at least one room per floor.

MAIN AND EMERGENCY ELECTRICAL ROOM

The main and emergency electrical rooms for a building should be located on the ground floor. It shall never be located below restrooms, custodial closets or at an elevation that requires sump pumps for drainage. The layout of the room shall comply with the National Electric Code requirements for minimum clearances. The rooms shall have a 2-hour firewall rating. The Texas State Fire Marshal's Office has interpreted the non-sprinkled allowance of NFPA 13 to be applicable ONLY to the main electrical room and the emergency electrical room. Access to electrical closets must be from within the building from the corridor system and not through any other space. Door should open out from space to provide unhindered egress.

COMMUNICATION CLOSETS

Communication closets must be designed so that all four walls stack vertically and NO wall is centered on a structural beam that would interfere with vertical risers. Communication closets must be provided on each floor and located such that no wiring run exceeds 270 feet. Access to communication closets must be from within the building from the corridor system and not through any other space. Door should open out from space to maximize usable interior floor and wall area.

AIR HANDLER ROOMS

Air Handler rooms should be designed so that they stack vertically and NO wall is centered on a structural beam that would interfere with vertical risers. The spaces must be arranged and sized to provide maintenance staff with safe access to all pieces of equipment for routine maintenance. Access to air handler rooms must be from within the building from the corridor system and not through any other space. Door should open out from space to maximize usable interior floor and wall area. Provide a minimum of 2 feet clearance on two sides and one end of the air handlers. Provide clearance for removing coils and filters completely. These clearances shall be modeled for coordination purposes. Air handler rooms shall be reviewed for locations for adjacencies to sensitive sound areas.

REST ROOMS

Rest rooms must be located on each floor and should be located within 200 feet of every occupied space. Rest rooms should be grouped with custodial closets for ease of maintenance and to reduce plumbing runs. Rest rooms should be sized to accommodate a minimum fixture count determined by the International Plumbing Code (IPC) and accessibility based on the Texas Accessibility Standards. Rest rooms serving assembly areas must accommodate short-term, high-volume traffic and will require higher fixture counts. Either the built-in trash receptacle shall be located adjacent to the restroom door or there shall be floor space available next to the door for the placement of a large trash can. Direct or reflected lines of sight into restrooms and dressing rooms from the corridor are prohibited.

Provide at least one accessible family restroom containing one water closet, one lavatory and a diaper changing station. Location should be adjacent to the building entrance or elevator lobby on the first floor.

LOADING DOCK

The loading dock and service yard is desired to be screened from major streets and views. Refer to the POR and RELLIS Administration for specific requirements for loading dock and whether it shall be raised. Provide at a minimum one 120 volt GFCI outlet with weathertight box and cover. Provide at a minimum 1-3/4" Hose Bib. Locate these items on the Loading Dock exterior wall. Verify location with the RELLIS Administration. The A/E design team should confirm adequate delivery and truck turning access required to support the building.

TRASH DUMPSTERS/TRASH COMPACTORS

Provide a concrete pad either in the loading dock service yard or a separate screened enclosure for trash dumpsters. Refer to the POR for any specific requirements for dumpsters or the need for a compactor. Refer to UES for the type of dumpsters used, access requirements, and any other equipment or area requirements that may be needed for the equipment.

CUSTODIAL CLOSETS

Should consist of 80 sq. ft. minimum floor space, include shelf, mop sink and hand operated eye wash. The minimum clear width of a custodial closet is six feet. A closet of this size can serve a floor area up to 50,000 gross square feet (gsf). Building designs with floor areas larger than 50,000 gsf shall require more than one custodial closet per floor. Door should open out from the closet to maximize usable interior floor and wall area. Custodial closets shall not have telephone, cable television, data, mechanical or electrical cables or equipment in them nor roof or under floor access through it. The custodial closet should be located near the restrooms on each floor.

Custodial closet shall contain the following (or as determined):

1. Standard 2'x2'x8" floor corner mounted mop sink located close to door.
2. Wall surface materials around the mop sink must be moisture resistant, FRP is recommended.
3. Provide six mop hangers, above the mop sink and twelve mop and broom hangers along the wall near the mop sink. If the mop hanger has an integrated shelf, it should be mounted 72 inches minimum above finish floor.
4. Provide shelving on one side wall, at least four 12” shelves 16" to 18" apart with the bottom one being mounted approximately two feet above the floor. Adjustable heavy duty shelving systems are acceptable.
5. Overhead lighting controlled from the switch just inside the door.
6. One electrical duplex outlet on each side wall. Use GFI outlets where required by code when placed near a water source.
7. Wall hung lavatory near the door with handheld eye wash.

SERVER ROOM REQUIREMENTS

Server Rooms have unique requirements depending on the building type and equipment application. Confirm all server room requirements with the RELLIS IT department during design.

FLOOR AND SPACE IDENTIFICATION ON DRAWINGS

Each space shall be identified by name and room number as identified in the POR or as agreed to by the Owner's Project Manager and the User Coordinator.

Coordinate room numbers with RELLIS Administration and the TAMU Office of Facility Analytics and Mapping (FAM) during design utilizing their latest available guidelines. Obtain approval no later than at the Design Development stage. Room numbers used in the Construction Documents will become the actual and permanent space numbers.

All equipment placed in or above a space shall use the space and floor number as identifying parametric data.

ASSIGNMENT OF FLOOR NUMBERS

The floor level containing the primary entrance shall be considered the First Floor and shall be numbered in the 100 series; the floor above being the Second Floor shall be numbered in the 200 series. Third and subsequent floors shall be numbered in a similar manner. Basement level shall be numbered 001 series.

ASSIGNMENT OF ROOM NUMBERS

The rooms on each floor opening to either side of a corridor shall be numbered consecutively in a clockwise direction from the primary entrance which shall be 100. If there is more than one main entrance to the building use the one mutually agreed to by the Owner's Project Manager and the User Coordinator.

Rooms and spaces not opening to a corridor shall carry the room number of the connecting room with an additional suffix letter (108A, B, C, etc.). Letter clockwise, if more than one room is involved.

Interior corridors are not numbered with room sequence; instead use Hall 1, Hall 2. This also applies for Stairs (such as 1S1 and 2nd level 2S1) and Elevators, Mechanical, Electrical, Data (Ex: 1M1). Rooms that have no internal access are not numbered from the interior corridor.

Exterior stairs shall use (open) XS1, XS2, etc.

Restrooms designator includes gender or gender neutral. "R" - (Ex: M101 for Men's Level 1) Lactation Room - (Ex: L101)

DESIGN PROCESS

GENERAL

The System Office of Facilities Planning and Construction (FP&C) administers all projects with scope ≥ $10M in cost and may, at the request of the applicable System Member, administer projects <$10M in cost. Projects <$10M in cost may also be administered by SSC Services, the current TAMUS Building Maintenance Contract Vendor, on behalf of the applicable System Member with facilities located on the RELLIS Campus.

Throughout the design and construction process, project teams are required to utilize the Owner's Project Management Information Systems. Both FP&C and SSC maintain separate implementations of eBuilder software by Trimble Systems. Consult with either the FP&C or SSC assigned project manager for current software specific processes and requirements. Training for eBuilder is available through the assigned project manager.

COLLABORATIVE DESIGN

Representatives from all parties involved in the design and construction of the project, the Architect/Engineer team, the Contractor team, the System member, the RELLIS Campus representatives, and the FP&C or SSC team are expected to work very collaboratively and openly sharing information, including but not limited to BIMs, knowledge and experience from the beginning of Schematic Design through the completion of construction. Representatives from all teams and all disciplines are expected to attend and actively participate in all design meetings.

RELLIS PLANNING AND DESIGN REVIEW BOARD (PDRB)

All development on the RELLIS Campus is governed by the approved RELLIS Campus Master Plan (CMP) in effect at the time of project initiation. Required project review and approval processes are administered by the RELLIS Planning & Design Review Board (PDRB). The PDRB reviews all projects at major design phases including initial land use/site approval, POR development, schematic design, design development, and for confirmation and approval of material selections and mockups during construction. Refer to the separate official RELLIS Procedure RP.4.1 for additional information.

CORRESPONDENCE AND REPORTS

The Project Architect/Engineer is expected to provide leadership of all design meetings and provide minutes of each meeting within five (5) working days. The meeting minutes shall separately indicate all decisions made at the meeting and all items requiring a decision, which party has responsibility for the decision and when the decision is required.

Communications between all parties involved in the planning and construction of a project is a requisite. All meeting minutes shall be saved in the appropriate location within eBuilder.

DRAWING/MODELING REQUIREMENTS

The Project A/E shall produce the design for all projects on the RELLIS Campus using Building Information Model (BIM) authoring software capable of producing IFC compliant files. It is understood that there may be some minor renovation and/or civil infrastructure projects where BIM modeling may be overly burdensome based on the limited scope of work, however, waiver of the requirement to utilize BIM software may only be granted with prior written approval from RELLIS Administration. The Project A/E shall begin using BIM as early in the design process as possible but no later than the drawings required for Design Development submittal. The A/E is encouraged to use BIM to verify compliance with the POR.

Use only the standard fonts supplied with the Microsoft Windows OS. On all drawings, provide a graphic scale in addition to the standard inch scale. On all plan sheets provide a north arrow and if a plan is divided over multiple sheets provide a key plan adjacent to the sheet number in the title block. Do not use the word "PROPOSED" in designating new work. All work shown on drawings shall be assumed to be new unless designated as existing.

Both FP&C and SSC managed projects have specific requirements for sheet numbering format, discipline designations, sheet types, title blocks, cover sheets, etc. Consult with the FP&C or SSC project manager for most current documentation guidelines applicable at the time of project design.

Detailing shall be adequate, with sufficient schedules, keys to materials, symbols and notes shall clearly indicate the work required. Abbreviations shall be held to a minimum. All schedules shall be derived from the BIM(s) by extracting parametric data associated with the objects used in the model. All required details will be shown on the drawings, not in a separate manual. All references to other disciplines shall indicate the appropriate sheet and detail. Room finish, door, and window schedules shall be on the drawings.

All of the Project A/E’s subconsultants shall also produce BIM models for their related discipline(s). The A/E shall work with the owner's team to set the stratification of equipment in the ceiling plenum. All equipment that requires access after construction is complete shall have the required clearance modeled along with the equipment. All equipment shall be named using an easily identifiable naming standard such as those set forth in the National CAD Standard V4.0. For instance, an air handler unit's family or object name should start out with something like AHU then go into more description.

Equipment objects shall have the minimum parametric attributes:

- Location, that is room number in which or above which the piece of equipment is located.

- Manufacturer, at the beginning of the project this is the basis of design manufacturer established by the A/E. In a CMAR project the CM may help to establish the manufacturer that is most likely to be used. This information shall be updated by the CM and its subs.

- Model number based on design intent set by the A/E at the beginning of the project and finalized by the CM at the end of the project.

- Any pertinent design criteria such as CFM, voltage, watts, volume, velocity, etc. This again is information that shall be updated by the CM and its subs and later by the commissioning (Cx) team.

All project schedules shall be linked to the model and be generated using parametric data from objects in the model. This link shall remain throughout the project.

Basic sun shading analysis shall be used to aid in the siting and massing of buildings to help produce efficient buildings that respond to the demands of their geographic location.

The MEP consultant is required to have a person that is responsible for the coordination and design of the various disciplines at coordination meetings, not just one overall project manager.

The models should be used to generate quick images for use in explaining the spaces to the clients. Elaborate renderings are not always required.

Electrical panelboard schedules shall list all unique characteristics of each panelboard including but not limited to each breaker size, the loading of each circuit, circuit number, wire size, main breaker size, bussing, interrupt rating, load summary and all panel nameplate data. Schedules that list quantities of breakers without scheduling each circuit shall not be used. All of this data shall be attached to the associated objects as parametric data. All panelboards, switchboards, transformers and other major electrical equipment shall have a unique identifier or tag.

Electrical one-line diagram shall show in a one-line format all medium voltage equipment including manholes, switchgear, transformers and cables. The Low Voltage system (600 volt and below) shall be detailed to the branch circuit panelboard level and to any point required in the NFPA 70E to have an Arch Flash Label. One-line shall include all information that results from an electrical study, such as: size of all wire, conduit, breakers, starters, transformers, generators, meters and transfer switches shall be indicated. Tables may be used. The sizing of wire and conduit using only panel schedules will not be accepted.

Ground riser diagram shall show the size and interconnection of all grounding systems. In most cases ground conductors shall be sized larger than required by the National Electrical Code.

Telephone riser diagram shall show all riser cables, conduits, sleeves and line protectors in their relative relationship to the building.

Fire Alarm riser diagram shall show all equipment associated with the fire alarm system.

Lightning protection system drawing(s) shall show the arrangement of the lightning protection system with details for each unique connection and roof penetration. These details shall be coordinated and compatible with the roof system.

SPECIFICATION REQUIREMENTS

Specifications shall include bidding and contract documents and technical specifications and the bound document will be entitled "SPECIFICATIONS." The importance of accurate, complete and coordinated specifications is very important. Specifications shall be carefully checked to include all items pertaining to the project and to eliminate inclusion of items not incorporated into the project.

Specifications shall follow CSI Masterformat and be prepared in letter format. Project A/E may use descriptive or performance type of specifications, naming three products by name, catalogue

number and manufacturer which will meet the standards required. Care shall be taken not to adopt wording recommended by a single manufacturer if the wording will require unique or patented features of a product. Throughout these guidelines there may be references to single products and/or manufacturers. These are NOT sole source items. The project A/E is required to identify and include in the documents other products and/or manufacturers that are equal.

In the various specification sections where the specification is based around the performance of a specific product or model from a manufacturer (for example fixed seating, laboratory casework, laboratory equipment, air handlers, etc.) all other manufacturers listed as approved equals must also indicate comparable model numbers.

Details and schedules shall be shown on the drawings and not in the specifications.

Specifications written "Install in accordance with the manufacturers specifications" are not an acceptable specification. Spell out the procedure to be used so that the Owner's Project Managers and the Contractor's Superintendent can ascertain from the Specifications the way a product is to be used or applied without reference to numerous catalogues which may not be readily available. The scope of work shall be accurately defined in each section; reference all related work provided under other sections.

Omit duplication of specifications included under Uniform General Conditions or Special Conditions; in each instance, reference the applicable paragraph by number and expand or modify the requirement only as necessary to accomplish a specific purpose. (This is particularly applicable to Mechanical and Electrical sections).

Both FP&C and SSC managed projects have specific requirements for specification numbering format, cover sheets, tables of contents, ordering, etc. Consult with the FP&C or SSC project manager for most current documentation guidelines applicable at the time of project design.

SQUARE FOOT TRACKING

The Project A/E is required to track the net and gross square footage of their design from the Program of Requirements through all design milestones and ending with final completion of construction. At each design milestone, the Project A/E must complete the area summary spreadsheet and upload it as part of an e-Builder process.

The Project A/E is required at the Design Development milestone to create floor plans that illustrate by color net assignable square foot, education & general net assignable square foot and unassignable square foot based on guideline from the State Higher Education Coordinating Board.

SCHEMATIC DESIGN (SD)

SCHEMATIC DESIGN MEETINGS

Establish interim schematic design meetings as required prior to the final schematic design submission and review. Materials submitted and reviewed during these meetings along with meeting minutes shall be uploaded to eBuilder.

The final Schematic Design review meeting will determine the arrangements of all building spaces as well as the exterior appearance of the building. The final Schematic Design review meeting will occur a minimum of one (1) week after the submission of all required materials.

The project team shall review construction sequencing. Once the sequencing has been established the project team shall review and establish any special drawing packages that will be required to begin construction in a timely manner. The drawings required for each package shall be reviewed and documented in eBuilder to ensure that the required drawings are completed and submitted when they are needed.

These early design meetings are a good time for the AEC to review any special project requirements or layout of equipment. For instance, the team shall establish a preliminary ceiling plenum stratification strategy by which the AE shall stack building services in the ceiling plenum or leave clearances for ceiling mounted equipment.

A component of Schematic Design will be, in conjunction with the contractor on CMAR and D-B projects, to identify an early release drawings and specifications that can be ready for construction after the approval of the GMP.

Some projects may be able to accomplish Schematic Design in fewer meetings; other projects may take more meetings. The A/E will not proceed to Design Development until all requirements for Schematic Design have been satisfied and approval of Schematic Design has been received.

MINIMUM SD SUBMITTAL REQUIREMENTS

All documents included within the submission shall be uploaded to the appropriate folder in the eBuilder documents module. Confirm location with FP&C or SSC project manager.

Drawings

General:

- All sheets shall have a text scale and graphic scale.
- All applicable sheets shall have a north arrow in a consistent orientation.
- If the site plan(s) and/or floor plan(s) is divided over multiple sheets then a key map near the title block is required.
- Plotted sheet size cannot exceed 30” x 42”.
- All text shall be minimum 1/8” when plotted to full size.

Civil:

- Civil notes.

- Civil site plan(s) at the same scale and orientation as the architectural site plan showing existing and new vehicular and pedestrian flat work, and existing and new utilities including site mechanical, electrical and telecommunications.
- Site plan showing the limits of construction and construction staging area showing construction fences, gates, trailers, and traffic flow.
- Site demolition plan showing all site demolition.
- Grading plan showing existing and new contours and key elevations.
- Storm plan showing site drainage areas maps for pre and post construction and calculations of runoff.

Landscape:

- Site plan(s) at the same scale and orientation as other site plan(s) showing existing and new planting, existing and new irrigation zones and other site features.

Architectural:

- Architectural site plan showing all existing and new site features as well as limits of construction and construction staging area.
- Floor plan of all levels showing fire walls, hazard level occupancies and travel distances.
- Floor plan of all levels showing room names, capacity information (occupancy), relative wall thicknesses, door swings, fixed casework and equipment, floor elevation, column grid, wall fire ratings, travel distances.
- Floor plan of all areas showing room names, preliminary furnishings and movable equipment, indication of floor and wall finishes.
- All elevations showing materials, floor elevations, fenestration, exposed mechanical and electrical equipment, finish grades and significant site features.
- Major building sections showing relative thickness of floors and walls, floor elevations, finish grades, room names, and significant mechanical and electrical equipment.
- Exterior and interior perspectives and/or animations to illustrate design.
- Space assignment floor plans indicating net assignable space as E&G and non-E&G, and unassignable space by different colors and hatching. Drawings to coordinate with (and be filed with) Space Summary in Basis of Design Reports. Net Assignable and Unassignable totals shall be given per floor, with the total summed space indicated on the First Floor Plan sheet.
- Floor plan of typical laboratories showing laboratory casework and laboratory equipment.

Plumbing:

- Floor plan of all levels showing all plumbing equipment and preliminary routing of main horizontal and vertical runs.

Mechanical:

- Site plan(s) at the same scale and orientation as other site plan(s) showing existing and new thermal and gas lines as well as limits of construction.
- Typical enlarged mechanical room plan showing equipment and required maintenance access.

Electrical:

- Site plan(s) at the same scale and orientation as other site plan(s) showing existing and new electrical distribution as well as limits of construction and construction staging area.
- Typical enlarged electrical room plans showing equipment and code required access.
- One line diagram of electrical system.

Telecommunications / Security / Audio Visual:

- Site plan(s) at the same scale and orientation as other site plan(s) showing existing and new telecommunications distribution as well as limits of construction.
- Typical enlarged data/telecom room plans showing equipment and access.
- Typical enlarged plans showing location of audio-visual equipment.
- One line diagram of data, telecommunications, broadband distribution and audio-visual systems.

Reports

All reports shall be uploaded to eBuilder in PDF format.

The Basis of Design Report is a narrative description of the project containing the basic information, criteria, logic, major decisions, evaluations and considerations developed in the following applicable categories to prepare the Schematic Design submittal.

- Hazardous Materials Survey Narrative
- Civil and Landscape Design Narrative
- Structural Design Narrative
- Architectural Design Narrative
- Mechanical Design Narrative
- Plumbing Design Narrative
- Electrical Design Narrative
- Data/Telecommunications Design Narrative
- Audio Visual Design Narrative
- Sustainable Design Narrative using LEED Checklist
- Listing and size of spaces comparing POR with Schematic Design and total by net assignable E&G, net assignable non-E&G, unassignable, and gross, with efficiency of net to gross calculated
- List of all variations from the Program of Requirements, Facility Design Guidelines, and Campus Master Plan that have been included in the Schematic Design.
- Life Cycle Cost Analysis for three or more major building systems and the determination of the system to move forward within each case.

Cost Estimate

Provide a cost estimate broken down by CSI MasterFormat divisions and/or subdivisions.

REVIEW PROCESS

A minimum of two weeks prior to the first submission of schematic design documents, drawings shall be issued for review and comments. Both FP&C and SSC managed projects have specific requirements for management of document review and comment. Consult with the FP&C or SSC project manager for most current process applicable at the time of project design.

COMPLETION OF SCHEMATIC DESIGN

Completed final Schematic Design documents are a result of a completed product and are

not a function of time or duration of work. Final Schematic Design documents that are “on average” 100% complete are not acceptable. Upon completion of Schematic Design, the following are established:

- The project scope, form and spatial relationships are defined.
- The selection and initial design of major building systems such as exterior envelope, structure, mechanical, plumbing and electrical are finalized.
- A preliminary construction schedule is established.
- The project as defined is achievable within the established Amount Available for the Construction Contract based on continuous input from the cost estimator or contractor in a Construction Manager at Risk or Design-Build project, or from the Architect’s cost consultant in a Competitive Sealed Proposal project.

DESIGN DEVELOPMENT (DD)

The approved Schematic Design shall be developed into Design Development documents sufficient to fully reveal all aspects of the project. This will include all items to meet the System Member's needs, and development of all facility components to fully illustrate the proposed aesthetics, construction, systems, utilities, services, and accessories.

Between the Schematic Design approval and the submission of Design Development most projects will require various meetings to identify the full requirements for basic components of the design as well as special or unique components such as data/telecommunications, audio visual systems, security systems, food service requirements, laboratory design, etc. It is anticipated that these meetings will occur, at a minimum, monthly.

DESIGN DEVELOPMENT PROGRESS MEETINGS

Review the recently closed issues from Schematic Design. Comments/issues noted in on the SD documents shall be incorporated into the DD documents prior to closing the issue. In order for a comment to be closed, comment must be visually reviewed with an updated document. Results of these meetings must be documented in a narrative describing systems and identifying the scope that will be in the project. Meeting agendas and minutes shall be maintained within eBuilder.

All documents included within the interim submissions shall be uploaded to Owner’s eBuilder site according to instructions provided during training. All submitted documents shall be complete and coordinated between design disciplines. All documents will address all comments from Schematic Design phase.

The project team shall review the drawings required for multiple packages, if required, to ensure that the required drawing list is still accurate and that it is still valid. This is the time to modify the required list of drawings for the early release drawing sets.

DESIGN DEVELOPMENT CLASH DETECTION/COORDINATION

At a minimum, during 50% DD phase or as agreed to by the Owner's Project Manager, upload models into eBuilder for clash detection review in accordance with the BIM execution plan. Comments/issues noted will be used to assist with the review process, as needed. In order for a comment to be closed, a comment must be visually reviewed with an updated document. Early in the design phase there will likely be clashes that will be resolved during the course of design. Critical clashes may result in an issue being created.

MINIMUM DD SUBMITTAL REQUIREMENTS

DD Submittal shall include all requirements previously identified for the SD Submittal. All documents included within the submission shall be uploaded to the appropriate folder in the eBuilder documents module. Confirm location with FP&C or SSC project manager.

Reports

The Basis of Design report from Schematic Design shall be updated to include the basic information, criteria, logic, major decisions, evaluations and considerations developed in the following applicable categories to prepare the Design Development submittal:

- Hazardous Materials Survey Narrative
- Civil and Landscape Design Narrative
- Structural Design Narrative
- Architectural Design Narrative
- Interior Design Narrative
- Mechanical Design Narrative
- Plumbing Design Narrative
- Electrical Design Narrative
- Data/Telecommunications Design Narrative
- Audio Visual Design Narrative
- Sustainable Design Narrative using LEED Checklist
- Listing and size of spaces comparing POR with Schematic Design and Design Development and total by net assignable E&G, net assignable non-E&G, unassignable, and gross, with efficiency of net to gross calculated.
- Code Analysis
- Life Safety Code Analysis: Provide a code analysis of the design utilizing the Life Safety Code, latest edition (NFPA 101) and all referenced codes.
- Building Code Analysis: Provide a code analysis of the design utilizing the International Building Code, latest edition covering only those elements not covered by the Life Safety Code (no duplicate items).
- Preliminary Drainage Report: Provide a report detailing methodology; pre and post construction runoff calculations; flood plain information; drainage area maps; hydrological and hydraulic computations for inlets, drains, pipes, and structures, hydrographs, and storm profiles showing water surface and hydraulic grade line (HGL) elevations.
- Energy Conservation: Provide a report on energy conservation provisions at Design Development consisting of compliance documentation that the building envelope meets the code. The report should also include the manufacturer's performance data for building envelope components. The report shall address all other code sections including HVAC,

service water heating, power, lighting and other equipment. To summarize, the report shall cover the following ASHRAE 90.1 applicable areas and include all compliance forms:
    - 5.0 Envelope
    - 6.0 HVAC
    - 7.0 Service Water Heating
    - 8.0 Power (Specification Item)
    - 9.0 Lighting
    - 10.0 Other Equipment (Specification Item)
    - 11.0 Energy Cost Budget Method
- The SECO Compliance Certification form(s) shall be included in the front of the report. There may be one or more certification forms, depending on how many separate professionals take responsibility for the various disciplines. The certification form must be preliminary at this point in the design.
- Life Cycle Cost Analysis
- Wind Tunnel Analysis
- Design Calculations
- Schedule of all recommended construction material testing. The schedules shall contain item tested, recommended test, frequency of test, estimated number of test, sampling method, testing method and acceptance criteria.
- Clash and Collision Detection Report.
- List of all variations from the Program of Requirements, Facility Design Guidelines, and Campus Master Plan that have been included in the Design Development documents.

Drawings

General:
- General Information Sheet(s) showing design criteria, net and gross square foot per floor, legend of symbols, abbreviations, drawing conventions, vicinity map & project location map.

Civil:
- Separate site fire plan.
- Separate dimension plan with survey control information.
- Separate plans showing new paving with jointing and dimensions.
- Separate composite utility plan which includes site mechanical, electrical and telecommunications.
- Separate individual utility plan sheets and profile sheets for all proposed underground utilities including any conduit, pipe, duct 2” and larger, excluding irrigation, sleeves, and lighting services.
- Full drainage plan and maps with calculations, including detention.
- Erosion control plans, details, and plan narrative.
- Typical detail sheets.

Landscape:
- Overall site plan(s) showing all new landscape construction with demolished items removed.
- Separate plans showing landscape features with spot elevations and dimensions.
- Separate plans showing new plantings.
- Separate plans showing new irrigation areas with type of heads and flow rates.
- Typical detail sheets.

Structural:

- Foundation plan with pier sizes.
- Crawl Space grading plan showing drainage.
- Floor plan of all levels showing column grid, location of beams and shear walls.
- All schedules and typical detail sheets.

Architectural:

- Floor plan of all levels showing room names, room numbers, capacity information (occupancy), actual wall thicknesses, floor elevation, structural grid, equipment, casework, vertical transportation and dimensions.
- Floor plan of all levels showing fire protection elements and egress plan with travel distances.
- Floor plan of all areas showing room names, room numbers, all furnishings and equipment, indication of finishes.
- Reflected ceiling plans.
- Roof plan showing major rooftop equipment.
- Interior Finish Schedules.
- Door Schedules.
- Window/Glazing Schedules.
- All elevations showing materials, floor elevations, exposed mechanical and electrical equipment, finish grades and significant site features.
- Interior elevations of typical spaces like restrooms and casework and major spaces like lobbies and ballrooms.
- Major building sections showing actual thickness of floors and walls, floor elevations, finish grades, room names, and significant mechanical and electrical equipment.
- Typical wall sections and details.
- Enlarged stairway plans and sections with railing details.
- Enlarged plan of restrooms with interior elevations.
- Enlarged plan and interior elevations of auditoriums and tiered lecture halls.
- Typical detail sheets.
- Space assignment floor plans indicating net assignable space as E&G and non-E&G, and unassignable space by different colors and hatching. Drawings to coordinate with (and be filed with) Space Summary in Basis of Design Reports. Net Assignable and Unassignable totals shall be given per floor, with the total summed space indicated on the first floor plan sheet.
- Floor plan of all laboratories showing laboratory casework and laboratory equipment.
- Enlarged plan and elevations of typical laboratory spaces.

Plumbing:

- Floor plan of all levels showing all plumbing fixtures/equipment and routing of horizontal and vertical runs.
- Details of major equipment and special conditions.

Mechanical:

- Site plan(s) at the same scale as other site plan(s) showing existing and new thermal and gas lines as well as limits of construction and construction staging area.
- Floor plans showing single line duct layout for supply air, return air and exhaust air and location of mixing boxes, coils, dampers, etc.
- Enlarged mechanical room plans showing equipment and maintenance access.
- Preliminary mechanical equipment schedules and typical details.

Electrical:

- Site plan(s) at the same scale as other site plan(s) showing existing and new electrical distribution as well as limits of construction and construction staging area.
- Floor plans showing typical light fixture layouts.
- Floor plans showing typical power outlet layouts.
- Enlarged electrical room plans showing equipment and code required access.
- One line diagram of electrical system.

Telecommunications / Security / Audio Visual:

- Site plan(s) at the same scale as other site plan(s) showing existing and new telecommunications distribution as well as limits of construction and construction staging area.
- Floor plans showing means of cable distribution and location of all devices and outlets.
- Enlarged data/telecom room plan showing equipment and access.
- Enlarged plans showing location of audio-visual equipment.
- One line diagram of data, telecom, security, and A/V systems

Specifications

- Specifications for significant architectural materials and engineering systems and equipment indicating quality of materials used in project.

Cost Estimate

Provide a cost estimate broken down by CSI MasterFormat divisions and/or subdivisions.

REVIEW PROCESS

The Design Development documents to be reviewed will need to be uploaded into the appropriate folder within eBuilder. The documents will be packaged as a set and sent to the project team for review. Both FP&C and SSC managed projects have specific requirements for management of document review and comment. Consult with the FP&C or SSC project manager for most current process applicable at the time of project design.

COMPLETION OF DESIGN DEVELOPMENT

Completed Design Development documents are a result of a completed product and are not a function of time or duration of work. Final Design Development documents that are “on average” 100% complete are not acceptable.

Upon completion of Design Development, the following are established such that the Construction Manager at Risk or Design Builder can provide a Guaranteed Maximum Price for the project.

- The project scope, form and spatial relationships are finalized.
- The design of all major building systems such as civil, landscape, site utilities, exterior envelope, interior finishes, structure, mechanical, plumbing, electrical and special systems such as telecommunications, data, audio-visual and security are completed.

- A construction schedule is established.
- The project as designed is achievable within the established Amount Available for the Construction Contract based on continuous input from the Construction Manager at Risk or Design Builder.
- Drawings and specifications for an early release package are ready for construction on CMAR and D-B projects.

After approval of the Design Development, the A/E shall furnish the following if required in their agreement:

- Presentation rendering(s) shall consist of a minimum of one exterior view and one interior view, drawn in perspective, at a scale of sufficient size (24" x 30" min.) to convey a true representation of the design of the project without distortions that would give misleading impressions. Landscape features together with existing structures should be indicated in a realistic manner. The name of the project, location, and the name of the A/E shall appear along the lower edge of the perspective.

- When construction approval is required based on the project schedule, a PowerPoint slide deck to be used to present the project to the Board of Regents. For this presentation, the A/E will provide images that include campus plan, site plan, representative floor plan(s) and exterior perspective(s).

CONSTRUCTION DOCUMENTS (CD)

The approved Design Development documents shall be developed into Construction Documents sufficient to construct the project.

CONSTRUCTION DOCUMENTS PROGRESS MEETINGS

All documents included within the submission shall be uploaded to Owner’s eBuilder site according to instructions provided during training. Comments/issues noted in shall be incorporated into the documents prior to closing the issue. For a comment to be closed, comment must be visually reviewed with an updated document.

Results of these meetings must be documented in a narrative describing systems and identifying the scope that will be in the project. Meeting agendas and meetings minutes shall be maintained within eBuilder.

All submitted documents shall be complete and coordinated between design disciplines throughout the project. All documents will address all the comments made from the previous design phases.

The project time schedule and the agreements identify interim progress meetings for review of Construction Documents by System Member and FP&C or SSC staff generally at 25%, 50% and 75% stages of completion. These meetings do not constitute approval of documents to date but are for the purpose of answering questions and resolving problems.

During the 25% Construction Documents meeting the Project A/E needs to present to the User Group, RELLIS Administration, and the FP&C/SSC Project Manager at least two interior color schemes for comments.
Updates and refinements to the mechanical systems sequence of operation need to be presented for comment. Also, during the review the team must review cut-sheets of all major elements of the design and pieces of equipment. Examples of these are curtain wall systems, fixed seating, laboratory equipment, audio visual equipment, air handling units, variable air volume boxes, plumbing fixtures and light fixtures. Verify list of items requiring cut-sheets with FP&C or SSC Project Manager.

During the 50% Construction Documents meeting the Project A/E must present to the Project Team the revised interior color scheme for comments. Updates and refinements to the mechanical systems sequence of operation need to be presented for comment. Also, during the review the team must review revised cut sheets of all major elements of the design and pieces of equipment.

CONSTRUCTION DOCUMENTS CLASH DETECTION/COORDINATION

Continue clash detection from the DD phase. Upload models into eBuilder for clash detection and review in accordance with the BIM execution plan. Comments/issues noted will be used to assist with the review process. In order for a comment to be closed, a comment must be visually reviewed with an updated document.

Critical clashes may result in an issue being created. Prior to issuing documents, all previously discussed clashes shall be resolved. The Project A/E shall provide a clash and collision detection report summary. The report submitted should have been evaluated so that only legitimate clashes remain for review. The A/E is responsible for generating this report in the absence of a Construction Manager. When a Construction Manager is part of the design phases they shall be responsible for running and vetting the report.

MINIMUM CD SUBMITTAL REQUIREMENTS

CD Submittal shall include all requirements previously identified for the SD and DD Submittals. All documents included within the submission shall be uploaded to the appropriate folder in the eBuilder documents module. Confirm location with FP&C or SSC project manager.

Reports

The Basis of Design report from Design Development shall be updated to include the basic information, criteria, logic, major decisions, evaluations and considerations developed in the following applicable categories to prepare the Construction Documents submittal.

- Hazardous Materials Survey Narrative
- Civil and Landscape Design Narrative
- Structural Design Narrative
- Architectural Design Narrative
- Interior Design Narrative
- Mechanical Design Narrative
- Plumbing Design Narrative
- Electrical Design Narrative

- Data/Telecommunications Design Narrative
- Audio Visual Design Narrative
- Sustainable Design Narrative using LEED Checklist
- List and size of spaces comparing POR with Schematic Design and Design Development
- Life Safety Code Analysis: Provide a code analysis of the design utilizing the Life Safety Code, latest edition (NFPA 101) and all referenced codes.
- Building Code Analysis: Provide a code analysis of the design utilizing the International Building Code, latest edition covering only those elements not covered by the Life Safety Code (no duplicate items).
- Final Drainage Report: Provide a final report, signed and sealed by a Professional Engineer in the State of Texas, detailing methodology; pre and post construction runoff calculations; flood plain information; drainage area maps; hydrological and hydraulic computations for inlets, drains, pipes, and structures, hydrographs, and storm profiles showing water surface and hydraulic grade line (HGL) elevations.
- Energy Conservation: Provide a report on energy conservation provisions at Design Development that shall consist of compliance documentation that the building envelope meets the code. The report must also include the manufacturer's performance data for building envelope components. The report shall address all other code sections including HVAC, service water heating, power, lighting and other equipment. To summarize, the report shall cover the following ASHRAE 90.1 applicable areas and include all compliance forms:
    - 5.0 Envelope
    - 6.0 HVAC
    - 7.0 Service Water Heating
    - 8.0 Power (Specification Item)
    - 9.0 Lighting
    - 10.0 Other Equipment (Specification Item)
    - 11.0 Energy Cost Budget Method
- The SECO Compliance Certification form(s) shall be included in the front of the report. There may be one or more certification forms, depending on how many separate professionals take responsibility for the various disciplines.
- Life Cycle Cost Analysis
- Wind Tunnel Analysis
- Design Calculations
- Schedule of all recommended construction material testing. The schedules shall contain item tested, recommended test, frequency of test, estimated number of test, sampling method, testing method and acceptance criteria.
- Clash and collision detection report summary.
- List of all variations from the Program of Requirements, Facility Design Guidelines, and Campus Master Plan that have been included in the Construction Documents.

Drawings

Provide 100% complete and coordinated drawings.

Specifications

Provide 100% complete and coordinated specifications.

Cost Estimate

Provide a cost estimate broken down by CSI MasterFormat divisions and/or subdivisions.

REVIEW PROCESS

The Construction Documents to be reviewed will need to be uploaded into the appropriate folder within eBuilder. The documents will be packaged as a set and sent to the project team for review. Both FP&C and SSC managed projects have specific requirements for management of document review and comment. Consult with the FP&C or SSC project manager for most current process applicable at the time of project design.

The A/E is responsible for ensuring comments/issues are sent to the appropriate consultant, answered completely, and sent back to the creator. Comments/issues noted shall be incorporated into the documents prior to closing the issue. For a comment to be closed, comment must be visually reviewed with an updated document.

Drawings for all divisions of work shall be complete and thorough in all respects, coordinated, clear, and neatly drawn and in accordance with the Standard of Care for the professions. Completed Construction Documents are a result of a completed product ready to be used for construction (bidding in the case of CSP delivery) and are not a function of time or duration of work.

Construction Documents shall not be submitted for review until all documents are 100% complete and a complete quality control/coordination check has been made by the Project A/E of all documents. If the Construction Documents are missing information from team members or drawing sheets are obviously incomplete do not submit for the 100% Construction Documents review. If cursory review by FP&C or SSC Project Manager indicates that the documents are not 100% complete, the submittal will be returned for completion.

A Construction Documents review meeting will be scheduled by the FP&C or SSC Project Manager
to include representatives from the A/E team, the Contractor team, RELLIS Administration, and the System Member team for a detailed discussion of comments.

All comments from the Construction Documents review meeting shall be incorporated into the final documents prior to issuance for construction (bidding in the case of CSP delivery). Lengthy addenda to correct the CSP bid documents is unacceptable. Comments/issues noted shall be incorporated into the documents prior to closing the issue. For a comment to be closed, comment must be visually reviewed with an updated document.

BIDDING AND CONTRACT AWARD STAGE (CSP ONLY)

The FP&C or SSC Project Manager will establish the dates for advertising, pre-proposal conference, and proposal opening in consultation with the Project A/E for projects that utilize the Competitive Sealed Proposal process to procure a Contractor. The Project A/E and required consultants will attend the Pre-proposal Conference prepared to receive contractor’s questions and conduct a site tour if necessary.

The Project A/E will assist the Owner during negotiations with the selected Contractor by evaluating the value engineering offerings from the selected Contractor. The A/E will be required to provide any and all documentation required to adequately describe the nature and extent of all accepted value engineering items.

CONSTRUCTION

PRE-CONSTRUCTION CONFERENCE

After the construction contract has been awarded the FP&C or SSC Project Manager will establish a date for the Pre-Construction Conference. The Project A/E is expected to attend. The FP&C or SSC Project Manager will review Owner procedures to accomplish the terms of the construction contract.

PROGRESS MEETINGS

Progress meetings shall be held at least monthly but may be held biweekly or weekly depending on the project. The Project A/E is expected to attend and be able to answers questions that arise. The Project A/E team consultants may be required to attend specific monthly meetings based on the project's requirements.

COLOR BOARDS

The Project A/E is required to develop color boards for all exterior and interior colors based on the contractor's manufacturer and/or supplier. The color boards shall be presented to RELLIS Administration and the User Coordinator for approval. The Project A/E shall also generate a listing of all finish materials for the project record.

SHOP DRAWINGS AND SUBMITTALS

The Project A/E team is responsible for the timely review and processing of contractor shop drawings and submittals as indicated in the Uniform General Conditions included in the Design Criteria section of this manual.

SUBSTITUTION REQUESTS

The Project A/E team is responsible for the timely review and acceptance or rejection of contractor substitution requests. Concurrence from FP&C or SSC Project Manager and RELLIS Administration is required prior to the approval of any substitution request.

RECORD DRAWINGS

The Project A/E is required to provide final models, drawings and specifications that reflect all changes made during construction. These documents shall be uploaded to the eBuilder documents module in a location as directed by the FP&C or SSC Project Manager.

Final models shall be upgraded to the latest software version in use by the Project A/E and uploaded in both native file format and IFC file format. Models shall be named with the discipline (Arch, Elec, Mech, etc.), the software version number and file extension.

Final drawings shall be uploaded as individual sheets in both PDF and DWG file formats. Both PDF and DWG files shall be named with the sheet number and sheet name then file extension. The DWG files shall have all reference files attached.

Specifications shall be uploaded by section in PDF format. Specifications shall be named by section number and section name then file extension.

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

Both TAMUS Facilities Planning and Construction (FP&C) and SSC Engineering, Design, and Construction Services (EDCS) have developed standard Division 0 specification sections, Uniform General Conditions (UGCs), special conditions, bidding/proposal forms, contract forms, and payment/performance bond forms for use on A&M System projects.

Consult with the applicable FP&C or SSC Project Manager to obtain most current versions of these front-end documents applicable to the project at the time of procurement.

DIVISION 01 – GENERAL REQUIREMENTS

Both TAMUS Facilities Planning and Construction (FP&C) and SSC Engineering, Design, and Construction Services (EDCS) have developed standard Division 1 specification sections for use on A&M System projects.

Consult with the applicable FP&C or SSC Project Manager to obtain most current versions of these front-end documents applicable to the project at the time of procurement.

DIVISION 02 – EXISTING CONDITIONS

BOUNDARY AND TOPOGRAPHIC SURVEY

A boundary and topographic survey will be performed for each project involving new construction and for renovation projects by a surveyor licensed in the State of Texas. Standards of survey should conform to the rules and regulations of the Texas Board of Professional Land Surveying (TBPLS). The land surveyor must provide professional expertise, trained personnel and equipment necessary to achieve the results required by these standards.

The survey shall include as-built and natural information for, but not limited to, topography, existing construction (buildings, roads, sidewalks, etc.), existing utilities on site including closest point of connection if not on site, significant vegetation, easements, etc.

Specifically, the survey shall:

1. Include a legend of symbols and abbreviations used on the drawing, a north arrow and a graphic scale.

2. Provide contours at a minimum of 1 foot intervals unless directed otherwise by the System Civil Engineer with an error not to exceed 1/2 contour interval.

3. Provide at least two horizontal and one vertical control points with description and elevation to nearest .01'. Datum shall be NAD 83 for horizontal and NGVD 88 for vertical (Grid Values).

4. Provide spot elevations at street intersections and curb, crown of roads, sidewalks, edge of paving including far side of paving, drainage flow line, manhole rims/covers/flowlines, top and bottom of retaining walls, etc. Spot elevation on paving or other hard surfaces shall be to the nearest .05’ and spot elevations on other surfaces to the nearest .1’.

5. Include the location of above and below ground structures, man-made and natural features, all floor elevations and finish floor elevations at each entrance of buildings on the property, if applicable.

6. Include the location, size and depth of water, gas and thermal utilities. For all campus overhead and underground utilities coordinate with: TAMU Utilities and Energy Services (UES). Coordinate as needed with ATMOS gas utility.

7. Include the location of fire hydrants available to the property and the size of the main serving each.

8. Include the location and characteristics of power and communications systems above and below grade.

9. Include the locations, size, depth and direction of flow of sanitary sewers, storm drains and culverts serving or on the property; location of catch basins, manholes, and inverts of pipe at each.

10. Provide the name of the operating authority of each utility clearly on survey. Utility Information can be provided by TAMU Utilities and Energy Services and/or RELLIS Administration.

11. Provide the mean elevation of water riparian or littoral body of water.

12. Provide the location of 1% annualized potential and 0.2% annualized potential (100yr & 500-yr) floodplains.

13. Provide the extent of the watershed onto the property.

14. Provide the location of trees along with the species name in English, the caliper in inches (at breast height) and the canopy width.

15. Provide the perimeter outline only of any thickly wooded areas unless otherwise directed.

16. Show boundary lines, giving length and bearing (including reference or basis) on each straight line; interior angles; radius, point of tangency and length of curved lines. Where no monument exists, set a permanent iron pin (monument) or other suitable permanent monument at property corners; drive pin into ground to prevent movement, mark with wooden stake; state on the drawing(s) whether corners were found or set and describe each.

17. Survey shall be reviewed by the FP&C or SSC Project Manager before being finalized.

The survey shall be drawn using a Computer-Aided design and drafting program and final copy shall be plotted. The survey shall be modeled at 1:1 scale. All dimensions and elevations shall be in English units. The plotted scale shall be 1.0” = 20.00’ (or an accepted standard engineering scale 30, 40, 50, 60, 80, 100) and the title block shall include the project name and project number. The final drawing shall be sealed by a Texas RPLS. Upon completion of the survey provide a digital version of the plotted survey containing the native CAD file (along with necessary reference files), a PDF copy of the file, as well as an ASCII file of the processed point data.

SUBSURFACE UTILITY ENGINEERING ASSESSMENT

Provide Subsurface Utility Engineering (SUE) for the area of interest as defined by the project (approximate footprint of the proposed building plus 10’ outside of the footprint). SUE should also be conducted where underground utilities will be installed. The width surveyed on either side of the utility alignment should be determined based on the depth and if trench protection is required. The SUE consultant shall follow ASCE 38-02, “Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data” and coordinate data with A/E design team and Owner’s Representative for the project. CADD files and survey data provided shall be tied into the existing control provided by the A/E team surveyor. All work shall be under the supervision of a Professional Engineer Registered in the State of Texas.

Phase I

Scope: Provide up to Utility Quality Level B during the SD phase of the project. Levels C and B shall be survey level horizontal location of the designation of the utilities.

Deliverables: Field sketches and CADD file with utility information in plan view with appropriate line code, formatting, and labeling to differentiate between levels D, C, and B.

Phase II

Scope: Provide Quality Level A during the DD Phase of the project. Level A shall be survey level horizontal and vertical locating of the utility.

Test Holes: Provide cost for test holes on a per hole basis.

Deliverables: Field sketches, CADD file with amended information from Phase I and Phase II with appropriate line code, formatting, labeling, and symbol embedding to differentiate between levels D, C, B, and A, and Engineering plan(s), sealed by a professional Engineer, to be included in the Construction Drawings. Drawing(s) shall be provided on the A/E border.

RELLIS ENVIRONMENTAL, ENGINEERING, AND REAL ESTATE RESOURCES

Phase I Environmental Site Assessments (ESA) have been completed for most of the RELLIS Campus and are available upon request. For A&M System or Member projects, additional Phase I Environmental Site Assessments (ESA) are generally not needed for properties already owned by the A&M System, unless there is reason to believe that a site could have contamination issues (e.g., former service station, dry cleaners, pesticide application site, former wastewater or landfill site). However, for P3 projects, an environmental site screen or a formal Phase I ESA is required to (1) establish a baseline condition prior to development and (2) provide the developer or their financiers assurance that there are no potential liabilities from preexisting conditions. P3 developers shall be responsible for an additional Phase I ESA as required by ground lease terms.

The following studies/assessments along with associated costs shall be the responsibility of the project and/or P3 developer unless noted otherwise:

Phase II Environmental Site Assessment (ESA)

Required for development if Phase I ESA indicates potential pollution liabilities that must be documented through field investigation and sampling. Each project, whether A&M System, Member, or P3, shall be responsible for Phase II ESA if needed.

Asbestos and Lead Paint

Each project, whether A&M System, Member, or P3, shall be responsible for a pre-demolition survey for all existing structures proposed to be renovated and/or demolished. If asbestos containing materials (ACM) are found, the project will also be responsible for abatement and air monitoring. It is recommended to complete the survey prior to signing the development contract so that all parties can have an opportunity to estimate abatement cost impact on project development and understand the effect on schedule. The A&M System shall monitor compliance efforts.

Asbestos abatement or building demolition (even if no asbestos is present) requires 10-day advance notice prior to abatement/demolition to the Texas Department of State Health Services.

For structures built before 1980, a lead paint survey should be included with the asbestos survey, particularly if the structure is to be retained and used as a child-occupied facility.

Natural Resource Constraints

Floodplains: Review Federal Emergency Management Agency (FEMA) flood insurance rate maps and site drainage for possible flood impacts to estimate usable area and possible mitigation costs to a planned project.

Wetlands and Waters of the U.S.: If there is any indication that there are possible wetlands or jurisdictional waters of the U.S. that would be impacted by the project development, then a waters and wetlands survey must be conducted by a registered professional engineer or scientist prior to development. It is recommended that this work be completed prior to closing so that the P3 developer can know the site constraints and usable acreage. If wetlands would be impacted by development, mitigation or off-setting measures may be required to compensate for the loss of wetlands. Filling or altering waters of the U.S. may require permitting and concurrence from the U.S. Army Corps of Engineers. Either of these can impact project design, cost and schedule.

Threatened and Endangered Species and Migratory Birds: Development of large tracts of rural or raw land may also require prior surveys of threatened and endangered species and nesting surveys of migratory birds. If migratory birds are found to be nesting on the tract, this can restrict the timing of land clearing to outside of the nesting season and may require habitat mitigation measures.

Cultural Resources Constraints: For tracts of raw, undeveloped land, generalized (“desk-top”) antiquities constraints assessments must be conducted prior to Texas Historical Commission (THC) notice (see next section). For properties deemed likely to include antiquities, it may be necessary to conduct archaeology field surveys (site walks and shovel tests) prior to THC notice to ensure that there are no likely antiquities on-site that could limit or slow project development. Also, any structures on site that are 50 years of age or older must also be evaluated for historic significance prior to renovation or demolition.

Under an anticipated MOU with the THC, small projects (5 acres or less) within contiguous, developed campus boundaries would be conducted without prior notice to THC (i.e., the MOU would constitute notice). Any larger or non-contiguous projects require a minimum of 30 days prior notice to THC (see next section). Under the MOU, the THC would review construction or maintenance projects larger than 5 acres in areas where similar activities have not occurred before, but THC would not review projects that are 5 acres or less.

Finally, if federal funds are directly involved in the project, antiquities reviews must also consider federal listing criteria when evaluating old structures.

Texas Historical Commission (THC) Notice: State antiquities law requires 30 day advance notice to the Texas Historical Commission prior to breaking ground on state-owned land. Aside from an anticipated MOU with the THC (summarized above), there is no lower limit of project size that requires notice. (Texas Natural Resources Code, Chapter 191 Antiquities Code, Sec. 191.0525)

Additional Considerations

Property Condition Assessment (PCA): If the site has existing structures or infrastructure that will be retained and/or renovated, a property condition assessment (PCA) is required for all projects estimated to exceed $4 million total project budget and recommended for projects less than $4 million in order to assess the status of:

- Structural integrity with estimated engineering cost estimates for structural maintenance or upgrade;
- Mechanical, electrical and plumbing (MEP) engineering assessment with estimated engineering cost estimates;
- Fire & life safety assessment with estimated engineering cost estimates;
- Americans with Disabilities Act (ADA) assessment of building, parking and access with estimated engineering cost estimates.

Each project, whether A&M System, Member or P3, shall be responsible for its own PCA if needed.

Real Estate: A survey is required to attach to the ground lease as an exhibit to show exactly what area is being leased. The A&M System or Member has the option to obtain the survey. The P3 has the option to obtain the survey with an A&M System authorized surveyor. An access permit is required to enter upon the property in order to survey it. Leasehold title insurance is not required by the A&M System/Member. The P3 developer shall be responsible for determining whether they want/need title insurance and obtaining accordingly.

GEOTECHNICAL INVESTIGATIONS

If included as a reimbursable service in the A/E Services Agreement the A/E shall include the services of a qualified Geotechnical firm.

Proposal for Geotechnical Services

Borings proposed by the geotechnical engineer are to be indicated on a map with depths. Where drilled piers are involved, provide a separate hourly rate and a not to exceed cost (based upon 1 trip and 8 hours of time) to be onsite during the first day of pier drilling to verify bearing stratum and other field conditions. Schedule of rates are to be attached to the proposal.

Drilling & Sampling Methods

Drilling and sampling shall be performed in accordance with current applicable ASTM standards. Samples taken at ground surface, at two feet below existing grade and at each change in soil stratification or soil consistency, but not further apart than five feet in each of the borings unless specified. Rock cores, if applicable are not to be less than 1 3/8" in diameter. Samples shall be preserved and field logs prepared by an experienced soil technician. Make any necessary pavement repairs of like material, all spoils to be hauled off or disposed of properly.

Field & Laboratory Reports

All parts of the report are to be made in digital format, suitable for distribution and printing. Written reports and analysis shall be on the geotechnical firm's letterhead. Additional information required but not limited to:

- Include with the report a chart illustrating the soils classification criteria and the terminology and symbols used on the boring logs.
- Identify the ASTM or other recognized standard sampling and test methods utilized.
- Provide a plot plan with horizontal location and ground elevation of test borings using the same datum as survey.
- Provide vertical sections for each boring plotted and graphically presented showing the number of borings, sampling method used and date of start and finish.
- Soil classified in the field logs in accordance with current applicable ASTM and other standards.
- Description of soil and thickness of each layer.
- Where standard penetration testing is utilized, number of blows per foot (N value).
- Depth to cave-in or boring collapse.
- Depth to artesian head.
- Groundwater elevation and time when water reading was made (repeat observation after 24 hours).
- Presence of gases if odor is noted during drilling.
- Location of strata containing organic materials, wet materials or other inconsistencies that might affect engineering conclusions.
- Description of the existing surface conditions and summarize the subsurface conditions.
- Description of sulfates affecting uplift or heave. Tests shall be performed in areas where lime stabilization is required and in areas known for potential sulfates.

At a minimum, the following tests are to be performed: Moisture Contents, Atterberg Limits, Percent Passing #200 Sieve, Pocket Penetrometer, Unconfined Compression and Unit Dry Weight.

Foundation Evaluation & Recommendations

Provide recommendations for foundation support of the structure and slab, including soil bearing pressures, bearing elevations foundation design recommendations, including drilled piers/auger cast piles, potential vertical rise and anticipated settlement. Provide recommendations for anticipation and management of groundwater, including temporary dewatering systems. Provide

lateral earth pressures for design of walls below grade, including backfill, compaction, sub drainage and associated requirements. This shall include design criteria for temporary excavations, temporary protection such as sheet piling, and underpinning. Provide recommended soil material and compaction requirements for foundation fill, construction backfill and for the support of structures.

Pavement Design

Provide design parameters for rigid and/or flexible pavement systems, including subgrade treatment, stabilization recommendations and base material as required for pavement type. Include pavement thickness for anticipated uses and design sections.

Stability of Slopes

Where significant slopes are being constructed, modified, loaded with adjacent surcharge, or construction is performed adjacent, provide recommendations for slope stabilization, modification, or reinforcement.

Deliverables

Provide a final report signed and sealed by a Texas Registered Professional Engineer with the project name and project number on the cover page with the report in .PDF format. The PDF shall contain a Table of Contents linked to the corresponding pages.

DEMOLITION

All site demolition shall be indicated on a separate demolition plan indicating all items to be turned over to the FP&C and RELLIS Administration. The plan shall indicate all trees and vegetation that shall remain and be protected during construction.

Perform all demolition of existing surface and underground facilities/improvements as required to construct the project. Demolition plans/details shall be included in the design drawings. Underground facilities shall be removed as required to clear construction and in accordance with good practice and considering potential future construction. At a minimum all structures shall be removed to a point 4' below natural ground. All cavities left below ground shall be filled with compacted native material or a flowable fill material and noted on the as-built drawings. The portions of piping systems remaining in place shall be neatly cut and capped/plugged and noted on the as-built drawings. Where partial demolition occurs, the remaining portions shall be left in a finished functional condition.

Fill all voids left by clearing and demolition operations with native material compacted in maximum 8" lifts to a density equal to that of the surrounding undisturbed soil.

TREE PROTECTION

Provide adequate tree protection around all trees within the project site that are to remain. Refer to Division 32 of these guidelines for information on tree protection requirements.

DIVISION 03 – CONCRETE

CAST-IN-PLACE CONCRETE

All concrete shall be designed, transported, placed, finished and cured in accordance with American Concrete Institute (ACI) requirements. Components of the concrete mix shall meet applicable ANSI/ASTM requirements. Mix requirements and strength shall be specified by the Design Team for each item of construction. Limit the number of mix strengths specified as much as practical. Hot-weather placement shall comply with current ACI 301 requirements and cold-weather placement shall comply with current ACI 306 requirements. Concrete form work shall meet applicable ACI requirements.

Concrete reinforcement material, design and placement shall meet the applicable requirements of ACI and the Concrete Reinforcing Steel Institute (CRSI) along with associated ASTM requirements. Reinforcing bars shall be Grade 60. No welded wire fabric reinforcing is allowed except in topping slabs, concrete supported on metal form deck, or unique situations as approved by the FP&C Project Manager or RELLIS Administration. Main reinforcing bars to be minimum No. 4 in size. Limit No. 3 bars (Grade 40) to ties and dowels.

Admixtures to the concrete mix meeting applicable ANSI/ASTM specifications may be used as recommended by the Structural Engineer to improve concrete workability, wear/weather resistance characteristics, and to better meet project conditions. Pozzolan admixtures should be used only within the limits recommended by the structural engineer and approved by the Owner.

The project specifications shall clearly establish finish measurement tolerances/standards suitable to the intended use of the surface and its exposure along with other quality control requirements needed to verify the concrete meets the specifications.

The curing compound manufacturer shall provide written certification that their product is compatible with the finish flooring scheduled for the space.

The CM/GC is responsible for creating a building information model (BIM) of the cast-in-place concrete building structure from which shop, fabrication, and as-built drawings shall be derived.

GENERAL FLOOR LOADING

Design floor live loads on all buildings shall be determined by the International Building Code, with a minimum live loading of 100 pounds per square foot (PSF). Design team shall work with RELLIS Administration to determine concentrated loads and ensure vibration requirements are met.

FOUNDATION SYSTEMS

A crawl space is preferred under all buildings. Where a crawl space is included in the design, provide a 2-inch thick, 2500 psi unreinforced mud slab, properly sloped and drained. Where the project budget does not permit a suspended structural floor with crawl space, a structural slab-on-void forms may be utilized. Void forms shall be manufactured by VoidForm Products, SuperVoid Systems, or equal. In both cases, provide soil retainers at face of grade beams below grade to form a void of sufficient depth to prevent expansion of earth to cause pressure on bottom

of beams. Acceptable products are BackFill or SureRetainer by VoidForm Products, or SuperVoid Rib Retainers by SuperVoid Systems.

In limited circumstances, slab-on-grade foundations may be employed for smaller buildings and/or support facilities located within Proving Ground support areas based on facility type and project budgetary constraints.

PORCHES AND STEPS

All stoops, porches, ramps, docks and steps, exterior and interior should have non-slip surfaces and nosing's where applicable. Slope exterior porches and treads where allowed by Texas Accessibility Standards to drain water. Ponding of water in these areas is unacceptable. It is recommended that exposed concrete work be accomplished in two pours: the first structural and the second a finish topping pour. The other option is protecting the work during construction by the Contractor.

Primary entry floors may not be constructed using brick or pavers since these surfaces are excessively noisy when carts are rolled across them.

Structural stoops shall be placed at all out swinging exterior doors and shall be isolated from soil movements by void forms or crawl space.

EXPOSED CONCRETE FLOORS

Exposed concrete floors are typically used only for "back-of-house" areas (i.e. mechanical, electrical, and/or service spaces). Exposed concrete floors shall receive liquid applied hardener/densifier and/or sealer. Colored or stained concrete is strongly discouraged due to difficulty in matching at future repairs or modifications. Positive protection is to be provided to prevent staining and chipping during construction work. Slick finishes shall be avoided.

PRECAST, TILT-UP, AND/OR SPECIAL FINISHED CONCRETE

On projects designed for precast, tilt-up and/or special finished concrete, the specifications shall require a sample panel, constructed as specified, at least 42 square feet to be erected at the jobsite for approval consideration by RELLIS Administration. The approved panel shall remain on the jobsite as a visual criterion which the final construction must match.

ROOF DECKS

The main slope for the roof shall be accomplished by the structural system. Only secondary slopes may be accomplished by insulation.

MOW STRIPS

Refer to Division 32 of these guidelines for requirements regarding concrete mow strips at building and landscape areas.

DIVISION 04 – MASONRY

GENERAL INFORMATION

The RELLIS Campus utilizes a limited palette of character-defining materials to draw a consistent built fabric that is identifiable at the campus scale. Materials for the campus are selected to create a unifying aesthetic theme. The predominant facade material for solid areas is brick and/or limestone. Special exceptions may be made by RELLIS Administration for facilities located within the secure Proving Grounds and other testing/training areas where public visibility is limited.

For all large capital projects, new facilities, and major renovations, the project A/E shall provide a detail that indicates the size of a mock-up panel that will contain all exterior materials such as brick, stone, cast stone, curtain wall, glazing, frames, waterproofing, flashings, sealants, etc. for final approval of all exterior colors for the project as well as assembly means and methods. The material colors will be selected to match the RELLIS standard material palette. The approved panel shall remain on the jobsite as a visual criterion which the final construction must match. The requirement for a full-scale mock-up panel may be waived or relaxed for smaller projects with prior approval from RELLIS Administration.

Construction where the masonry units are supported overhead using concealed mechanical devices in tension, or where the units extend beyond lower courses using concealed mechanical support devices in tension is not permitted.

BRICK

Brick masonry shall be designed and constructed per the standards of the Brick Industry Association (BIA). Face Brick generally shall be ASTM C216; Type FBS grade SW unless indicated otherwise in POR. Expansion joints and control joints in masonry veneer walls shall be appropriately detailed and shown on building elevations.

RELLIS Campus Basis of Design Brick Selections:

1. Acme Brick BLEND 129 University RELLIS Red Modular Velour.
2. General Shale Autumn Leaf Grain RELLIS Blend.

Mortar shall be Type N with concave tooled joints. Raked joints are not permitted. RELLIS standard mortar is Spec Mix white - SM 200 White PCLN or approved equal.

NATURAL AND CAST STONE

Stone shall be no closer than 4 inches to grade when adjacent to lawns and planting areas. Interior limestone masonry shall be sealed. Clean using only soap and water, avoid staining from cleaning solutions of adjacent masonry surfaces.

All limestone veneer utilized on the RELLIS Campus shall be: Texas Lueders Limestone, Finish: Honed, Color: Buff. Unit sizing shall be as indicated on the drawings.

Where natural stone is not feasible due to unit sizing limitations or within monument or wayfinding signage bases, cast stone may be utilized with prior approval from RELLIS Administration. Cast stone shall match Lueders Limestone specified above in both color and finish.

CONCRETE MASONRY UNITS (CMU)

Concrete masonry units shall be used as back up for exterior face brick for service yard enclosures. Concrete masonry units shall comply with ASTM C90.

MASONRY ACCESSORIES

Mortar net or a comparable mortar collection product shall be added to the base of brick veneer and single wythe concrete masonry walls to prevent clogging of weep holes. Masonry veneer anchors, dowels, termination bars and other accessories used in setting stone and brick veneer shall be stainless steel. Base wall flashings and other thru-wall flashings shall be stainless steel.

CLEANING

RELLIS domestic water source has trace minerals that remain after initial masonry cleaning. Assume four additional clean and rinses required on brick and stone surfaces.

Remove excess mortar and mortar smears as work progresses. Clean soiled surfaces with cleaning solution. Comply with recommendation of manufacturers of chemical cleaners for protecting building surfaces against damage from exposure to their products.

For stone masonry clean using only Soap and Water, avoid staining from cleaning solutions of adjacent masonry surfaces.

DIVISON 05 – METALS

GENERAL REQUIREMENTS

Wherever possible the A/E shall, in accordance with Texas Government Code Chapter 2252 specify iron and steel products that are produced in the United States. The A/E shall notify the Owner of any specified iron and steel product not produced in the United States. The A/E shall also advise the Owner if any of the exemptions identified in Chapter 2252 such as availability and quality might apply.

Pursuant to Sections 2252.201-2252.205 of the Government Code, Contractor shall require that any iron or steel product produced through a manufacturing process and used in the project be produced in the United States. Contractor will require that the bid documents provided to all bidders and the contract include this same requirement.

STRUCTURAL STEEL

The contractor shall be required to provide an affidavit, at the completion of the project, that the structural steel framing is plumb and level within the normal tolerances specified in the AISC Code of Standard Practice.

The main slope for the roof shall be accomplished by the structural system. Only secondary slopes can be accomplished by the roof system.

The CM/GC is responsible for creating a building information model (BIM) of the structural steel from which shop, fabrication, and as-built drawings shall be derived.

All exterior structural steel is to be hot dipped galvanized, as are smaller members mentioned in this section.

The project A/E is responsible for ensuring all miscellaneous steel is properly identified in the construction documents, including coordinating elevator rail supports and hoist beam where required.

COLD-FORMED METAL FRAMING

The project A/E is responsible for engineering design of all structural metal framing and shall not delegate this design to the contractor and/or subcontractors. Non-structural Cold-formed metal framing shall be spaced per code and/or manufacturer’s standard design tables.

METAL FABRICATIONS

All exterior ferrous metals shall be hot dip galvanized including but not limited to ladders, bollards, ledge angles, shelf angles, lintels. Paint exposed galvanized metal fabrications where desired. Refer to Division 32 of these guidelines for information on RELLIS Campus standard decorative bollards.

Wherever dissimilar metals come in contact with each other, they must be separated with an approved layer of bituminous coating. Galvanized metal or zinc plated fasteners shall not be used to anchor aluminum or copper. Use aluminum or copper fasteners.

METAL STAIRS

Metal stairs with concrete, terrazzo or other similar treads are acceptable for use as egress stairs. All exterior metal stairs shall be galvanized. All stairs shall have cast in or applied safety nosings.

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

GENERAL INFORMATION

Consider specifying products from sustainable sources such as FSC Certified Wood or regionally available from abundant sources. Avoid use of imported or exotic species of wood.

WOOD TREATMENT

Wood used in conjunction with roofing installations and wood which is installed in contact with concrete or masonry shall be pressure treated with an approved preservative to meet AWPA U1 Standards. Other installations shall receive prime coats suitable for finishes specified as soon as installation is complete. Back prime where dampness or warping is anticipated.

Interior fire-retardant wood products where required, shall be AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.

SHEATHING

Exterior wall construction with metal stud back-up sheathing material shall be minimum 5/8-inch-thick glass mat faced as defined in ASTM C1177/C1177M. Edges shall be square.

PLYWOOD

Communications and Electrical Room shall include mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84. Ensure that the manufacturer UL rated label is not painted over.

ARCHITECTURAL WOODWORK, MILLWORK, AND FINISH CARPETNRY

Materials and fabrication shall conform to specifications of Architectural Woodwork Institute's (AWI) Architectural Woodwork Quality Standards Illustrated "Custom Grade". Provide "Premium Grade" where required for unique and special features.

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

GENERAL INFORMATION

Building Envelope shall comply with State Energy Code, ASHRAE 90.1-latest adopted edition.

A method to clean all exterior glazing must be incorporated into the project. This includes cleaning from ground mounted equipment and lifts up to 3 stories and providing means such as davits and roof anchors for exterior staging. Verify method with RELLIS Administration.

BUILDING INSULATION

Maximize insulation value of the building envelope to conserve energy and incorporate an air barrier. Avoid insulation material containing formaldehyde and consider insulations with recycled content. Exterior insulation shall be continuous (CI).

Non-combustible is recommended in place of foam-based products (polyurethane, polystyrene, etc.), and is especially important in unprotected, concealed spaces, such as attics and crawl spaces, or in hollow-core walls that will be penetrated by electrically rated equipment. Follow applicable codes for foam-based plastics where used.

Where spray foam-based products are exposed, thermal and ignition barriers shall be incorporated.

ROOFING

Renovation/replacement of existing roofs shall confirm with RELLIS Administration for system type to be used. All new roofing systems shall be coordinated with RELLIS Administration through the Planning and Design Review Board (PDRB) process during design. The RELLIS Campus Master Plan has established a common vocabulary for sloped roofing elements and colors to unify the campus from a broader vantage point. These roofs shall be standing seam metal roofs and may also incorporate deep overhangs. Use of this connective common vocabulary and color is strongly encouraged on all new facilities to reinforce the RELLIS sense of place.

Roof mounted equipment other than exhaust fans is not permitted in new facilities or major renovations on the RELLIS campus unless the following design strategies are utilized:

- Conditioned mechanical penthouse
- Fully screened mechanical roof well
- Roof mounted equipment screens (subject to RELLIS Administration approval)

Specify service walkways (minimum 2’0” in width) appropriately located to service all roof top equipment from the roof access. Where roof mounted equipment cannot be avoided, include “passive” fall protection such as parapets and/or guardrails.

Carefully detail roof expansion joints and flashing. Flashing materials for institutional grade buildings shall be aluminum, stainless or copper (not galvanized metal). Completely detail all

parapet walls, caps, coping and scuppers. Top of coping should slope toward roofs. Detail roof edges sufficiently high to prevent water from spilling over and spotting walls and fascias where roof drains are used. Provide drips on overhangs, ledges, window stools and coping to prevent discolorations of fascias, soffits and walls.

Slope all roofs adequately to drain (minimum 1/4"/ft. slope). Design primary roof slopes for new buildings into structural frame and not by roof insulation. Crickets to roof drains may be sloped with insulation. Metal building roofs shall have minimum 1/4"/ft. slope.

Lightweight concrete insulating fill roof decks will not be used in conjunction with urethane roof system. Lightweight structural concrete is allowed.

Roofing systems for all new facilities at RELLIS shall be either single-ply thermoplastic polyolefin (TPO), standing seam metal, sprayed polyurethane foam (SPF), or some combination of the three. Alternate roofing systems are not permitted without express approval from RELLIS Administration.

Roof systems for new and existing facilities shall meet International Building Code and NRCA requirements and be selected to meet the specific design requirements of each building. Specified roof systems shall carry a manufacturer’s 20-year warranty.

The roofing manufacturer’s representative shall visit the site at the appropriate intervals during construction and review installation to verify warranty is enforceable. The project A/E team and any 3rd party envelope consultant (if applicable) shall also observe the roof installation at appropriate progress intervals during construction. A quality control checklist from the contractor is required to include a plan for roof installation. Contractor shall protect the roof system during all construction activities and repair as needed prior to substantial completion.

Metal Roof Panels

Metal roof panels shall comply with the following minimum requirements:

- Factory-formed panels with factory-applied finish.
- Zinc-coated steel panels conforming to ASTM A653/A653M; minimum G60 galvanizing.
- Panel thickness: minimum 24 gage (0.024 inch).
- Profile: Zee-Lock Double Lock, with separate snap-on battens of same metal as panels; concealed fastener system. Place standing seam clips at 18" O.C. max in the field and perimeter, 9" O.C. max in the corner roof areas.
- Texture: Smooth, with intermediate ribs for added stiffness. Length: Full length of roof slope, without lapped horizontal joints. Width: Maximum panel coverage of 16 inches.
- Finish: Fluoropolymer Coating System: Manufacturer's standard multi-coat thermocured coating system, including minimum 70 percent fluoropolymer color topcoat with minimum total dry film thickness of 0.9 mil; color and gloss to match sample.

All metal roof panels and associated flashings and sheet metal shall match basis of design: Berridge **"Antique Copper-Cote"**. Alternate products may be utilized if color matched to the basis of design finish with written approval by RELLIS Administration.

Single Ply Roofing

Single ply roofing shall comply with the following minimum requirements:

- Membrane: Flexible, heat weldable sheet composed of thermoplastic polyolefin polymer and ethylene propylene rubber; complying with ASTM D6878/D6878M, with polyester weft inserted reinforcement.
- Thickness: 0.080 inch plus/minus 10 percent
- Puncture Resistance: 415 lbf, minimum, when tested in accordance with FTM 101C Method 2031.
- Solar Reflectance: 0.79, minimum, when tested in accordance with ASTM C1549.
- SRI: 92 minimum.
- Color: White.

Sprayed Polyurethane Foam Roofing

Sprayed polyurethane foam (SPF) roofing is used extensively on the TAMU main campus and only in limited applications on the RELLIS campus. SSC Services maintains and updates a guideline specification for SPF roofing in association with TAMU's deferred maintenance reroofing program. If selected for any new facilities or renovation/reroof projects at RELLIS, the A/E team shall obtain current SPF specifications from the SSC Engineering, Design, and Construction Services (EDCS) Department.

SEALANTS

Ensure that the specified sealants are used within their limitations.

At the project A/E's option, masonry control joint sealants on the RELLIS campus shall be color matched either to the adjoining masonry color or to the adjoining mortar color. Perimeter sealants at aluminum storefront and curtainwall framing shall be bronze to match the RELLIS standard aluminum framing color specified in Division 08 of these guidelines. Contrasting and/or visually distracting sealants are not permitted.

DIVISION 08 – OPENINGS

GENERAL REQUIREMENTS

Building fenestration shall comply with State Energy Code, ASHRAE 90.1-latest adopted, including assembly U values, assembly SHGC and percentage of glass. Ensure that windows, doors, and louvers are designed for adequate wind loading and velocity pressures per International Building Code and Texas Windstorm requirements as applicable.

The use of daylighting in the building design is strongly encouraged. Use of skylights is not permitted unless approved in writing by RELLIS Administration. Use of protected clerestory glazing is allowed.

Exterior doors shall be hinged/swinging, as appropriate to the building use and design, with safeguards and handicapped accessibility as necessary. Automatic sliding doors are not permitted without the express written permission of RELLIS Administration. Door types, materials, hardware, and sensors shall be established designs with proven field experience under similar usage. Consideration shall be given to availability of trained service technicians and spare parts.

All general use building entrances shall have a vestibule. At least one door at primary entrances shall be power operated. Exterior entrance doors on all new facilities and major renovations shall be provided with proximity card access readers and electrified hardware in accordance with the Division 28 section of these guidelines. The door frames shall be prepped as a part of the design and construction of the building.

Warning bars or cross mullions shall extend across all full-height glazed areas. Meet requirements of "Model Safety Glazing Code" and "Consumer Product Safety Commission."

DOORS AND FRAMES

Exterior and interior personnel doors shall be maximum 7 feet high unless approved by RELLIS Administration or if required for ingress and egress of specialty equipment to be utilized in the facility. Coordinate opening sizes with large equipment in mechanical and electrical rooms for move-in and/or future replacement. All entrance doors and frames shall be hinge and strike reinforced for “high frequency” use.

Exterior hollow metal doors shall be not less than 16 gauge with 14 gauge or heavier one piece welded frames. Interior hollow metal doors shall be not less than 18 gauge with 16 gauge one piece welded frames. Knock-down metal frames are expressly prohibited. All hollow metal doors and frames shall be A60 galvanized.

Interior aluminum frames (i.e. Raco or similar) may be utilized in office and administrative areas only with prior approval from RELLIS Administration. Interior frames in high traffic, high use, or other areas subject to damage or abuse shall be hollow metal.

Wood doors are permitted for interior applications only and shall be minimum 1-3/4” thick to accommodate mortise locks per RELLIS/TAMU finish hardware guidelines. Interior wood doors shall be flush type, solid core, hardwood. Stile and rail or paneled wood doors are prohibited without express written approval from RELLIS Administration. Interior wood doors may be either

wood veneer (field finished or factory pre-finished) or plastic laminate faced. Exotic wood veneers are prohibited.

ALUMINUM STOREFRONTS, CURTAIN WALLS, AND ENTRANCES

Metal framed glazed entrance assemblies shall be wide-stile with sufficient width to receive mortise locksets and/or panic hardware per RELLIS/TAMU hardware guidelines. Narrow-stile aluminum entrances are expressly prohibited. Medium-stile aluminum entrances will only be permitted if the project A/E and the proposed supplier can document in writing that the entrance frame and door are compatible with the hardware guidelines.

Frameless glass and/or Herculite doors are prohibited. Locksets shall be at conventional height and shall not be permitted in bottom rails. Bottom rail shall be a minimum of 12 inches and top rail shall be a minimum of 6 inches. Include in specifications, steel reinforcing inserts in the hinge jamb section of doors in aluminum storefront systems.

Wherever possible utilize storefront systems instead of curtain wall systems.

Curtainwalls are expected to be placed on a formed concrete curb at the building perimeter and not set directly on the building slab.

Color of storefront, curtainwall and window frames shall match the campus standard - Medium Bronze, Class 1 anodized. High-performance painted finishes matching the campus standard bronze color may be considered with prior approval from RELLIS Administration.

Automatic Operator Supplier Qualifications: Power operator products and accessories are required to be supplied and installed through current members of the manufacturer's "Power Operator Preferred Installer" program. Suppliers are to be factory trained, certified, and a direct purchaser of the specified power operators and be responsible for the installation and maintenance of the units and accessories indicated for the Project.

WINDOWS

Heads, jambs, and sills of windows in walls shall be properly flashed and shall be caulked or sealed during the window installation, prior to the placement of snap-on moldings or covers, to ensure that concealed surfaces are properly sealed against the penetration of wind and water. Flashing shall include pre-molded end dams. All windows should have drips at heads and sills.

Projected and casement type windows, and flush mounted windows are difficult to maintain watertight and their use is discouraged. Design windows with maintenance in mind and include provisions for cleaning windows including elevated systems. Verify accessibility for cleaning during Design Development.

Provide a typical sample window with weather resistive barrier and flashing in the exterior mock-up. The completed install should be reviewed with all exterior wall components.

HARDWARE

Door hardware and keying on the RELLIS Campus are managed and serviced by TAMU Building Access. RELLIS follows TAMU main campus guidelines for hardware and keying. Refer to TAMU's current hardware standard located here:

https://facilities.tamu.edu/procedures-standards.html

For broken hyperlinks or confirmation of most current version, contact TAMU Building Access for additional information. Additional RELLIS Campus specific requirements are detailed below.

A hardware schedule shall be included in the project specifications for every project which requires new or modified door hardware. The schedule shall list all finish hardware for each discrete opening and shall be included in the specifications no later than the construction documents phase. The hardware schedule shall be reviewed by both RELLIS Administration and TAMU Building Access prior to completion of construction documents and during the project submittal phase.

A minimum of one pair of exterior double doors shall have a keyed, removable mullion for equipment access. Coordinate access with users for moving mobile equipment out of buildings or spaces for adequate clearance.

All doors at wet and high humidity areas such as kitchens, shower rooms, mechanical rooms, etc. shall have a brass or bronze (non-ferrous) base metal hinge or stainless-steel hinge. All doors having closers should be protected from wear of wheelchairs by a minimum of 10" high kickplates.

Pivot hinges and/or concealed closers are prohibited in facilities on the RELLIS Campus.

The A/E shall investigate the security requirements for the project and develop an appropriate keying system. Final keying functions shall be established during a key conference conducted by the Owner's designated representative, with the A/E, User, RELLIS Administration, TAMU Building Access (The Key Shop), Contractor, and successful hardware supplier during construction. Verify other requirements such as extra key blanks, key box, etc. with the User and RELLIS Administration.

GLAZING

Current approved glazing for new RELLIS campus buildings is the Vitro Glazing Solarbronze product line or equal. Acceptable insulating glass units include:

- Solarban 90 (2) Solarbronze outboard lite + clear glass inboard lite
- Solarban 70 (2) Solarbronze outboard lite + clear glass inboard lite

Alternate products may be considered with approval of physical samples by RELLIS Administration during design. Highly reflective (mirror) glass is not permitted.

Partial shading of insulating glass can cause stress breakage. Manufacturers consider this to be a design error and will not replace glass broken by temperature differential stresses. Avoid partial shading of large panes.

Provide manufacturer's written guarantee that for ten years from date of Substantial Completion a replacement will be provided for any insulated glass unit which develops edge separation or other defects which materially obstruct vision through the glass or safety or affects the insulating qualities. Guarantee shall not cover glass breakage from physical abuse, storm or similar causes.

Building fenestration shall comply with ASHRAE 90.1-latest adopted including assembly U values, assembly SHGC and percentage of glass.

DIVISION 09 - FINISHES

GENERAL INFORMATION

The preliminary selection of interior finish materials shall take place during the schematic design phase. During the design development phase, the A/E's Interior Designer shall present a minimum of two distinct color schemes to the User Coordinator and FP&C or SSC Project Manager. A final color scheme will be selected and incorporated into the specifications.

Interior finish materials shall be high quality, durable materials that are easily maintained and manufactured regionally. Particular attention shall be given to finishes in public spaces. The use of materials with recycled content is encouraged.

Avoid the use of imported, costly, or high maintenance finish materials. Finishes or detailing that have minimal tolerances and place unrealistic expectations on the installing contractor(s) shall be avoided.

Verify attic stock quantities of all interior finish materials with the Member Facilities Department.

GYPSUM WALLBOARD

All interior gypsum wallboard should be at least DensArmor, DensArmor Plus, or equal impact and mold resistant wallboard.

Impact resistant gypsum board shall be used in public hallways and corridors. Impact resistant board shall be Type X very high impact-resistant (VHI), paper-faced panels with moisture and mold resistance meeting ASTM C1629 level 3 for soft- and hard-body impact.

All gypsum wallboard, regardless of location, shall be not less than 5/8" thick. A/E team shall specify finish level type 5 for all large open areas, common areas, and/or corridors. Specify level 4 finish only in enclosed areas or where lighting (artificial and/or daylight) will not result in detrimental appearance.

SUSPENDED ACOUSTICAL CEILINGS

All ceilings shall be designed to be easily accessible for maintenance and other access needs. A single type of ceiling tile such as 2 ft x 2 ft or 2 ft x 4 ft, minimum 5/8" thick, non-directional pattern tiles with a recycled content shall be used throughout a building to minimize maintenance and repair costs. Exceptions to this are special areas that are identified in the POR.

Tegular and/or beveled edge tiles are expressly prohibited on the RELLIS Campus without special prior approval from RELLIS Administration. All tiles shall be square edge to facilitate ease of access and replacement without damaging edges. Acoustical ceiling tiles larger than 2 ft x 4 ft are expressly prohibited on the RELLIS Campus without special prior approval from RELLIS Administration.

Ceiling suspension assemblies shall be supported directly from the building structure and shall be supported at all four corners of light fixtures. Location of hangers shall not interfere with access to VAV filters, valves, dampers and other items requiring maintenance.

All ceilings shall be modeled at the assigned height in the building information models (BIMs).

CERAMIC TILE

The use of ceramic tile is encouraged for high profile/high use public areas, restrooms, storage rooms, furniture storage rooms, shower and locker rooms, or other spaces where a durable material is appropriate. Avoid extremely light colors for tiles. Avoid white or light-colored grout for floor applications. Large format tile shall be coordinated with lighting design. Wall wash lighting with large format tile is strongly discouraged. Consider the use of tile or other durable material as wainscot on high traffic corridor walls especially near classrooms. All floor tiles shall be non-slip and rated for heavy duty use.

Designs where floor and wall tile indicate a pattern of colors or a “mosaic” shall be detailed in the drawings using specific tile sizes dimensions and notes to clearly indicate the extent and complexity of the pattern or “mosaic”.

All floor tile grout shall be epoxy. In frequently wet areas such as showers, epoxy wall grout shall be used. Epoxy grout shall match intended application.

Where floor drains are required, such as janitor, lab, restroom or mechanical rooms, the floor shall be sloped to drain with depressed slab as required. Provide waterproofing and crack control membrane as needed.

TERRAZZO

Where budget permits, use of epoxy terrazzo or traditional sand-bed terrazzo flooring in high traffic areas (i.e. lobbies, corridors, and commons spaces) is encouraged.

CARPET SYSTEMS

Refer to Guide Specification at the end of this division. Use of carpet tiles is strongly encouraged for ease of repair and replacement.

RESILIENT TILE FLOORING

The use of vinyl composition tile (VCT) in new construction and major renovations is strongly discouraged due to maintenance requirements associated with routing stripping and waxing. If specified, VCT shall be minimum 1/8 inch thick with thru pattern or thru-chip construction and meeting the requirements of ADA for static coefficient of friction when installed in accordance with manufacturer’s guidelines. Recycled content (post-consumer and post-industrial waste) shall be minimum 10%. Material must meet or exceed a 5-year warranty. If VCT is specified, Contractor is responsible for the initial strip and wax of all floor tile. Wax materials shall be coordinated with and pre-approved by SSC Custodial Services.

Luxury vinyl tile (LVT) or rubber tile flooring is preferred due to lower maintenance requirements. Specified LVT or RT must meet or exceed a 5-year warranty.

VINYL WALL COVERING

The use of vinyl wall covering is strongly discouraged and is expressly prohibited on the interior surface of exterior walls.

FIBER REINFORCED PANELS (FRP)

The use of FRP is required at custodial rooms and environmental areas as requested by RELLIS Administration or the User Coordinator. FRP shall be provided above mop sinks in all custodial rooms a minimum of 4’ high on both sides of the sink for the full width of the basin.

PAINTING AND COATINGS

Satin or semi-gloss enamel paint shall be used on all surfaces and items normally painted. Flat finish paint is not acceptable. Gloss paint is discouraged. Specify a minimum of two finish coats over a prime coat of a different tint than finish coats.

Manufacturer’s standard color selection shall be utilized. Avoid the use of deeply saturated colors for walls. The use of lighter colors is recommended since these colors enhance reflectivity and reduce the need for lighting. The selection of zero or low VOC products is required to eliminate problems with off gassing.

Inside surface of wood cabinet drawers two receive two coats of clear sealer. Top and bottom edges of wood doors to receive two coats of tinted sealer to aid visual inspection. Except for prime coats on equipment and piping insulation, specify all field painting under the painting section of the specifications.

Refer to the UES guidelines referenced in the mechanical, electrical and plumbing sections of this guideline for requirements related to identification and painting of all piping and conduits. Refer to UES guidelines referenced in the electrical section for required standard paint color for exterior medium voltage switches and pad-mounted utility transformers.

GUIDE SPECIFICATION – CARPET SYSTEMS

1.0 General

1.1 Summary: The following shall be used as a guide for a minimum carpet specification. Other products with equal or better characteristics or qualities shall be considered.

2.0 Products

2.1 Carpet Systems

2.1.1 Modular vinyl backed carpet tile or six foot roll carpet with vinyl back.

2.1.2 Manufacturers: Interface, Shaw, Lees, Mannington, or acceptable substitute shall meet the following requirements:

2.1.2.1 Construction: Textured or level loop tufted.

2.1.2.2 Face Fiber: 100% Invista Antron Lumena® or Antron® Legacy, Antron Blend. Type 6,6 nylon - continuous filament with anti-oil, anti-stain protection.

2.1.2.3 Pile Height: >0.117 and <0.187.

2.1.2.4 Yarn Weight: (minimum 22 oz/yd).

2.1.2.5 Dye Method: 100% solution dyed or a solution dyed yarn dye blend.

2.1.2.6 Stitches per inch: 12/in minimum.

2.1.2.7 Primary Backing: 100% sealant vinyl or non-woven synthetic.

2.1.2.8 Secondary Backing: 100% vinyl back or 5/32 inch vinyl closed cell cushion back. Backing shall be fusion bonded to face fiber and primary backing to create an integrated product. Shall pass: Test ASTMD 3936 delaminating of secondary back, Test ASTMD 1667 with 25% deflection @ 710 PSI.

2.1.2.9 Density: 4500 minimum.

2.1.2.10 Electrostatic Propensity: 3.5 KV or Less.

2.1.2.11 Warranty: Lifetime – 20 years, non-prorated warranty against delaminating, edge ravel, zippering, moisture penetration, wear.

2.1.3 Performance Characteristics:

2.1.3.1 Flammability: Radiant Panel Test (Direct Glue): ASTM E-648, Class 1. Pill Test: pass CPSC-FF1-70. Flaming Mode: <450 per ASTM E-662 NBS Smoke Density. Non-flaming Mode: <450 per ASTM E-662 NBS Smoke Density.

2.1.3.2 Static: < 3.5 KV Permanent Conductive Fiber per AATCC-134.

2.1.3.3 Electric Resistance: pass NFPA 99.

2.1.3.4 Burroughs Method: pass NFPA 99.

2.1.3.5 Recycled content: minimum 35%.

2.1.3.6 Recyclable: 100% of all content.

2.2 Accessories

2.2.1 Carpet Adhesive: Releasable, pressure sensitive type adhesive shall be water based and allow for removal without damage to carpet or substrate and leave no residue.

2.2.2 Adhesive Seam Sealer: (For 6 foot roll goods) As required, provide adhesive seam sealer certified in writing by the manufacturer as compatible with carpet backing. Seam sealer shall have minimum five year manufacturer's guarantee. Sealer shall create a 100% chemical weld at the seam site to provide a monolithic installation with a moisture barrier.

2.2.3 Carpet Edge Guard: Shall be either aluminum or vinyl edge guard or transition in color suitable for a particular installation. Edge guard attachment shall be by mechanical fasteners or glued down.

2.2.4 Tread Edge Strip: Shall be rubber or transition in color suitable for a particular installation.

3.0 Execution

3.1 Installation Requirements

3.1.1 All existing carpet and existing carpet waste shall be reused or recycled in an "environmentally friendly" manner. "Environmentally friendly" carpet recycling methods shall be performed after job completion. As used herein, "environmentally friendly" methods consist of the following:

3.1.1.1 Repurposing – reusing the product in another application such as facilitating the donation of used carpeting to a charity or other nonprofit organization.

3.1.1.2 Recycling – turning waste materials into new materials.

3.2 Installation Conditions

3.2.1 All sub floors shall be level, clean, dry, and free of dust, dirt, wax, paint, grease, cut back adhesive or any material that might interfere with the overall bond strength of the adhesive. Concrete floors shall be fully cured and free of excessive moisture and alkalinity. No condensation within 48 hours on underside of a 4ft x 4ft polyethylene sheet, fully taped at perimeter to substrate. Conduct moisture test; maximum allowable amount of

moisture emitted from floor shall be 3.0 pounds per 1,000 square feet in a 24 hour period.

3.2.2 Store carpet and adhesive at a temperature of 70 degrees Fahrenheit for 48 hours prior to installation and maintain for 48 hours during and after completion.

3.2.3 Do not expose adhesive to ultraviolet light. Adhesive may be photosensitive and lose its tack.

3.2.4 For 6-foot roll carpet cut edges tight to form seams, without gaps, using carpet manufacturer's recommended seam sealer.

3.2.5 When carpet is scheduled for installation on risers and treads, as in auditoriums, and the carpet project as specified with a vinyl cushion back will not install properly over risers and treads, the installer of the carpet project shall be required to provide and install rubber tread edge strips along the front edge of all treads including treads located within the seating areas.

3.2.6 Installer shall have at least five years of experience and be certified by the manufacturer of the carpet submitted.

End of Guide Specification

DIVISION 10 - SPECIALTIES

TOILET PARTITIONS

Partitions or stalls should be floor mounted and overhead braced and constructed of solid plastic or stainless steel in all permanent buildings unless other materials are approved by RELLIS Administration. Painted metal or plastic laminate are not acceptable. Provide a coat hook and bumper guard on back of each toilet partition door. Coordinate the location of toilet partitions and floor drains.

TOILET ACCESSORIES

Verify all accessories with RELLIS Administration and SSC Custodial Services during Design Development. Toilet accessories which use consumable products must be obtained from SSC Custodial Services (owner furnished and contractor installed) so they are coordinated with custodial supplies provided for the campus. These include:

- Paper towel dispensers
- Toilet tissue dispensers
- Soap dispensers

SSC offers a base model for each of the above accessories and an upgraded model with stainless steel finishes if desired (at additional cost). No other products for the above three items are permitted in any RELLIS Facility without prior approval from RELLIS Administration. Confirm current manufacturer and model numbers during design.

Remaining toilet accessories (i.e. mirrors, grab bars, sanitary napkin disposals, etc.) may be selected by the project Architect subject to approval by RELLIS Administration and SSC Custodial Services during design. All other accessories shall be contractor furnished and installed.

Electric hand dryers may be specified in group toilet rooms subject to approval by RELLIS Administration. Soap dispensers shall be affixed to walls or mirrors such that excess soap will drip into the sink or on the counter and not onto floors. Group toilet rooms shall be provided with an area containing shelves and/or wall hooks for safe storage of handbags and personal items.

CORNER GUARDS AND RAILS

Provide corner guards on corners of corridor walls with heavy pedestrian traffic. Provide wall guard rails along corridor walls in laboratory areas to protect walls from lab carts.

EMERGENCY KEY BOXES

Refer to Division 21 of these guidelines for information on required Knox Boxes at all RELLIS Campus facilities.

FIRE EXTINGUISHERS AND CABINETS

Requirements for fire extinguishers and cabinets on the RELLIS Campus are governed by the most current version of the TAMU EHS fire and life safety design guidelines. This document is maintained and updated by TAMU EHS and can be found on their website here:

Texas A&M University Supplemental Guide for the Design, Installation, and Acceptance of Fire and Life Safety Systems

For broken hyperlinks or confirmation of most current version, contact TAMU EHS for additional information.

New portable fire extinguishers shall be installed in every new or renovated facility unless approved by the AHJ. Extinguishers shall be clean and free of any dust and construction debris. All extinguishers shall be selected and installed in accordance with the most recent edition of NFPA 10, Standard for the Installation of Portable Fire Extinguishers. If a conflict exists, contact RELLIS EHS for clarification or direction.

All fire extinguishers shall bear the current years manufacture date at the time of substantial completion of the facility or renovation if substantial completion falls on or after March 1st of the year. If substantial completion of a project occurs between January 1st and the last day of February, then the previous year's manufacture date is acceptable. In no case shall an extinguisher be more than one year past its manufacture date.

AUTOMATED EXTERNAL DEFIBRILLATORS (AED)

Provide a minimum of one (1) AED per building coordinated with RELLIS/TAMU EHS. AED shall be Cardiac Science G3 or G5 Item # 9390A-1001(plus specified accessories) or Item# G5A-80-P (plus specified accessories). A/E team shall locate and specify an accessory cabinet for the AED (either recessed, semi-recessed, or surface mounted) as needed to meet ADA requirements.

ARCHITECTURAL GRAPHICS

Interior Building Signage

Interior building and wayfinding signage shall be shown and specified by the project A/E. Placement shall be in accordance with Texas Accessibility Standards, International Building Code, International Fire Code, and any other applicable codes and ordinances. Use industry standard method to anchor graphics (double face VHB tape or silicone construction adhesive). All fonts and colors shall match RELLIS Campus standard detailed further below. Identification signage for offices shall have an area for changeable names.

Examples of interior base building signs include:

- Stairway Identification
- Area of Refuge Identification
- Elevator Emergency Sign
- Fire or Emergency Elevator Operation notice
- Fire Door Signage
- Electrical Room identification

- Exit Door Identification
- Permanent Room Identification
- Restroom Identification
- Office Identification
- Assembly Space Maximum Occupancy
- Severe Weather or Emergency Shelter Identification

Examples of interior wayfinding signs include:
- Overhead Directional
- Wall-mounted Directional
- Room and Space Identification Blade or Flag signs

All building utility spaces, stairs, and rooms shall include the name of the space as well as room number on identification signage.

Room numbering shall be approved by the TAMU Office of Facility Analytics and Mapping (FAM) and RELLIS Administration no later than the completion of Design Development.

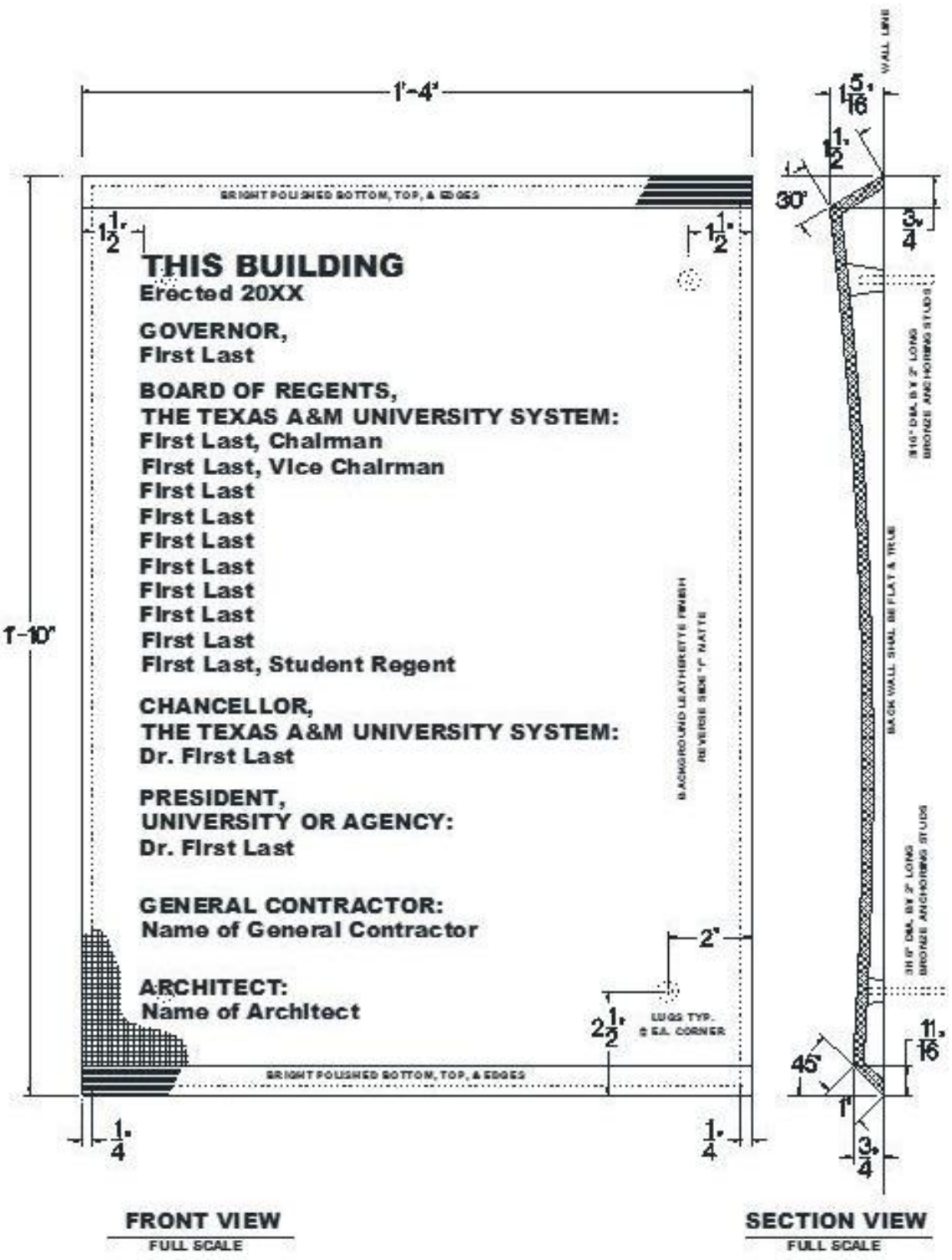
Construction Project Signage

Capital construction projects (new facilities and/or major renovations) shall include provisions for a minimum 4’x8’ project sign to be placed in a conspicuous location at the entry to the project site. Consult with the FP&C or SSC project manager for current TAMUS guidelines for construction project signage.

Building Dedication Plaque

All new construction and major renovation capital projects shall provide a bronze building dedication plaque per TAMUS standards. The plaque shall be owner furnished and contractor installed. TAMUS standard plaque detail provided on the following page.

Plaques shall be manufactured by Time Works Unlimited, Inc., P.O. Box 9052, College Station, Texas 77842-9052, (http://timeworksunl.com/), or approved equal. Tablet is to be cast of virgin ingots (85-5-5-5 standard U.S. Bronze Alloy). Casting shall be free of pits, porosity, imperfections and gas holes and all letters shall be sharp and hand tooled. The backs shall be flat and true. Border and faces of raised letters are to be a satin finish. Background shall be leatherette. Coat with compound to ensure plaques will not bleed and discolor the mounting surface. Tap backs of plaques and provide bronze or stainless-steel studs for blind fastening.



CAST BRONZE DEDICATORY BUILDING PLAQUE

Name of Project Proj. No. XX-XXXX

EXTERIOR BUILDING AND CAMPUS WAYFINDING SIGNAGE

INTRODUCTION

The purpose of this section of these guidelines is to define the standards for all exterior building and campus wayfinding signage design and construction. The objective is to assist the RELLIS Campus in providing thoughtful and useful experience for its greater community through consistent visual signage design standards.

The institutional signage design guidelines for RELLIS provide a central resource to assist in visioning and design for all future development. It offers clarity for all stakeholders and ensures compliance with signage requirements. The standards ensure that each visitor will be left with a positive and lasting impression of RELLIS.

The signage guidelines provide the means for campus stakeholders and partners to reference the guiding principles, material specifications, usage diagrams, sign type inventories, restrictions, and related material. It is intended to be a comprehensive point of reference. Any sign designed in adherence to the guidelines can be built and installed by following the procedures herein.

GUIDING PRINCIPLES

There are several guiding principles that unify the design and development of all RELLIS Campus signage:

- Brand Expression: The design of all sign structures and messages must align to the brand standards of the RELLIS Campus, as determined by the A&M System. All campus signage designs must be in line with the prescribed brand standards and approved before production.

- Unified Campus Environment: The signage guidelines establish a unified system that enhances visitors' recognition of the campus, the daily experience of its community, and the prestige of the RELLIS Campus as an institution.

- Safety and Utility: The signage guidelines assist in creating and siting signage where it will be most effective to keep both visitors and the campus community informed of the proximity of restricted and/or hazardous areas. The guidelines also utilize best practices to make wayfinding as intuitive as possible.

MATERIAL VOCABULARY

The RELLIS architectural color and material palette informs the look and feel of all signage.

Sign Cabinet/Lettering Colors


Pantone 7421


Pantone 422


Pantone 7540

Sign Base

Leuders Limestone w/honed finish

Smooth finished concrete (sign foundation only)

Typography and Graphics

Typography for all RELLIS Campus signage will be:

- Primary Typeface: Frutiger Lt Std 65 Bold is the primary signage and wayfinding typeface. It will be used for all wayfinding and informational content. It could also be appropriate for stylized storytelling, narrative, or interpretive elements.

- Secondary Typeface: Frutiger LT Std - 55 Roman is the secondary typeface. It will be used for formal building and place identification. It could be appropriate for stylized storytelling, narrative, or interpretive elements.

Frutiger Lt Std - 65 Bold

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

Frutiger Lt Std - 55

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789

Typography Colors

White

Pantone 422

Pantone 424

RELLIS Logo

The RELLIS Logo may only appear on campus identification monument signage.

Secondary Branding Elements

A secondary branded graphic element will be employed on signage elements which establish the perimeter of the campus. This branded element can be in Aggie Maroon, Pantone 442, Cool Gray 11, or tonal on approved materials.

Only RELLIS campus signage shall have conspicuous display of The Texas A&M University System seal. RELLIS Campus use of the A&M System Seal can be in the form of bronze plaques, carved elements or other additive features. Development Partners may only utilize bronze plaques OR internal, nondescript use of the System Seal.

Secondary Branding Element

The Texas A&M University System Seal

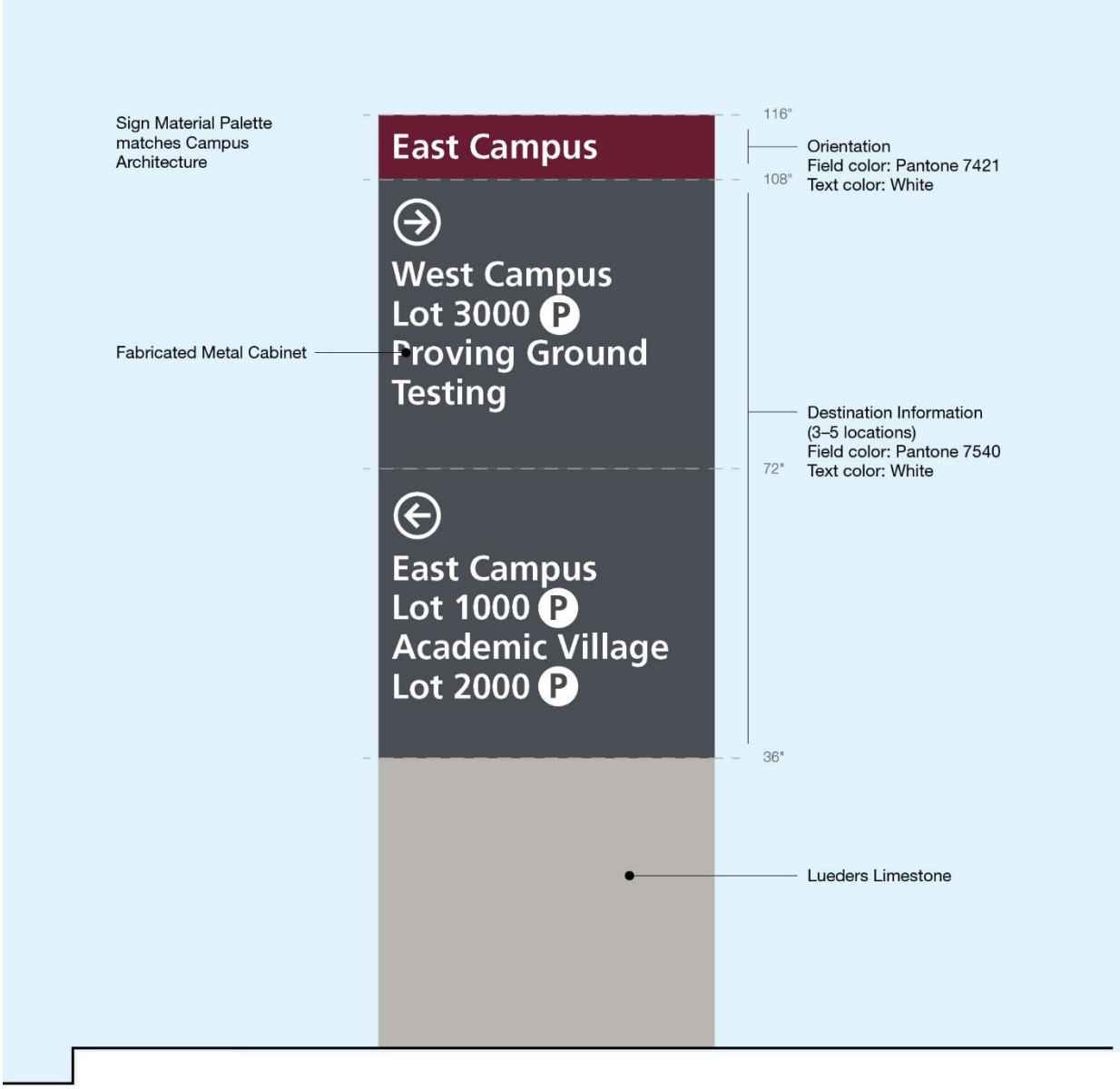
SIGN INFORMATION HIERARCHY

For signage information hierarchy and nomenclature include the following:

- Clear and consistent messaging will be used throughout all campus communications. Destinations and place names will be vetted with consideration for visitors. Naming opportunities to increase orientation and better serve direction sets include campus organization (east and west), entrances, parking areas, and public destinations.

- Vehicular wayfinding can carry a minimal amount of information and should be easily readable at a glance (3-5 destinations).

- Pedestrian wayfinding can carry a variety of information with different levels of density (quick reference directional cues and detailed information to study).



Information hierarchy will provide a systematic approach for displaying information consistently from one sign to the next.

Messaging and Naming Hierarchy

The message hierarchy system for the RELLIS campus should maintain the following principles:

- Use naming and language that is expandable as the campus grows.
- Make use of clear and consistent terminology. Only use acronyms that have a common understanding.
- Display information in a consistent manner to allow the wayfinding system to be easy to use and intuitive.
- Use on-brand terminology.
- Use language and messages that work with technology tools such as websites, mapping programs, etc.

Wayfinding and Messaging Logic

The primary steps or sequence of events that make up the logic for the campus wayfinding system are:

- Find the Campus
- Orient to major/primary campus organization
- Follow street address system to partner facility with dedicated parking.
- Follow wayfinding signs to public parking or to primary campus destination.
- Once parked, follow pedestrian wayfinding signs to destination.

CAMPUS SIGNAGE GUIDELINES

Overview

The contents of this section are guidelines for signage design and installation for all official RELLIS Campus infrastructure signage. All campus departments must adhere to these guidelines for all development or temporary signage. All signage should be designed as a part of the overall campus presentation. Signage should complement the campus brand as well as the architecture of the buildings or facilities.

Nothing in this document shall be construed to preempt any local, state, or federal regulation or ordinance. It is the responsibility of the campus to ensure that proposed signage meets all requirements of the Texas A&M system. Any deviation from these criteria must be approved in writing by RELLIS administration. The A&M System and RELLIS Campus require accuracy and conformity with any building code, signage code, or other governmental and regulatory requirements. Campus procedures to ensure the accuracy and conformity of plans, and the responsibility for obtaining all permits and approvals from all appropriate governmental and regulatory bodies, must be applied and followed. Please refer to the Resources section for additional guidance.

Illumination

Campus signage with illumination will have ground mounted or indirect, and internal illumination methods. Campus identification and major directional elements will have a combination of internal and ground mounted illumination. Typical directional elements will not have internal or external illumination.

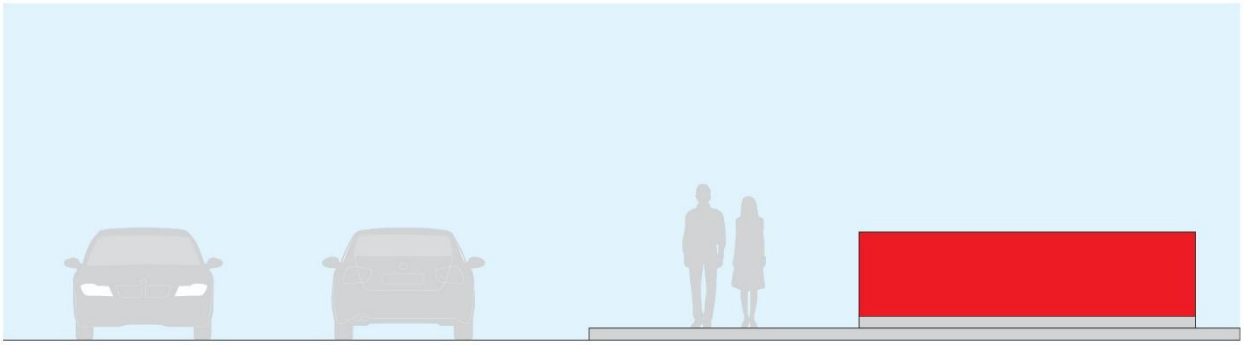
- Ground mounted illumination: low profile light fixtures used to illuminate the sign face, with a lighting color temperature of approximately 3,000-3,500K. Ground mounted lighting should be placed up out of finished grade conditions, not mounted in areas to receive mowing or other mechanical maintenance. Efforts to obscure the lighting elements with landscape bedding plants or other elements are encouraged. Users must maintain the lighting in working conditions at all times.

- Halo illumination: letter-forms, graphics, or signage elements applied to sign face with internal illumination that is projected out the back of the letter-form or graphic, creating a halo or glow, bringing a definition to the letter-form, graphic, and signage element.

- Internal illumination: push-through lettering or logo cut through the sign face and backing material and mounted or inlaid so the sign looks as if the lettering or image had been pushed through, up, and out of the sign. Push-through lettering may be back-lit through the sign, or the fascia of the lettering may be translucent to allow lighting the imagery from behind. Note: All RELLIS standard monument signs are required to have internal illumination. Ground mounted illumination is not permitted for monument signs.

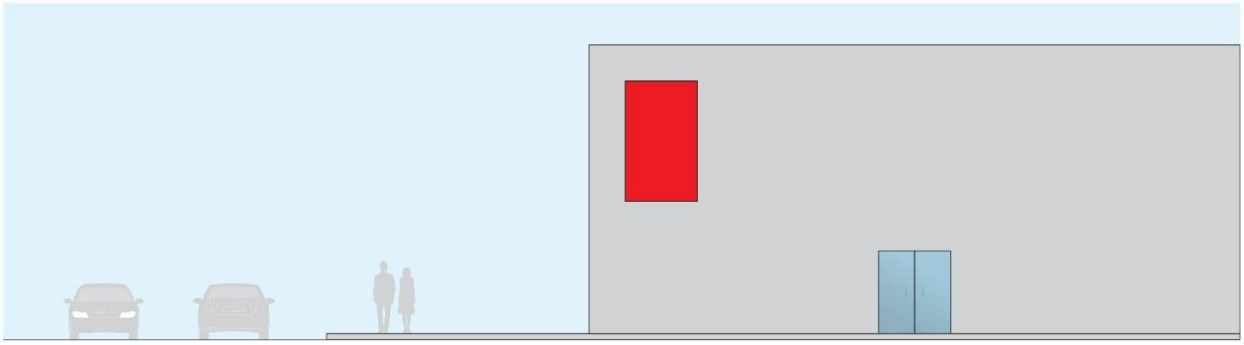
Sign Type Diagrams

The RELLIS Campus will require many different sign types as it evolves. The campus sign system should be considered for consistency of form, application, economy of scale, and modularity. Examples of sign types are shown in the diagrams below.



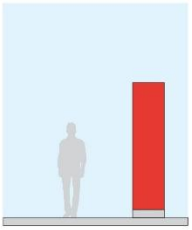
Site Identification - Monument Sign

Site Identification - Pylon Sign

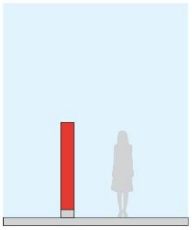


Site Identificaiton - Building Mounted

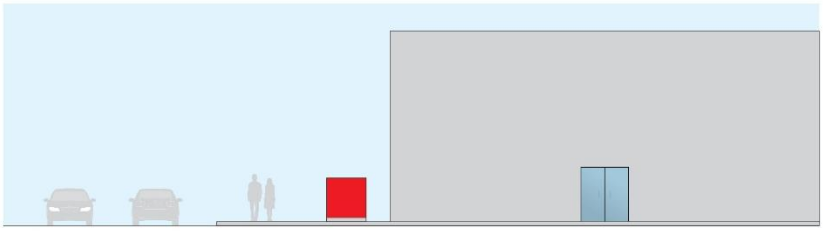
Building Identification - Building Mounted



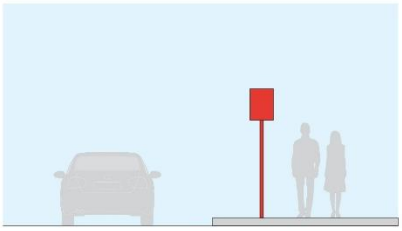
Large Pedestrian Directional



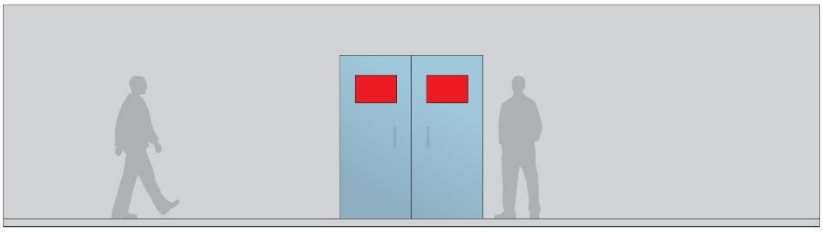
Small Pedestrian Directional



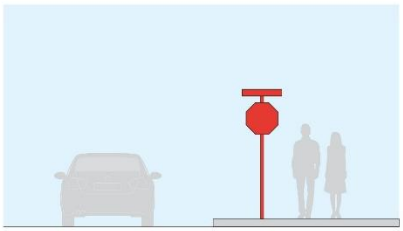
Building Identification - Free Standing Monument Sign



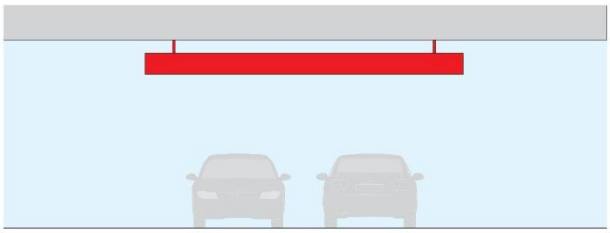
Typical Regulatory Sign



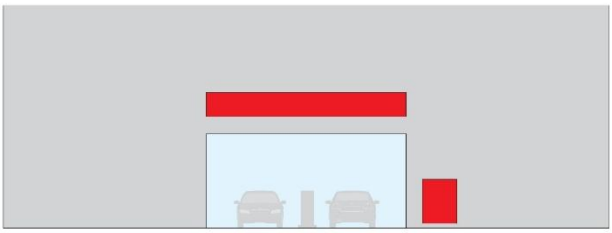
Building Identification - Vinyl on Glass



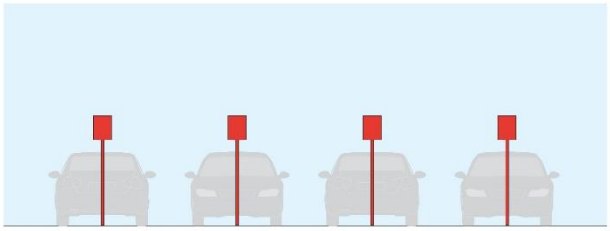
Street and Stop Sign



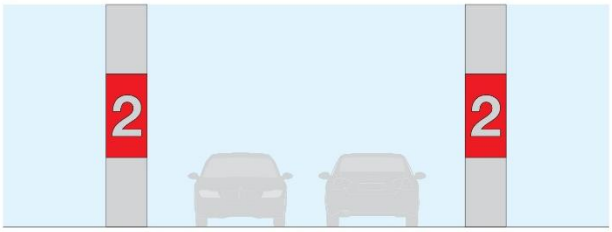
Column Mounted Level Identification



Parking Lot Identification - Free Standing Monument and Building Mounted

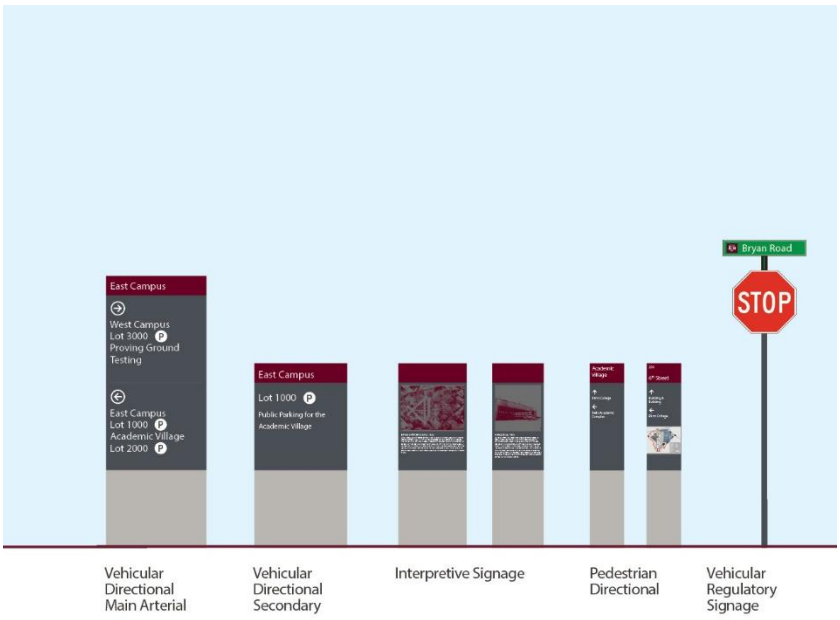


Parking Stall Singage



Column Mounted Level Identification

Elevator Lobby Level Identification



Wayfinding signs are placed at decision points. Primary decision point is appropriate for a Main Arterial Directional. Secondary decision points are appropriate for a secondary directional.

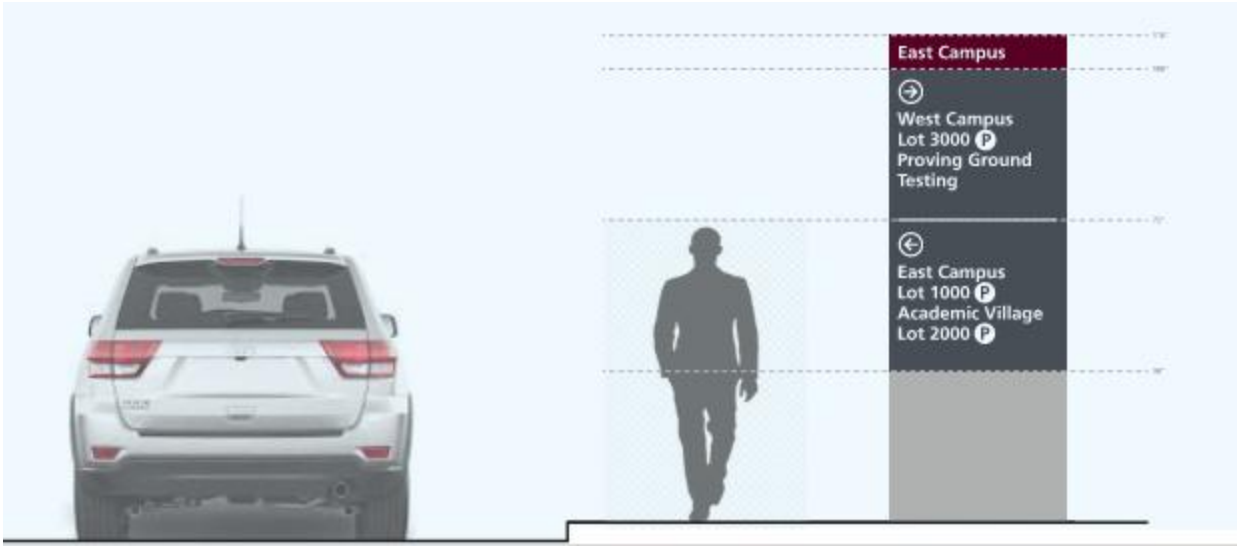
CAMPUS DIRECTIONAL SIGNAGE

Vehicular Directional Signage

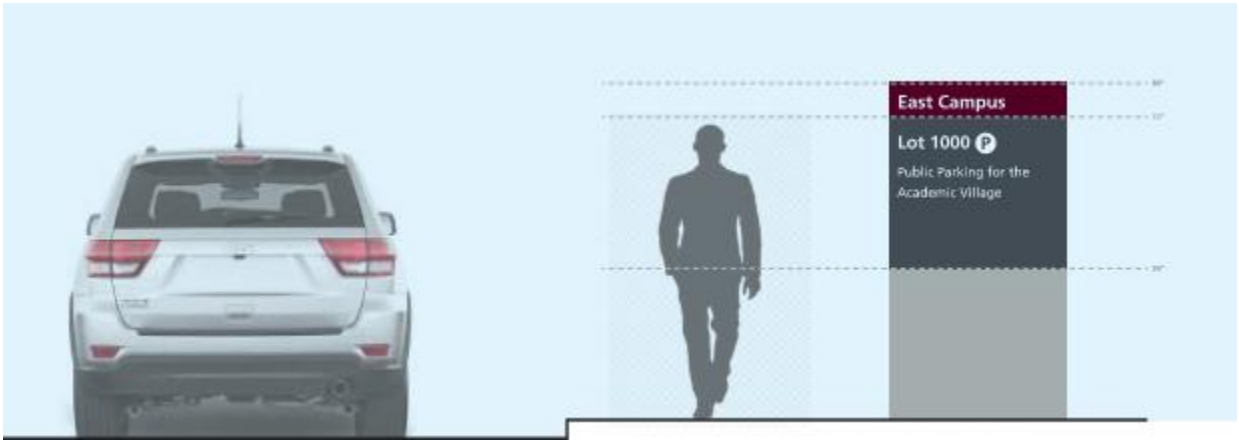
Vehicular wayfinding signage will direct to major geographic destinations and public parking. Vehicular wayfinding will provide clear guidance at multiple decision-making points within the campus. It will clarify navigation to defined parking zones and reinforce visibility of primary complex destinations.

Content for vehicular directional signs will highlight visitor destinations and include simple, prioritized information about key parking areas, geographic locations, roadways, and visitor destinations. However, vehicular signs will not include individual building or donor named locations to keep signs relevant for the maximum amount of time. Wayfinding will direct visitors to visitor parking areas associated with key visitor destinations.

Vehicular wayfinding will work within the modular system. Wayfinding information should be applied to elements that are sized according to the information that is necessary to display. Vehicular directional elements should not overpopulate the roads and streets but offer cues at important decision points.



A typical roadway intersection with two stacking signage modules can allow for two levels of directional information.

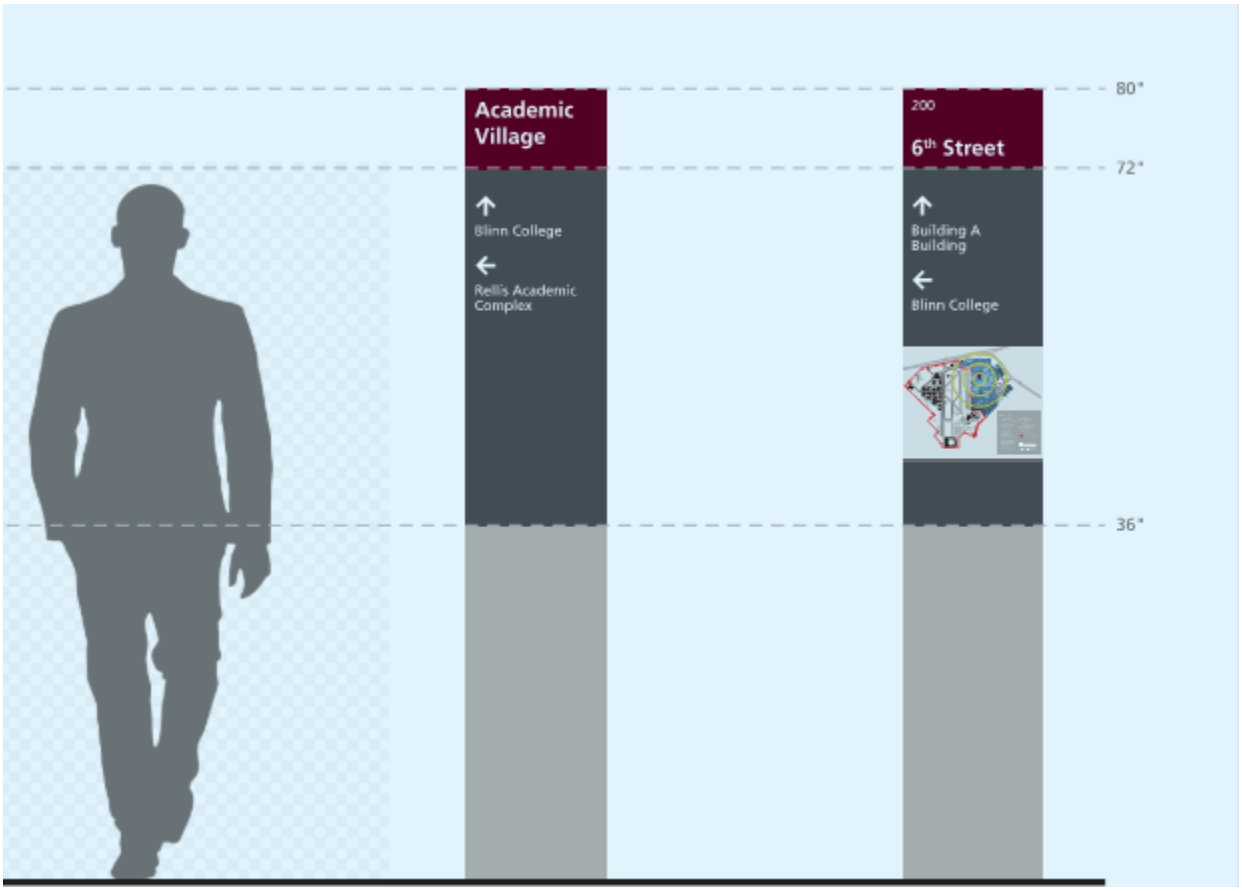


Example location which requires a single group of information using a single signage module.

Pedestrian Directional Signage

Most of the pedestrian traffic originates from parking areas with considerations for future public transit stops. Pedestrian wayfinding will establish clear orientation and direction for pedestrian traffic, encouraging foot traffic along the campus pedestrian-only areas and supporting the connections of the different districts.

Pedestrian wayfinding can carry a variety of information with different levels of density, including quick reference directional cues, as well as detailed information for further study. Signage can include orientation maps, travel distances to major destinations, highlight community amenities, and serve recreational and exploration purposes. It can also serve to increase pedestrian safety at traffic intersections.



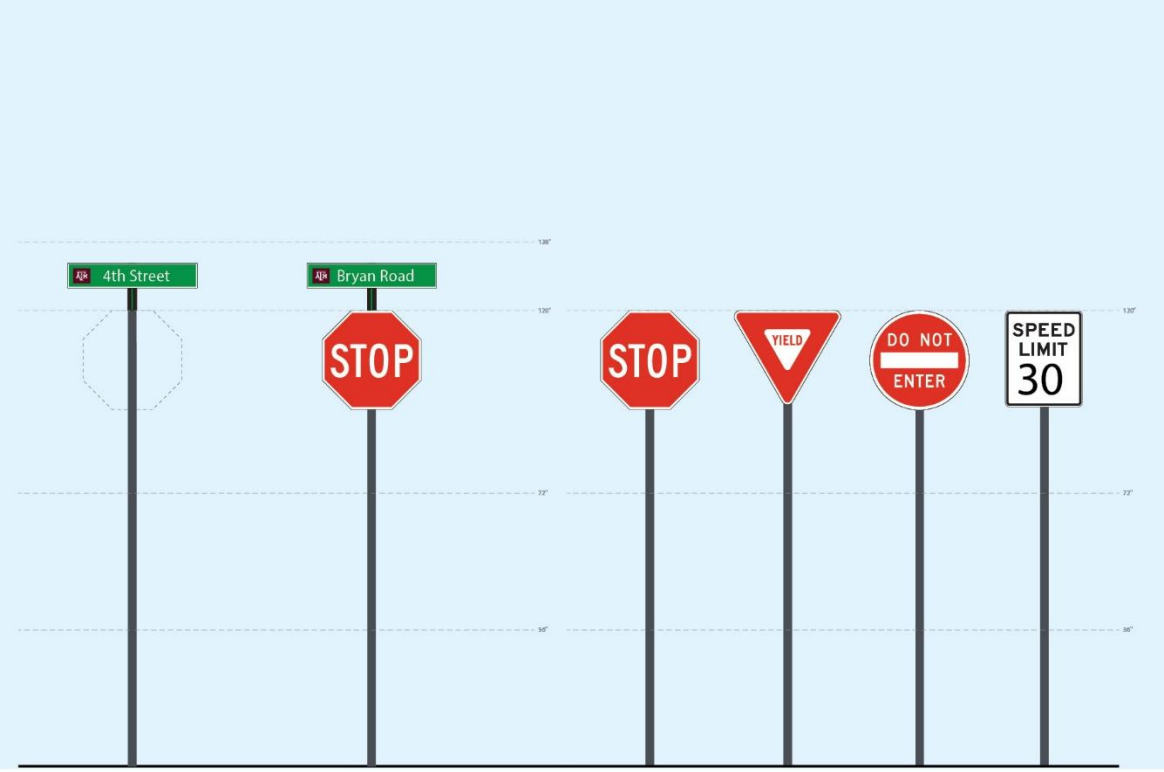
Example of pedestrian directional signage.

Maps should appear on the pedestrian directionals so that visitors can use them as the navigate the different areas of the campus. The maps should be easy to be changed on the directional elements and be of an illustrative nature to reinforce the RELLIS brand. The maps can carry a variety of information from simple directional cues or highly detailed features of the campus with travel times marked and illustrated.

Regulatory Signage

The campus will employ typical regulatory signs that comply with RELLIS traffic control, law enforcement, and the A&M System requirements.

Campus regulatory signage may employ a custom painted sleeve for signposts that are in public facing areas, major roadways, and streets.



Example of RELLIS Campus Regulatory Signage.

Campus Signage Placement

Highway signage requires scale and placement specific to highway visibility and reduction of speed from 75 mph. Interior loop signage requires scale and placement specific to RELLIS Parkway visibility and reduction of speed from 35 mph.

Interior surface street signage should be placed as close to curb edge as possible while still allowing for safe vehicle passage. Take care to coordinate locations of wayfinding signs with roadway lighting and other regulatory signage.

Pedestrian signage should be located close to the path of travel and be visible from some relative distance. A variety of information from quick directional to detailed maps should be provided.

Secure proving ground entry gates require clear, highly visible signage.

PARTNER SIGNAGE GUIDELINES

Overview

The contents of this section are guidelines for signage design and installation for all A&M System Members, and institutional and corporate partners operating on the RELLIS Campus. Partners must adhere to these guidelines for all permanent or temporary signage. All business entities are encouraged to express their brand presence in an outward display of quality and contributing nature to reinforce RELLIS as a campus environment.

Good design practices ensure harmony throughout the overall campus presentation. Signage should complement the unified campus experience as well as the architecture of the buildings or facilities. Presentation should work with surroundings to create a sense of place for the individual partner and its neighbors and also within the campus as a whole.

Nothing in this document shall be construed to preempt any local, state, or federal regulation or ordinance. It is the responsibility of the campus to ensure that proposed signage meets all requirements of the local city sign regulations, as well as all applicable building or other governmental or regulatory requirements. Any deviation from these criteria must be approved in writing by RELLIS Administration. RELLIS requires accuracy or conformity with any building code, signage code, or other governmental and regulatory requirements. The submissions resources section provides many tools to assist partners in achieving compliance. However, the responsibility for obtaining all permits and approvals from all appropriate governmental and regulatory bodies ultimately lies with each partner. Please refer to the resources section for additional guidance.

Partner Signage Guiding Principles

There are several guiding principles that unify the design and development of all RELLIS Partner signage:

- Brand Expression: The design of partner sign structures and messages must align to the design standards established by the RELLIS Campus, as determined by the A&M University System. Any partner signage that deviates from these guidelines must be modified and be in compliance before production can be approved. The guidelines provide broad accommodations for the inclusion of corporate or institutional identity elements necessary for partners to establish and maintain the presence of their brand.

- Unified Campus Environment: The signage guidelines establish a unified system that enhances visitors' recognition of the campus, the daily experience of its community, and the prestige of the RELLIS Campus as an institution.

- Quality: Partner signage should strive to communicate that RELLIS is a place of quality and excellence. High-quality design and materials should be paramount for signage elements.

Partner Sign Types

Multiple sign types in many forms make up a comprehensive system. Signage helps define Partner developments by reinforcing their brand, helping to improve operational aspects and help build the collective of the RELLIS experience. The major signage elements that affect the outward appearance of a development are:

- Project identity
- Monument (RELLIS standard)
- Building identification

Other elements include:

- Internal wayfinding

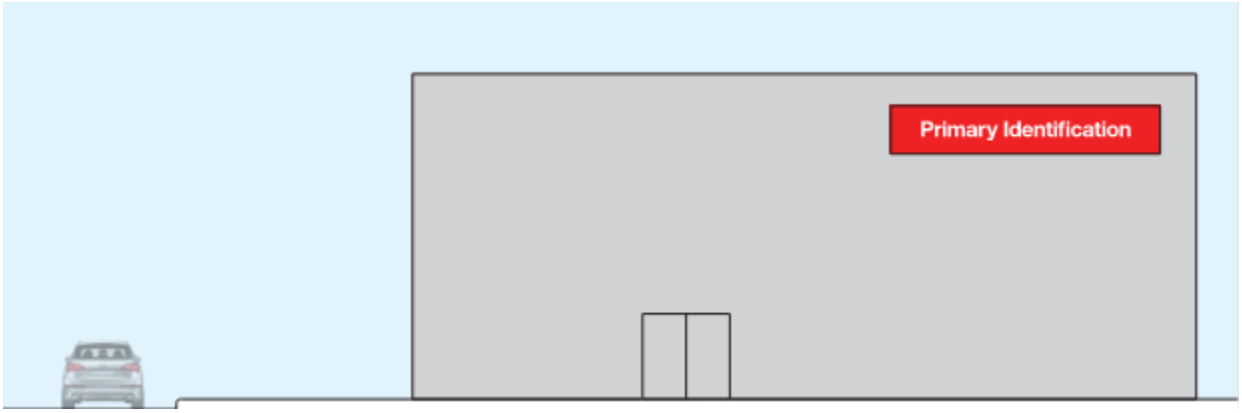
- Regulatory/security
- Placemaking
- Donor recognition*

RELLIS Partner signage allotments are dictated by the property type and size of building. Partners will align their overall development configuration with their building sizes to determine project identification size and number. Internal elements not critical to the overall visual experience to a development such as internal exterior wayfinding, donor recognition elements, or placemaking, will be reviewed by the Campus for quality of design and appropriateness to the campus.

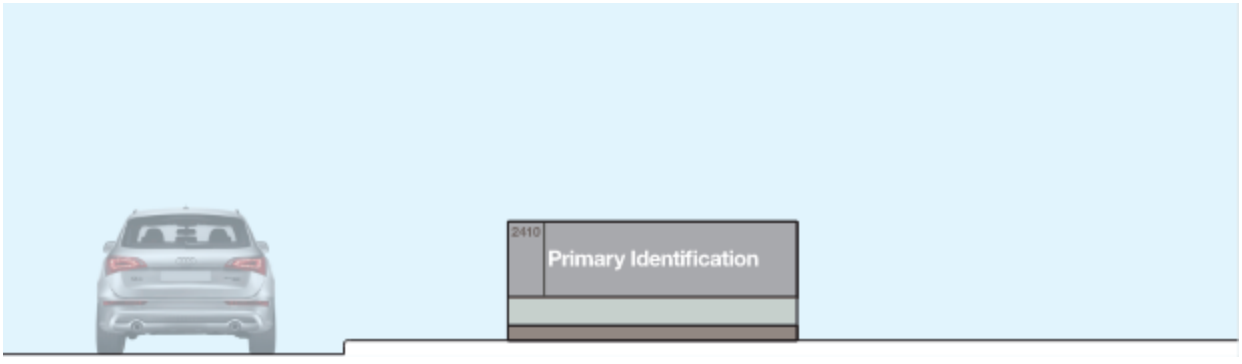
*Donor recognition features that are part or whole of a building mounted project identification or a ground or building identification sign must conform to the maximum allowable areas indicated.

Project Identification Signage

Project identification signs are signs with the purpose of displaying entity branded logos, wordmarks, and organization names and are meant to be seen externally to the property. Project identification signage can be building or ground mounted. Allotment and sizes determined in the subsequent sections.



Building Mounted Project Identification

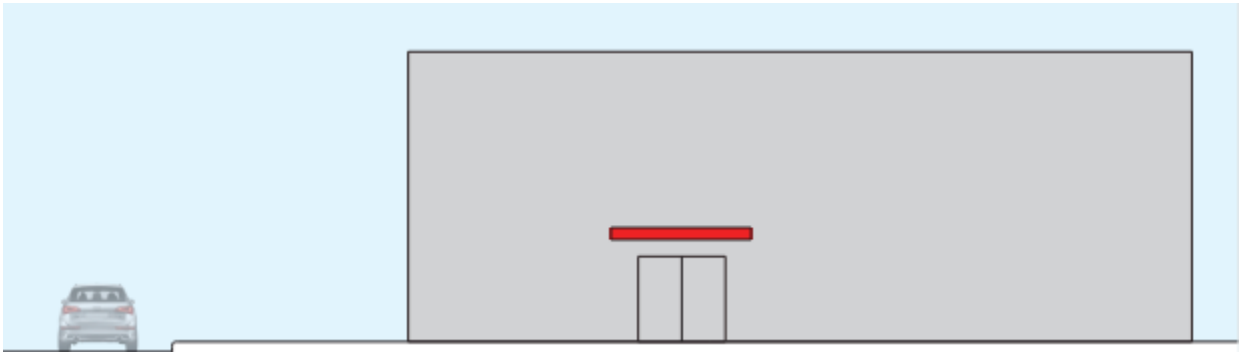


Ground Mounted Project Identification (RELLIS Standard)

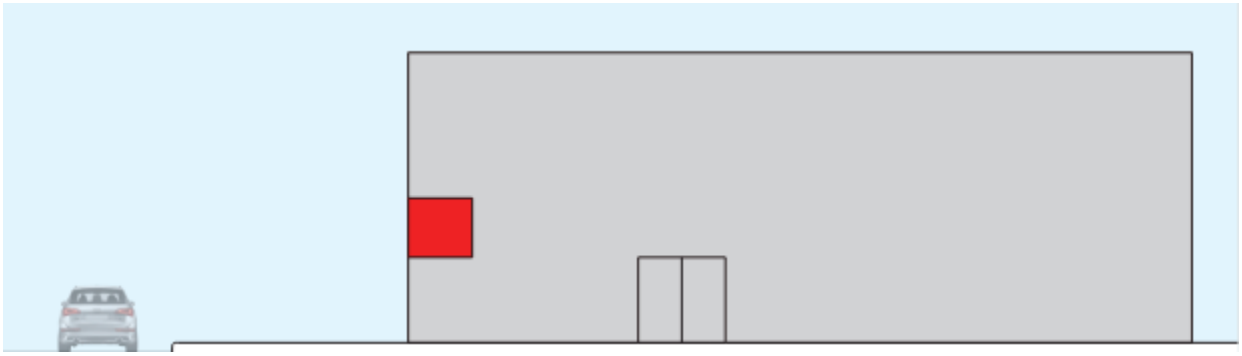
Building/Entrance Identification

Messaging priorities:

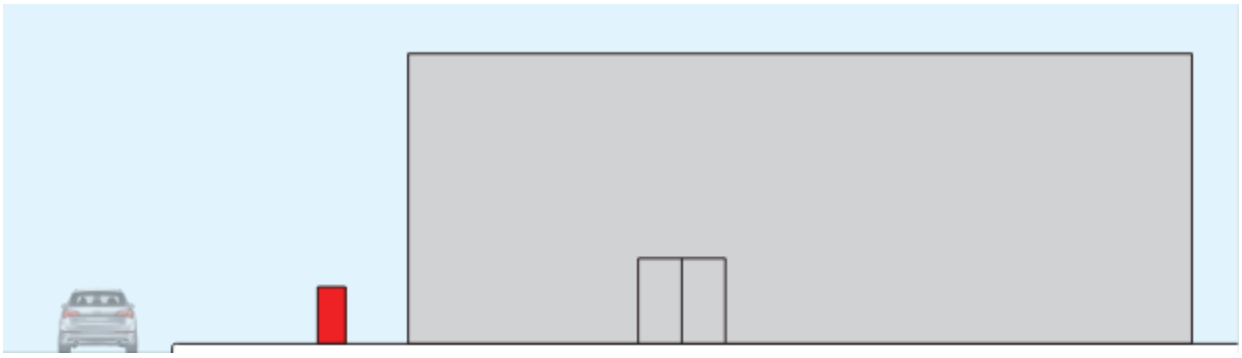
1. Donor/Honorific name
2. Entity Address
3. Entrance Identification
4. Regulatory Information
5. Wayfinding Information



Donor/Honorific Name



Building Mounted Identification



Free-standing Identification

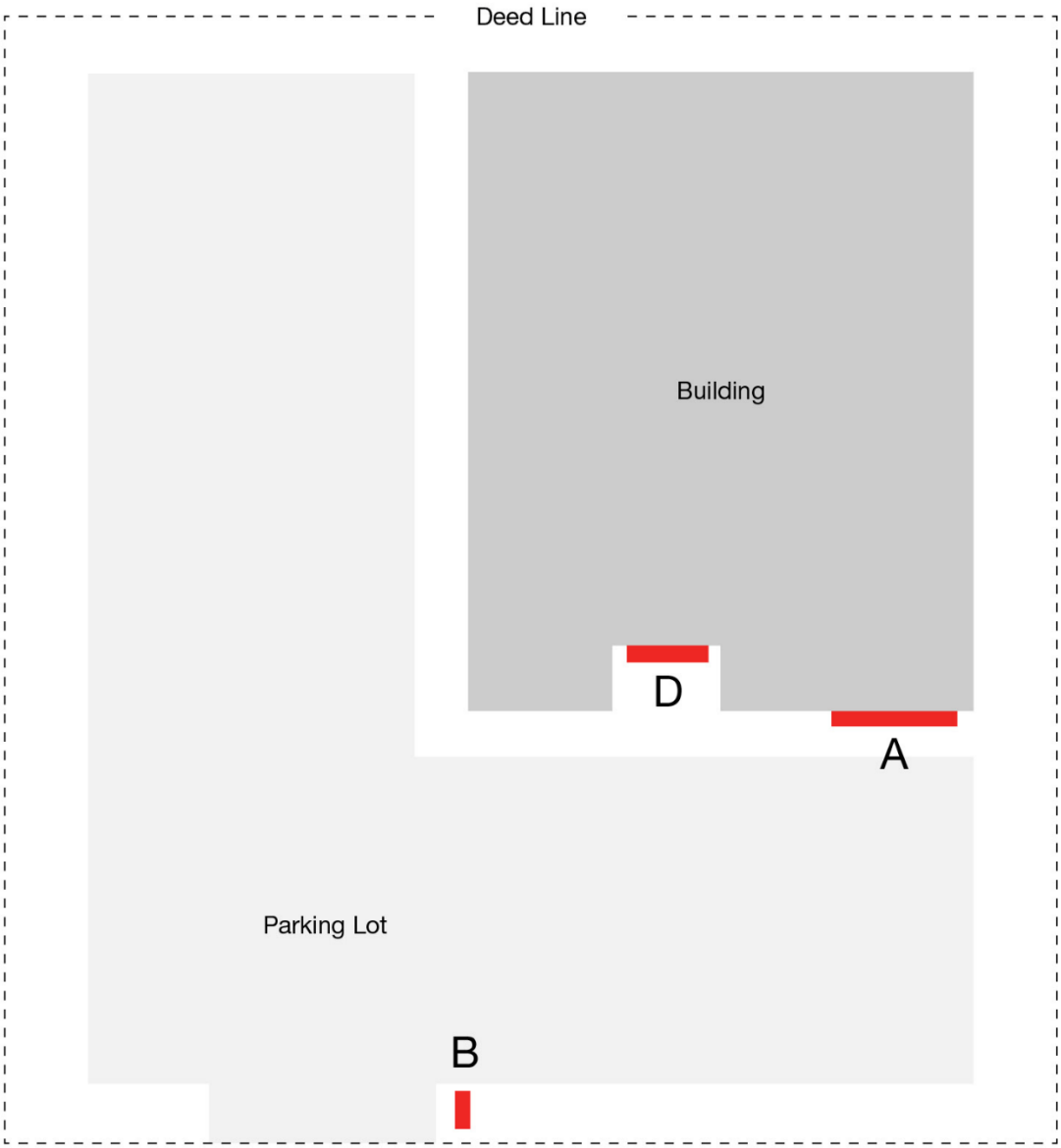
Sign Quantity Diagrams

Each diagram on the following pages shows the number of signs allotted in each existing condition.

Type 1: Location with one building and on-site parking that represents total site build-out. Allowed two exterior project identification signs (building or ground mounted) with clear hierarchy between the two.

Permissible Scope:

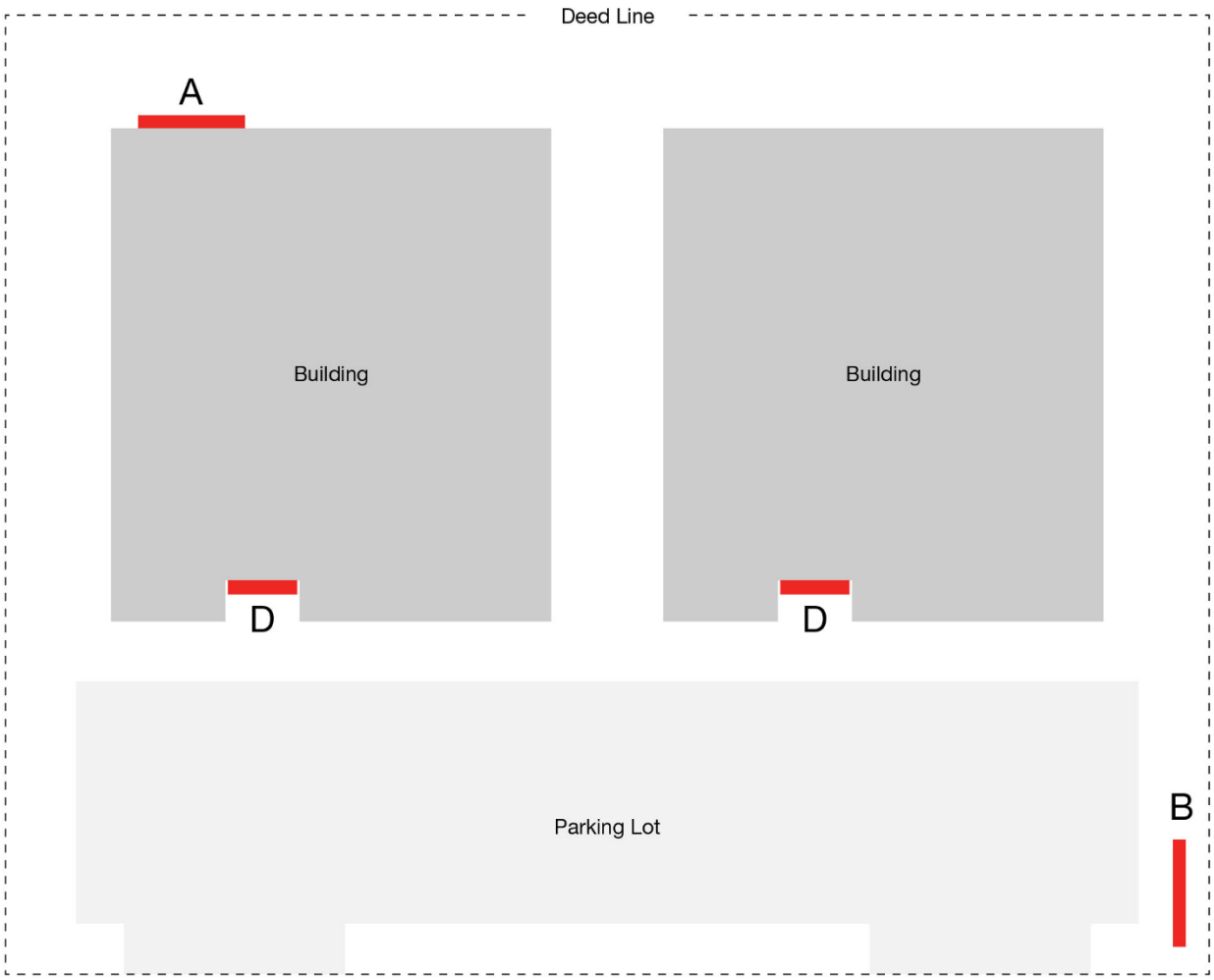
- One (1) building mounted identification sign "**A**"
- One (1) ground mounted RELLIS standard monument sign "**B**"
- One (1) building entrance identification sign per main entrance; can be building or ground mounted sign "**D**"



Type 2: Location with multiple buildings and on-site parking that represents total site build-out. Allowed two exterior project identification signs (building or ground mounted) with clear hierarchy between the two.

Permissible Scope:

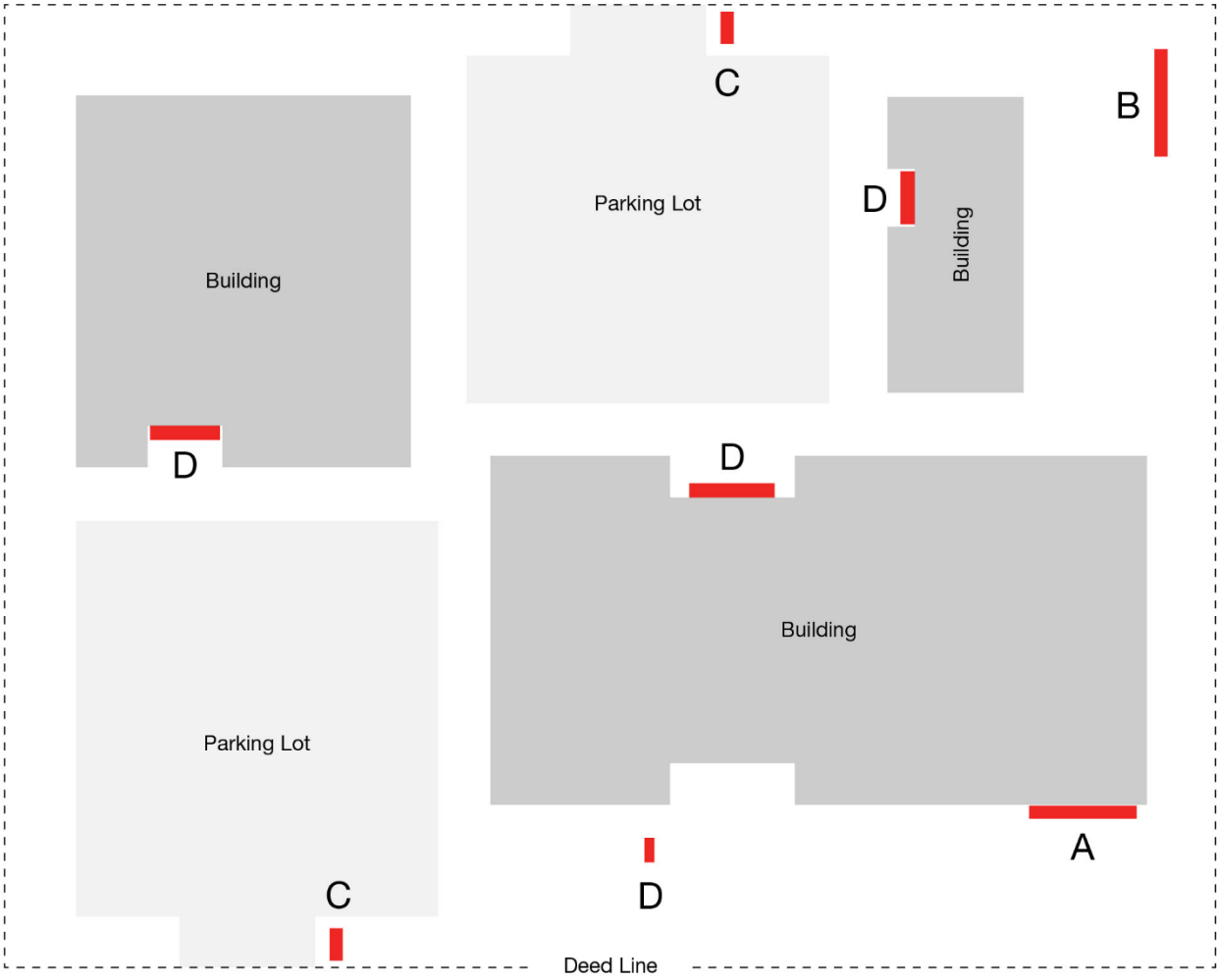
- One (1) building mounted identification sign "**A**"
- One (1) ground mounted RELLIS standard monument sign "**B**"
- One (1) building entrance identification sign per main entrance; can be building or ground mounted sign "**D**"



Type 3: Location with multiple buildings and multiple on-site parking that represents total site build-out. Allowed two exterior project identification signs (building or ground mounted) with clear hierarchy between the two.

Permissible Scope:

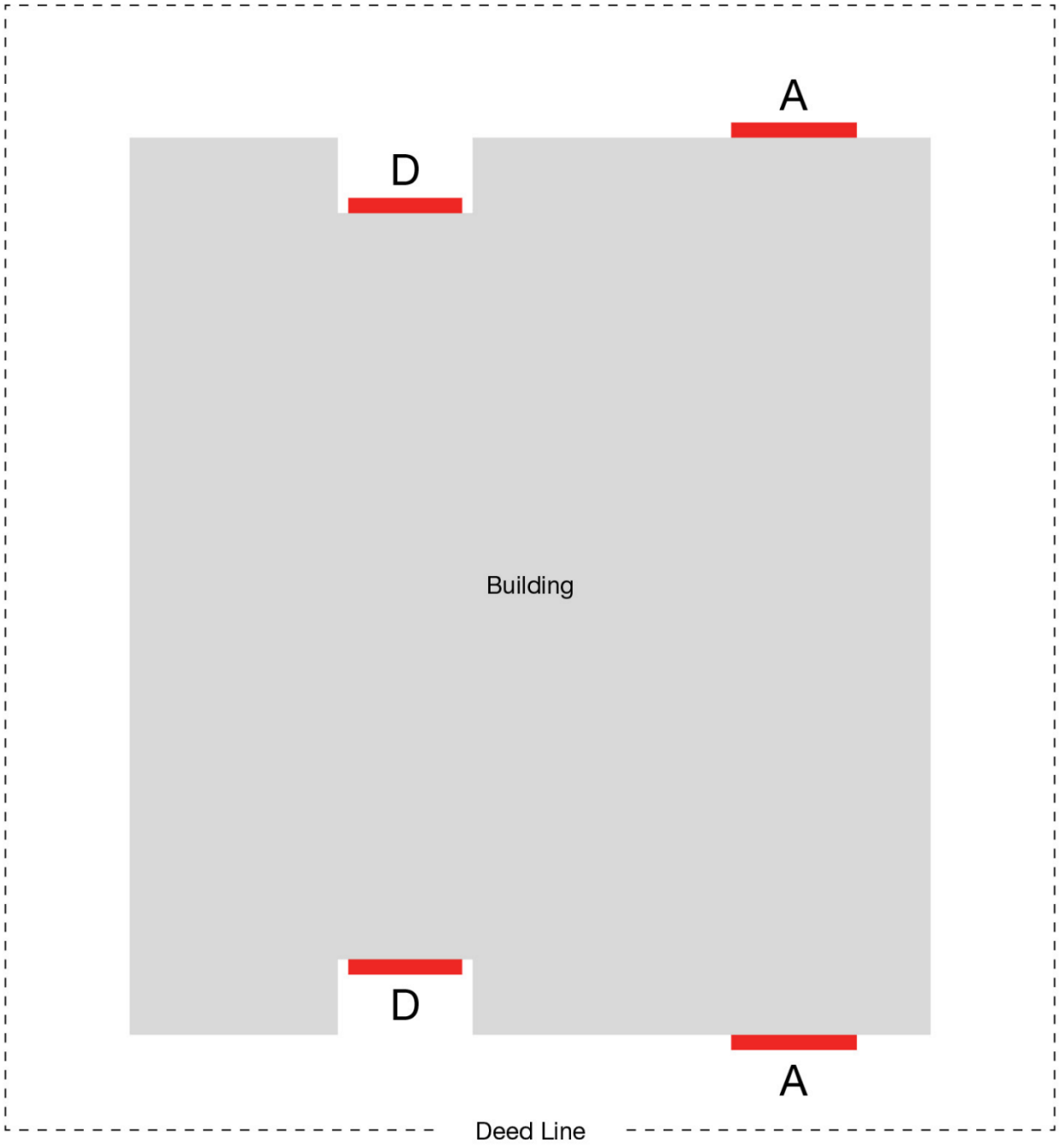
- One (1) building mounted identification sign "**A**"
- One (1) ground mounted RELLIS standard monument sign "**B**"
- Parking lot identification sign(s) "**C**"
- One (1) building entrance identification sign per main entrance; can be building or ground mounted sign "**D**"



Type 4: Location with one building without on-site parking that represents total site build-out. Allowed two exterior project identification signs (building or ground mounted) with clear hierarchy between the two.

Permissible Scope:

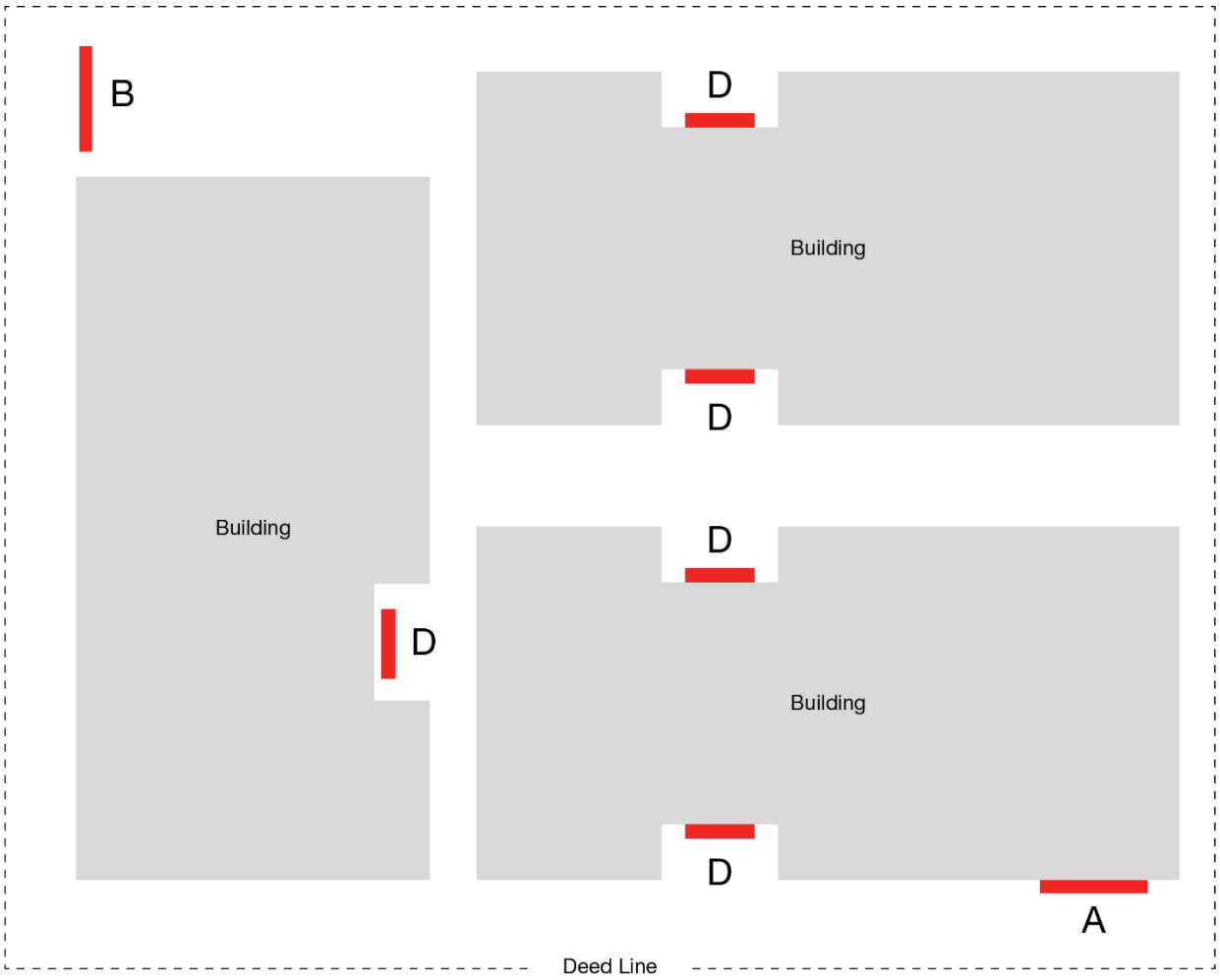
- Two (2) project identification signs; can be building or ground mounted identification signs "**A**" and "**B**"
- One (1) building entrance identification sign per main entrance; can be building or ground mounted sign "**D**"



Type 5: Location with multiple buildings without on-site parking that represents total site build-out. Allowed two exterior project identification signs (building or ground mounted) with clear hierarchy between the two.

Permissible Scope:

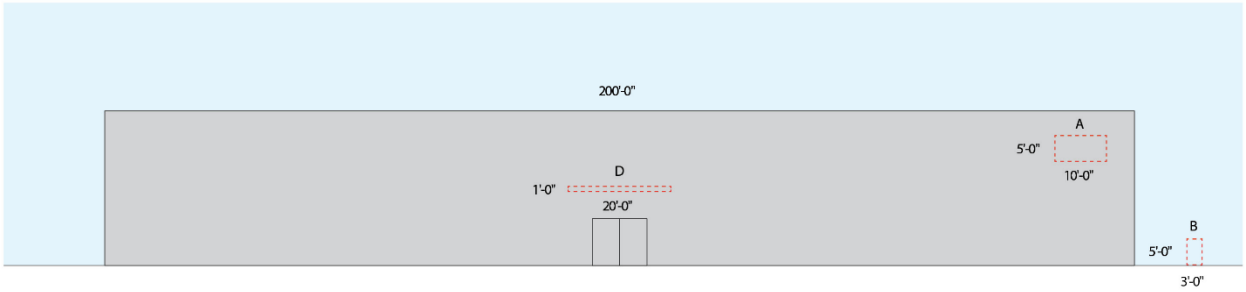
- One (1) building mounted identification sign "**A**"
- One (1) ground mounted RELLIS Standard monument sign "**B**"
- One (1) building entrance identification sign per main entrance; can be building or ground mounted sign "**D**"



Sign Allotments

Use these calculations to determine the size of the major signage components for the development type.

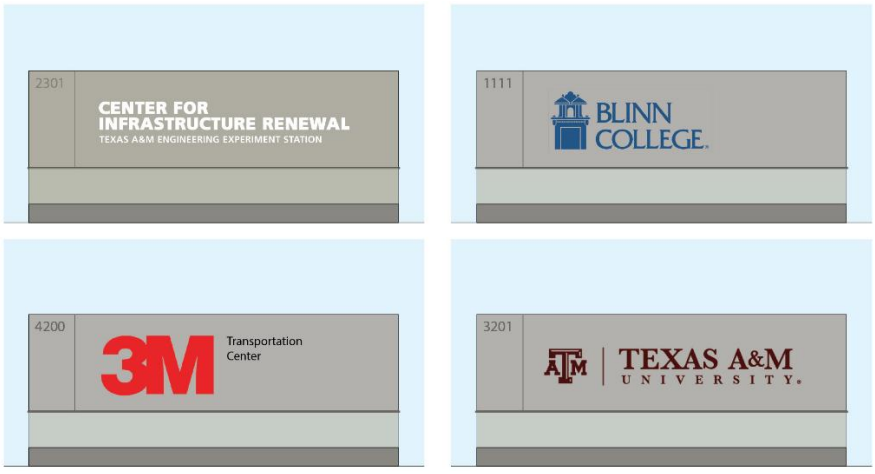
- "**A**" Project Identification – Primary Building Mounted: total number of 2.5 square feet per linear foot of the primary public facing façade of building with a maximum of 250 square feet; see conditions below for total square footage:
    - Less than 20,000 sq ft overall = 50 sq ft maximum
    - Less than 100,000 sq ft = 75 sq ft maximum
    - Less than 300,000 sq ft = 100 sq ft maximum
- "**B**" Building Identification – Ground Mounted: total number of 9 square feet for each public entrance of public facing façade with a maximum of 2, which includes donor recognition components.
- "**D**" Building Identification – Building Mounted: total number of 20 square feet for each public entrance of public facing façades with a maximum of 2, which includes donor recognition components.



Example of signage allotments for a 20,000 SF building.

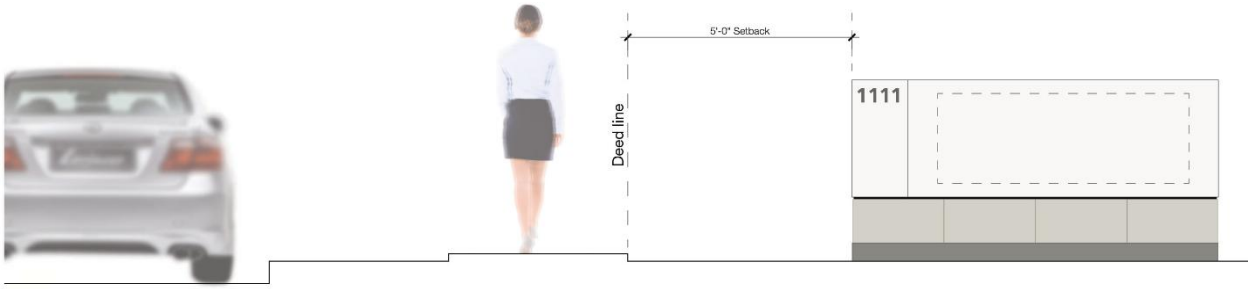
Partner Monument Signage

Partner monument signs have a standard sign body while allowing partner logos in a confined area. RELLIS development partners wanting to have monument signs for their development allotment are required to use the RELLIS Standard monument sign.

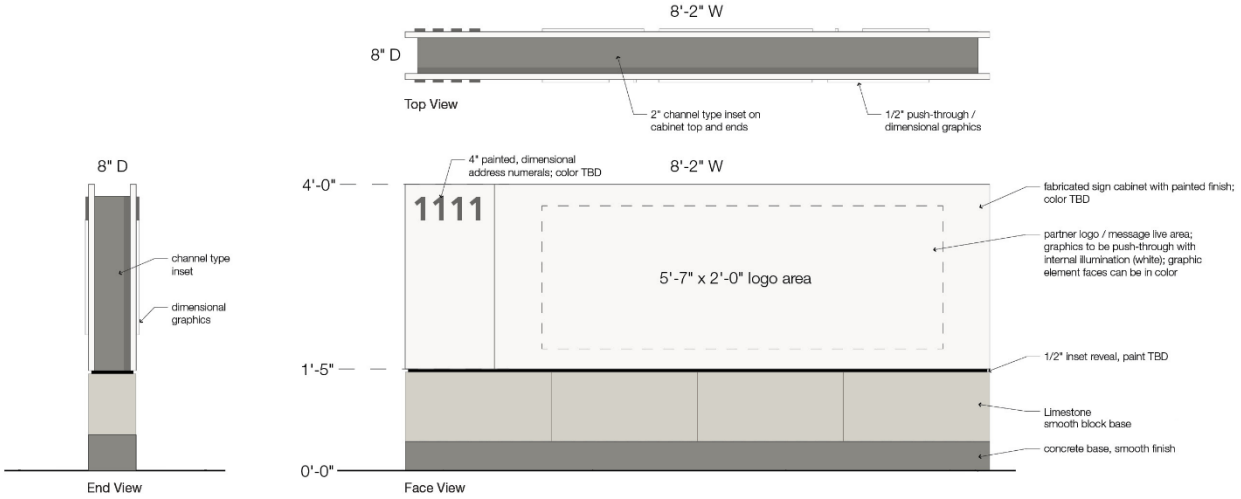


RELLIS Standard Monument Sign Details

All entities wanting ground mounted monument sign allowed by their development type must use the RELLIS standard monument sign.

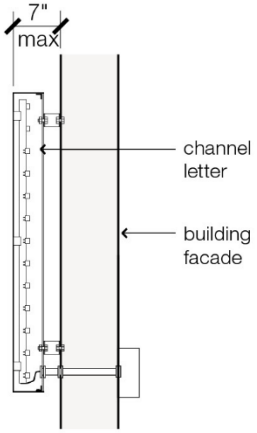


Monument Sign Elevation

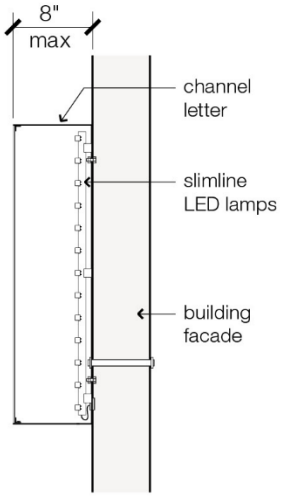


Partner Building Mounted Signage

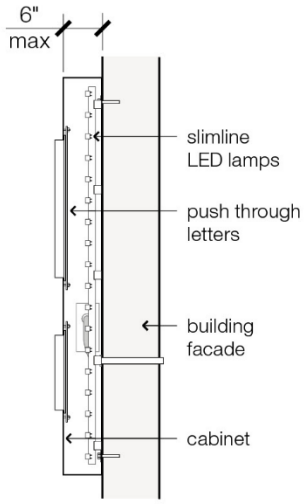
Partner allowable building mounted signage are shown in the diagrams below.



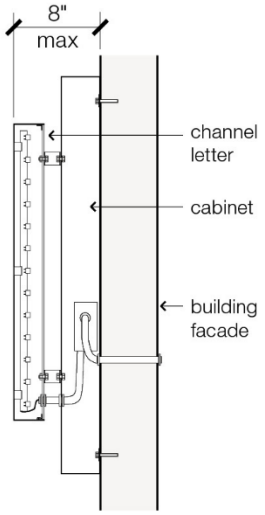
Section Detail



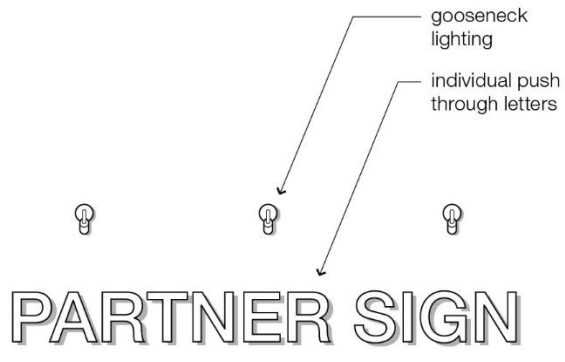
Section Detail

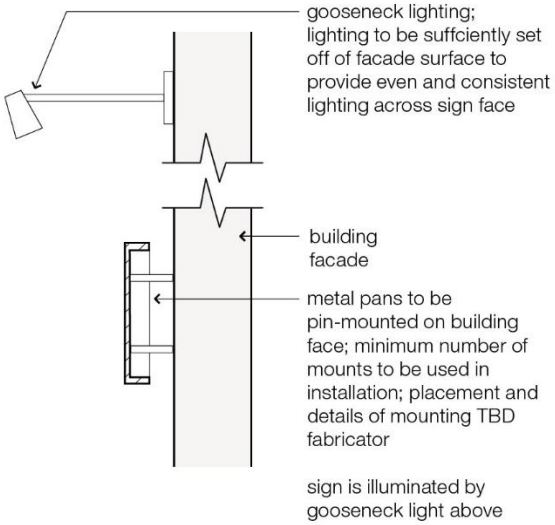


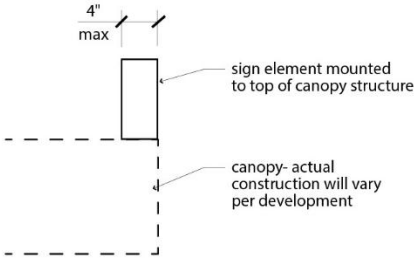
Section Detail

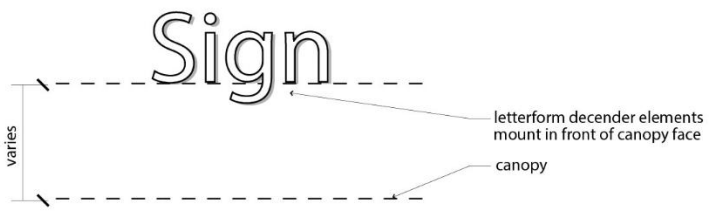


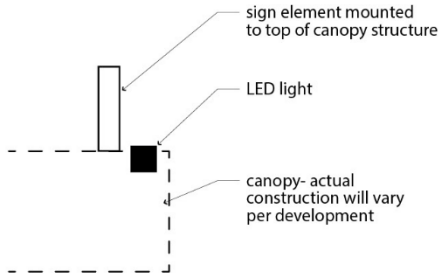
Section Detail


gooseneck lighting
individual push through letters
PARTNER SIGN

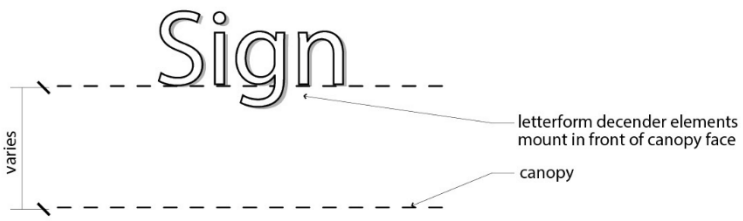

gooseneck lighting; lighting to be suffciently set off of facade surface to provide even and consistent lighting across sign face
building facade
metal pans to be pin-mounted on building face; minimum number of mounts to be used in installation; placement and details of mounting TBD fabricator
sign is illuminated by gooseneck light above


4" max
sign element mounted to top of canopy structure
canopy- actual construction will vary per development

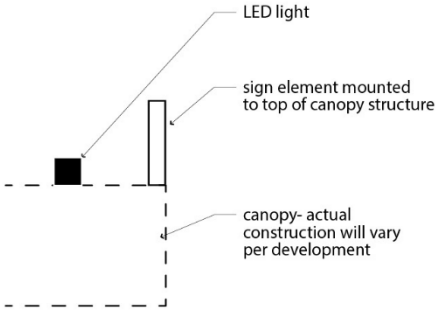

Sign
varies
letterform decender elements mount in front of canopy face
canopy



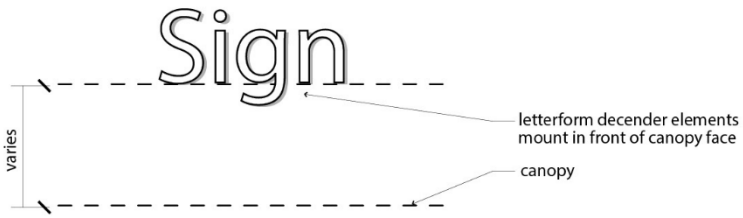
Side View



Front View



Side View



Front View

SIGNAGE GUIDELINES

Primary Partner signage may be made in any number of methods, materials, and can incorporate many different lighting methods. This signage serves as the main identification for the Partner's space. Partners are allowed one sign per facade, no more than two signs maximum unless by written permission from the Campus.

Tips and Recommendations:

- Using simple shapes and color palettes help with visibility and contrast.
- Dimensional pin-mounted letters add depth and interest.
- Keep lettering simple and minimal.
- Use colors and materials that contrast with the facade.
- Illumination allows the sign to be effective at night.
- Use fonts that are easy to read.
- Use materials and methods appropriate to the architectural and natural environment that can be implemented over time while maintaining their integrity.
- All lighting shall be Dark Sky compliant.

Primary Signage

Depending on site configurations, Partners shall be allowed up to two primary identification signs, one facade mounted and one freestanding. In certain site configurations, a Partner may have two facade mounted primary signs and no freestanding, providing the arrangement of the same meets the approval of the Campus and is within the restrictions of the local sign code.

If a Partner elects to have a facade sign in addition to another sign type, one shall be deemed the primary identification through a hierarchy of dimensions or sizing. Use of second primary identification requires prior Campus approval. Facade sign content shall be limited to the Partner's name. Description of services or products offered is not allowed on a facade sign. Additional brand language requires prior Campus approval. Multi-line signs require prior Campus approval and should be no more than 30" overall height or the maximum allowed by the specific property. Overall signage length is to be determined case-by-case at the discretion of the Campus based on frontage and facade proportions.

Signs may have internal or external illumination. External illumination shall be well integrated into storefront design. A projecting facade sign, or blade sign, is an option for Partners with corner locations and is only permitted with prior Campus approval.

Facade signs area to have a minimum clearance of 10" from upper and lower edges of sign band, and 12" clearance from a demising wall center line. Facade signs and other sign elements may not be installed outside of Partner's frontage without prior Campus approval. Refer to local codes and ordinances for maximum sign size for business type.

Primary Freestanding Signage

A freestanding sign is most appropriate for when an out parcel is set back from the street or sidewalk. The RELLIS standard monument sign has two faces and the Partner's brand elements shall be appropriately scaled to compliment the sign and the Partner location.

A freestanding, out-parcel, business shall be allowed one freestanding sign provided the approval of the Campus and is within the restrictions of the local sign code. Place freestanding signs near the public right-of-way where appropriately scaled for pedestrians or slow speed surface streets, a minimum of five feet from the street right-of-way and ten feet from all interior side lot lines. No freestanding sign should be placed in a manner that obstructs the pedestrian walkway or visibility from street intersections or parking lot entrances or exits.

If a Partner elects to have a freestanding sign in addition to another sign type, one shall be deemed the primary identification through a hierarchy of dimensions or sizing. Use of a second primary identification sign requires prior Campus approval and shall be within the restrictions of the local sign code.

Freestanding sign content shall be limited to the business name and address. Description of services, tag lines, or products offered is not allowed on a freestanding sign. Additional brand language requires prior Campus approval. Freestanding signs may carry more than one business name but must be considered as part of the overall building signage plan. If more than one business is displayed, they should be considered primary occupants of a building.

Refer to RELLIS monument signage diagrams for illumination and other signage information. Freestanding signs must have a maintained ground plain of plantings, mulch, gravel, or other improved dressing as a component of an overall landscape plan. Bollards or other traffic impediments are not permitted. Signs must not interfere with street trees or the future growth of street trees.

General Signage Requirements

1. The sign and any part, or parts thereof, except as otherwise provided in these criteria, shall be located within the limits of the business's storefront premises.

2. All signs must be new and custom-made. Restored vintage or re-purposed signs may be acceptable with written approval by the Campus.

3. The term "primary identification signage" or "facade signage" used in this section refers to the partner's most prominent display of identity. Primary identification signage may be placed anywhere within the storefront envelope and may be any sign type listed in this document. The term "secondary identification signage" denotes any sign that supports the aesthetic or branding message of the primary identification sign or business identity. Primary signage shall be larger than any single secondary signage element. The use of primary/secondary signage is intended for the Partner to have an opportunity to convey a hierarchy of messaging. Placement locations will require the Campus review and approval.

4. The signage contractor shall perform all cutting and patching of existing surfaces where required for installation of the signage work included herein. The procedures for the accomplishment of cutting and patching work shall be submitted by the sign contractor to

the Campus for approval. The submission is to also include a work schedule showing start of work, finish date, and any other important dates within the project timeline. The procedures shall include a detailed description of the methods and equipment to be used for each operation. The sequence of operations of all materials for patching and repairing of existing surfaces shall match existing adjacent surfaces in all respects.

5. Service/rear egress/delivery doors to business areas will have standard identification (business's name and address number) designed and installed by the Campus at the business's expense. No other signing or graphic is permitted at the service entrance.

6. Illumination shall be internal to the sign or by external front lighting. Light sources shall not cause glare hazardous to pedestrians or vehicle drivers. Lighting for internally illuminated signs is to be white. With the exception of neon signs, colored lamps shall be permitted only with Campus approval.

7. Face illumination should only consist of day/night type face material so that the face reads as a solid element during the day and illuminates at night. Illumination is to be consistent with no shows or hot spots. Standard type acrylic faced letters/signs with colored faces are prohibited or by the Campus approval only.

8. Non-illuminated storefront facade signage requires written Campus approval.

9. If applicable, the Partner shall provide a dedicated circuit for the Partner's signage illumination and shall coordinate and utilize a Campus-provided master switching relay system for all illuminated signage.

10. Red, green, or yellow as a primary or majority color of business signage is prohibited without prior Campus approval. This includes material finish as well as illumination.

11. The Campus is not responsible for costs incurred for replacement or construction of signs that do not conform to these sign criteria or for signage that did not receive prior Campus approval.

12. Prohibited sign elements and materials include, but are not limited to the following:

    a. Flashing lights.

    b. Animated components.

    c. Vinyl trim caps on letter-form/sign face or return. See note J for face material limitations. Use of minimal size aluminum retainers or other low profile retainers for letter-form/sign face are encouraged.

    d. Cabinet signs with illuminated, translucent background and silhouette letters.

    e. Vacuum-formed plastic letters.

    f. Paper, cardboard, stickers, or decals applied to or located behind the storefront glazing.

g. Sandblasted wood signs in natural wood finish with painted, raised letters and/or logos.

h. Advertising placards, banners, pennants, names, insignia, trademarks, or other descriptive or promotional material not designed as part of the business's overall presentation and brand identity may not be affixed or maintained on windows, glass fixtures, equipment, or another area of the storefront without owner approval.

i. Exposed raceways, exposed ballast boxes, or electrical transformers; if raceway is used, it must be integrated into the design of the sign. Note applies to wall/facade and canopy signs.

j. Acrylic faced letter-forms and sign cabinet; the only allowed acyclic faced elements are the day/night type where the face appears a solid color during the day and illuminates white at night. See note C for trim cap limitations unless approved in writing by the Campus.

13. Entity addresses, including building numbers located on the building façade and/or on freestanding signage, shall be the authorized Brazos 9-1-1 address.

Note: The Campus may modify this list at any time to include any material specific to a business's signage design and/or fabrication that in the Campus's opinion is not in keeping with the architectural character or overall quality of the development.

Campus Administration has authority over all campus signage.

Signage Submission Resources

Member and Partner applicants will submit the formal design submission to the PDRB. Concepts approved (Concept Design Submission) may then be developed into implementation documents through any required design professionals.

The required design professionals include any professional design services such as architects and engineers for building envelope development. Members and Partners may also consider (though not required) environmental graphic designers to provide designs and fabrication documents for signage. Signage fabricators typically provide the necessary engineering requirements for signage installation.

Digital files in PDF format of the following materials are required:

- Detailed construction documents showing detailed information on materials, colors, dimensions, design details, connection details, lighting features for architectural features, and signage/graphic elements (see Signage Overview for Signage requirements);

- Exterior color elevations or renderings depicting the overall architectural and signage characteristics;

Note: Members and Partners shall provide working drawings to the PDRB. No construction shall commence until written approval from the PDRB has been obtained.

DIVISION 11 – EQUIPMENT

AUDIO VISUAL EQUIPMENT

Refer to the Division 27 section of this guideline for detailed information on audio visual system equipment and infrastructure requirements. All A/V installations in new construction and/or renovation projects shall be reviewed by and coordinated with the RELLIS Campus Chief Information Officer (CIO) during both design and construction.

Audio visual equipment may be purchased and installed under a separate contract/integrator managed by FP&C or designed and specified to be provided by the CMAR/GC under the construction contract. Regardless of the procurement method for the physical equipment, the Project A/E shall be responsible for the design and specification of all facility infrastructure necessary to support the A/V equipment installation (i.e. conduit/raceway, backboxes, cabling, power, data connections, etc.).

FOOD SERVICE EQUIPMENT

Retail food service establishments within RELLIS facilities may be provided via the existing TAMUS contract with Chartwells. Chartwells (or current contracted service provider) shall be consulted during project design for review of all related design and equipment selections. Spaces may or may not be designed as “white boxes” for future build-out by a Chartwells contractor. Consult with RELLIS Administration and the Owner’s Designated Representative for guidance prior to engagement with Chartwells on any project.

VENDING MACHINES

Building designs may include appropriate space for vending machines where required by the program of requirements or occupant preference. Vending machines are provided and serviced by the current TAMUS contracted service provider. Consult with RELLIS Administration and the Owner’s Designated Representative for current guidance prior to incorporating vending equipment into the design of any project. If applicable, provide appropriate power receptacles on dedicated circuits for all vending equipment. Confirm any communication and/or networking requirements for point-of-sale vending devices with RELLIS IT and coordinate networking requirements with Division 27 of these guidelines.

APPLIANCES

Residential appliances (i.e. refrigerators, dishwashers, microwaves, etc.) may be specified as a part of the construction contract or coordinated with the FP&C or SSC project manager to be purchased below the line. Finishes shall be selected for durability and ease of cleaning (stainless steel preferred). At typical kitchenette or break room sinks, provide a garbage disposal unless directed otherwise by the Owner’s Designated Representative.

LABORATORY FUME HOODS

General Design Requirements

The following are minimum design specifications for laboratory fume hoods and associated exhaust systems for RELLIS Campus projects except as modified with the approval of the RELLIS Environmental Health and Safety Department.

All laboratory hoods shall meet the requirements of the National Fire Codes, NFPA 45, “Fire Protection for Laboratories Using Chemicals.” Hoods handling radioactive material shall also meet the requirements of NFPA 801, “Recommended Fire Protection Practice for Facilities Handling Radioactive Materials.” Fume hood systems shall also meet the requirements of the current ANSI Z9.5 Standard/ASHRAE 110 TEST. If the requirements below conflict with those of the most recent versions of these national standards, the national standards shall prevail.

Fume hood testing and certification shall be done by the fume hood manufacturer by an independent certifying firm and be done after the installation of the fume hood.

Hood design will incorporate airfoil jamb and airfoil sill to reduce airflow turbulence.

A variable volume system design is preferred, depending upon the HVAC system design and associated Laboratory Control System. Refer to current UES requirements as referenced in Division 23 of this guideline for additional information on Laboratory Control Systems.

Constant volume systems are prohibited without prior approval from the RELLIS EHS Department. For constant air volume hoods, bypass or balanced air feature should be considered to provide an inlet for air to be drawn into the top of the hood as the sash is lowered, still maintaining the velocity through the face opening at 100 FPM. Hoods must be designed as an integral part of the HVAC system. Auxiliary Air Make-up Hoods with make-up air externally supplied above and on the outside of the hood face are not permitted.

Utility valves and switches shall be external and shall be in conformance with applicable codes and standards. All service valves shall be easily accessible for maintenance personnel and clearly marked. Fixture outlets inside the hood shall be corrosion resistant or have a corrosion resistant finish.

Hood lighting shall be vapor or explosion proof, depending upon the intended purpose of the hood. Hood design should be such that light bulbs are changeable from the outside of the hood.

The hood sash shall be transparent, easily removable, horizontal sliding or vertical rising panel that will close off the hood face. All parts and counterbalance mechanisms shall be of corrosion-resistant material and finish. The sash panel shall be safety glass or plastic that has a flammability rating of 25 or less.

Fume hoods with vertical sashes shall have stops at 18 inches. Whenever the sash is beyond 18 inches a visual alarm shall be activated. The sash must be auto closing.

Hood construction materials should be selected to meet the specific requirements of the intended hood use. Examples of material used include stainless steel and epoxy coated material.

Face Velocity Requirements

Hood selection is greatly influenced by the type of experiments to be conducted within the hood. It is important to establish the maximum degree of hazard anticipated for present and future use before the choice of a hood is made. National standards recognize that the acceptable face velocity requirement for toxic materials used in research laboratories is an average face velocity of 100 fpm with the hood sash fully open (100%) and a minimum at any point of 80 fpm. These performance parameters are to be met. Fume hood testing shall be in accordance with ANSI/ASHRAE 110. Provide consideration during the design process for auto sash features for energy management.

Airflow Measuring Device

An airflow measuring device shall be permanently installed on each fume hood. The device must continuously monitor airflow face velocity, must give a digital readout of face velocity, and must sound an alarm for low-flow conditions or whenever the face velocity drops below 80 fpm.

Exhaust Duct

Fume hoods may be designed with either an independent exhaust duct system or a manifold system.

A high transport velocity of at least 2,000 fpm is required so that dust and aerosol-size materials are not deposited in the joints, cracks, or corners in the duct system. Normally all exhaust ducts will be constructed of Type 316L Stainless Steel, except where hydrofluoric acid or fluorides in general are used, with all TIG welded or mechanically fastened joints sealed with mineral impregnated woven fiber taper which is further impregnated with an activator/adhesive of the polyvinyl acetate type as manufactured by Hardcast, Inc. or equal. Ducts should be routed vertically with a minimum number of turns. Alternate duct materials will be considered in some applications.

Perchloric acid hoods shall have a completely welded exhaust duct system. Duct shall be routed by the shortest and straightest path to the roof. Horizontal runs are not permitted in Perchloric acid hoods. When required for construction, and approved by the Owner, flange joints and acid-resistant gaskets may be used. Do not manifold perchloric hoods. Perchloric acid hood exhaust outlets shall be flanged and furnished with a companion flange for welding to the exhaust duct.

Hood exhaust system design should provide for 10% minimum flow through the exhaust duct when hood is not in service. The hood exhaust may be used as part or all of the required exhaust from the laboratory room.

Exhaust fans are to be located to the exterior of the building envelope and the pressure in the duct shall always be negative relative to the building.

Fume Hood Location

No fume hood should be installed closer than 10 feet to the primary room entrance/exit door. Fume hoods should also not be installed near expected high traffic areas within the laboratory or where supply air grills can cause turbulence at the hood face.

Referenced Standards

The following codes and standards should be reviewed when planning to purchase and install a chemical fume hood:

A. ANSI/ASHRAE 110 – Method of Testing Performance of Laboratory Fume Hoods

B. ANSI/AIHA Z9.5 – The American National Standard for Laboratory Ventilation NFPA 45 – Standard on Fire Protection for Laboratories Using Chemicals

C. SEFA 1.2 – “Laboratory Fume Hoods Recommended Practices”

Special Hoods

A. Perchloric: Perchloric acid hoods require a “wash down” feature in which water spray is used to remove acid crystals from the exhaust fan, ductwork, and hood plenum after each use. The water must not splash or fall on the work surface. Only one manual valve will control the wash down water. The valve handle shall be outside of the hood enclosure. Each perchloric hood shall have an automatic five minute wash down cycle activated when the fume hood fan is de-energized.

B. Radioisotope: Radioisotope hoods require special construction to permit easy cleaning. Filtration requirements of the exhaust air and fume hood construction shall be determined on a case-by-case basis in consultation with RELLIS Environmental Health and Safety Department.

C. Biological: Biological hoods and/or safety cabinets shall meet NIH 03-112C Performance Specifications and shall be in accordance with National Sanitation Foundation Standard, NSF 49, and be listed by NSF. For application guidelines and filtration requirements use HHS Publication No. (CDC) 93-8395, “Biosafety in Microbiological and Biomedical Laboratories.” Units shall be of steel or stainless-steel construction; interior shall be stainless-steel with coved corners. All seams and welds to be ground smooth and polished. Sliding view window shall be 1/4" safety or tempered glass. Supply and exhaust HEPA filters shall be front loading and shall be 99.99% efficient for 0.3-micron sized particles. Unit shall be listed by UL and CSA for electrical safety. Unit shall include at least one petcock and one duplex outlet; additional services to be provided by user request. Unit shall include a fluorescent light and an ultraviolet (germicidal) light. Certification of unit after installation is required and must be performed by an approved certification company.

SAFETY SHOWERS

Confirm with RELLIS EHS on a project specific basis whether floor drains are required beneath safety showers.

Eyewash stations are required, confirm with RELLIS EH&S for locations and approval. Refer to user specific requirements in the POR.

DIVISION 12 - FURNISHINGS

WINDOW TREATMENTS

Window treatments have a significant impact on the HVAC and daylighting systems in a building. Window treatments shall be provided wherever practicable to support and enhance energy efficiency of building systems.

Approved options for window treatments on the RELLIS Campus include horizontal 1” mini-blinds or roller shades. Transparent roller shades (single run) shall be included in the design for classroom areas. Transparent roller shades and blackout shades (double run) shall be included in the design for Conference, Seminar and Auditorium areas. Roller shades shall be by Mechoshade or approved equal.

All window treatments shall be manually operated unless window height or location does not permit building occupants to operate them from normal standing position within the building. Motor operated shades are expressly prohibited without prior approval from RELLIS Administration and may only be considered if there is no other safe method for operation. If motor operation is permitted, it shall be via stand-alone wall mounted control switch(es) from hardwired 120VAC power supplied within the room. Automatic operation of window treatments via daylight sensors or controls within the room is also expressly prohibited without prior approval from RELLIS Administration.

LABORATORY CASEWORK

Laboratory casework shall be high quality wood or steel construction unless other materials are appropriate due to specific laboratory requirements.

Materials for laboratory tops shall be based on intended use. Verify casework requirements and layouts for accessibility. Verify any data networking requirements, including specific routing, labeling and quantity with Users and where indicated in the POR.

BOOK SHELVES

To maintain maximum room use and furniture placement flexibility, typical faculty and staff offices shall not have built-in book shelving. Movable bookcases will be provided as movable furnishings where indicated in the POR.

FURNITURE SELECTION

During the preparation of the POR, the FP&C Interior Designer will consult with the User Coordinator to determine only the types and quantity of furniture needed to satisfy functional requirements. The A/E in their Schematic and Design Development submittals will include furniture layouts aligned to POR requirements to ensure accommodation in the space proposed for doors, columns, etc.

FIXED SEATING

All classrooms are to be designed to accommodate left-handed students. A minimum of 10% of the total number of desks shall be for left-handed people or as directed by the User. Seating shall be not less than 20 inches in width with preference for 22 inch width.

DIVISION 13 – SPECIAL CONSTRUCTION

PRE-ENGINEERED METAL BUILDINGS

Pre-engineered metal buildings (PEMBs) may be utilized at the RELLIS Campus where permitted by architectural guidelines in the Campus Master Plan and with prior approval from RELLIS Administration. In general, PEMBs are utilized in training and testing areas and Proving Grounds support areas where cost and efficiency are of primary concern.

The PEMB structure all be designed in accordance with the current version of the IBC as well as the following referenced standards:

- MBMA – Metal Building Systems Manual
- AISC – American Institute of Steel Construction
- AISI – American Iron and Steel Institute

The design for all PEMB members and components shall be the responsibility of the PEMB manufacturer. The design shall be carried out under the direction of a registered professional engineer licensed in the State of Texas. The PEMB manufacturer shall have a current AISC-MB Certification.

The Project A/E shall be responsible for the design of all building foundations supporting the PEMB. The Project A/E shall work with specified manufacturer(s) during design to obtain preliminary column reactions and any other information needed for the design of the structural foundations.

All exterior PEMB finishes, panel profiles, and/or colors shall be subject to review and approval by the RELLIS Planning and Design Review Board (PDRB). Roofing panels shall at a minimum be standing seam with concealed clips and fastening systems. Roofing panels mounted with exposed fasteners and neoprene washers are not permitted.

CONTROLLED ENVIRONMENT ROOMS

Rooms defined as cold rooms, environmental rooms, plant growth chambers, etc., including controls shall be specified as complete units from a single manufacturer. The design of refrigeration systems for environmental rooms and growth chambers shall be reviewed by the Mechanical Engineer for coordination with the building mechanical systems. Project A/E shall specify that the manufacturer of this equipment shall submit a detailed test procedure for factory testing the first unit of each type and that the Owner will witness the test.

DIVISION 14 – CONVEYING SYSTEMS

ELEVATOR GENERAL REQUIREMENTS

Elevators shall be selected and designed to comply with American Society of Mechanical Engineers/American National Standards Institute safety code for elevators, dumbwaiters and escalators, and moving walks, A17.1, latest revision as well as all requirements from with Texas Department of Licensing and Regulation and Texas Accessibility Standards.

Elevators manufactured by Otis, ThyssenKrupp, and Kone may be acceptable subject to meeting all applicable requirements of this section. Equal quality elevators of other manufacturers will be acceptable subject to approval of the Project A/E, the FP&C or SSC Project Manager, SSC Services Maintenance Department Elevator Inspector and RELLIS Administration.

Elevators shall be specified to receive an electronic door safety device that extends the full height of the cab. Mechanical safety edge or traditional two-beam photo-electric eyes are not acceptable.

Installation shall be by mechanic directly employed by the manufacturer or by installers franchised by and responsible to the manufacturer.

Electric operated traction elevators are preferred; however, oil hydraulic operation may be considered where use is intermittent or where the elevator serves only two floors.

General Contractor's use of elevators will only be allowed with written permission of the FP&C or SSC Project Manager, RELLIS Administration and Elevator Vendor. Contractor shall be responsible for protecting interior finishes of all elevators. At Substantial Completion condition of all elevators shall be as new. Contractor's use of the elevator even with written permission of the Owner and vendor shall not relieve Elevator Vendor of any warranties expressed or implied. Provide complete inspection and maintenance service of each elevator for a period of 12 months at no cost to Owner. Elevator Vendor shall be able to show that they have had successful experience in the erection and maintenance of the type elevator equipment proposed for this project and that they maintain within 50 miles of the elevator installation an adequate stock of parts for emergency and replacement purposes; and that they have qualified men in their own employ available to insure the fulfillment of any maintenance and/or repair services without delay within one hour notification, 7 days a week on a 24 hour basis. Elevator Vendor must be established in operation for the past five years and have a proven selection of parts and service facilities to meet the qualifications stated above for 2 years. The elevator contractor must also be the manufacturer of the elevator being installed.

Provide building information models (BIMs) of elevators to be used. Ensure that the following minimum data is associated with the model: manufacturer, model, number, speed, and capacity.

PASSENGER ELEVATORS

- Speed: 2 through 3 floors travel of 150 ft./min.; 4 and above floors travel of 350 ft./min.;
- Capacity: Generally, stretcher number 3500 to 4500 pounds is specified depending on floor area and person density.

- Control: Selective/collective automatic for single cars. For multiple units of two or more, group automatic control. Solid state controls preferred.

- Diagnostic Tools: The elevator contractor shall provide to the Owner, integral with and built into the elevator controller, as part of this specification, any and all diagnostic tools and/or instruments and all written operating and instruction manuals needed to use the diagnostic tools required by the specification to allow for adjustment of any and all computer parameters and/or troubleshooting the equipment provided. These diagnostic tools shall be provided at no additional cost to the Owner. The Owner shall not be required to execute any type of written agreement to obtain said tools. The use of any handheld or removable diagnostic devices is specifically prohibited. The integral diagnostic tools and/or instruments shall permit the Owner and/or his authorized representative to access, diagnose and/or adjust all computer and/or software based variable features and/or parameters for the entire lifespan of the new equipment provided as required by the specification.

- Operation: Leveling with resistance operation through 150 ft./min.; generator or solid-state control for 200 ft./min. and above.

- Cab: Stainless steel front and car door, stainless steel base, plastic laminated sides and rear, luminous ceiling with UL approved, manufacturer's Standard concealed fluorescent lighting, exhaust fan, stainless steel handrails on three sides and contain a device for voice communication to meet Texas Accessibility Standards.

    - The cab should have the following as standard features:

        - Emergency Phone: Must be ADA compliant hands free, auto dial, flush mount, push to talk. The phone must not require the person answering the phone to follow any special instructions to establish two-way communication, to disconnect, or to call back to the support center. A separate phone line and phone number shall be provided for each individual elevator, this phone number shall have caller ID that will allow the person answering the call to know exactly which elevator is sending the call, the building name, building number, and elevator ID number. (Caller ID shall be programmed in advance of the acceptance inspection and must work correctly before the elevator is placed into service.

        - Door Operators: Heavy duty, non-proprietary. Must include all tools to adjust and/or maintain. Include instructions for use.

        - Door Protection/Reopening Device: Infrared electronic scanning.

        - Fireman Service Key Switches Phases I and II: “Adams” cylinders with WD01 key.

        - Cab Lights: LED, fluorescent, or screw-in base with easy access for replacement. Replacement parts must be readily available from local supply.

        - Vandal-resistant Car Enclosures: Swing return (hinged) car stations; hall and car button and fixtures.

- Hoist way Entrances: 3'-6" min. width, 7'-0" min. high, stainless steel finish, power operation.

- Machine Location:

    - Electric Traction Elevators: Overhead preferred, but location at lower level optional on installations of four floors and less.

    - Hydraulic Elevators: Not above the first floor, adjacent to hoist way preferred.

    - Machine Room Less options are not permitted without special prior approval from RELLIS Administration.

    - Machine rooms shall be provided with a self-closing, self-locking, properly rated door. The Machine room shall be properly ventilated, heated, and cooled. Within the machine room provide a 120V, 20amp circuit for car lights, fan and alarm. All disconnects within the machine room shall be able to be secured with a lock in the “OFF” position.

    - Provide a 10-pound type ABC fire extinguisher in each machine room.

    - Only equipment directly related to the function or support of the elevator system is allowed in the machine room or hoist way. No other equipment, piping, drains, etc. is permitted in this space.

- Platform: Size according to code for capacity; however, standard sizes should be selected.

- Signals: Provide Braille markings on car operating faceplate and call signals and other features. One emergency alarm bell button in each car connected to emergency alarm station on the main floor. Position indicators, direction arrows, and hall, and car buttons should be LED standard 100,000 hour lamps.

- Flooring: Same as adjacent area by flooring subcontractor.

- Floor Lockout Provisions: Provisions shall be included if directed by the FP&C Project Manager.

- Emergency Generator: Interlock with emergency generator if Emergency Power System is provided for the building. Otherwise, make no provision for an emergency generator for the elevator unless specifically directed to do so by the FP&C Project Manager and RELLIS Administration. If the building does not have an emergency generator, ensure battery lowering is specified and provide an auxiliary contact on the main disconnect for the elevator equipment. This contact shall be used to determine the difference between a power outage and a maintenance or emergency shutdown.

- Hooks & Pads: Hooks shall be installed in all passenger elevators. In addition, one complete set of pads shall be furnished for the Contractors' and Owners' use during construction. Prior to final acceptance, the pads are to be furnished in good condition and clean to the Owner.

- Pit:

  - Sumps in all pits shall be covered. The cover shall be level with the pit floor.

  - Pit shall be fully waterproofed. Means to prevent the accumulation of water shall be provided per ASME A17.1. Sump pumps, where specified, shall have drain routed to an exterior oil separator and discharged to sanitary sewer.

  - Provide in the pit at a minimum: Weatherproof light fixture with switch and weatherproof duplex 120V GFCI receptacle.

- Fire Alarm and Fire Suppression:

  - Smoke detectors must be installed in each elevator equipment room and elevator lobby. They must be so arranged that if activated, the elevators will go into recall mode. Activation of the smoke detector will recall all elevators to the designated floor.

  - If the building is fully sprinklered, sprinklers shall be installed in hoist ways and elevator equipment rooms in accordance with NFPA requirements. A heat detector must be installed within 24 inches of each sprinkler head located in the hoist ways and elevator equipment rooms. The fire alarm system must function such that when the heat detectors temperature rating is reached, the fire alarm system shunt trips the main breaker in the elevator equipment room in accordance with ASME A17.1 Rule 102.2C (3) and (4). A smoke detector shall be installed.

  - Temperature settings for heat detectors and sprinkler heads shall be as follows. Heat detectors: 175 to 195 degrees F. Sprinkler heads: 200 to 225 degrees F. The sprinkler head rating will be selected to be approximately 25 degrees F higher than the temperature rating of the heat detector.

COMBINATION PASSENGER/SERVICE ELEVATORS

Combination passenger/service elevators shall be designed to meet all requirements of passenger elevators listed above. Cab size, hoist way entrances, and capacity to meet freight requirements.

FREIGHT ELEVATORS (FREIGHT ONLY)

- Speed: Up to and including 2 floors travel of 50 ft./min.; above 2 floors travel 100 ft./min.

- Capacity: Minimum of 4500 pounds; however, product and product weight should be considered.

- Control: Same as for passenger elevator operation except for 2 floor installation single automatic push button.

- Operation: Same as passenger service.

- Cab: Standard freight (steel wainscoting).

- Hoist Way Entrances: Bi-parting type. Generally, door operation is manual; however, consideration should be given to power operation where use of equipment is extensive.
- Signals: Door open bell, in use light, and illuminating buttons.
- Machine Location: Same as passenger elevators.
- Platform: Size and classification according to code, building requirements, and capacity.
- Pit: Same as passenger elevators.
- Fire Alarm and Fire Suppression: Same as passenger elevators.

DIVISION 21 – FIRE SUPPRESSION

GENERAL REQUIREMENTS

Texas A&M University Department of Environmental Health and Safety (TAMU EHS) serves as the local Authority Having Jurisdiction (AHJ) for all System owned property and any buildings or structures on the RELLIS Campus, including any public private partnership (P3) entities via intra-system cooperation agreement. All proposed construction, structural changes, changes in use, any change affecting egress from a building or space, or any modification or work involving life safety systems or equipment, regardless of building occupant, must be reviewed and approved by EHS as well as the appropriate construction design, management, or review team in order to address fire and life safety issues in accordance with TAMUS policy.

TAMU EHS provides plan review, in-wall inspections, above ceiling inspections, final inspections and acceptance testing of all fire suppression systems for both new construction and facility renovation projects.

Requirements for fire suppression systems are governed by the most current version of the TAMU EHS fire and life safety design guidelines. This document is maintained and updated by TAMU EHS and can be found on their website here:

Texas A&M University Supplemental Guide for the Design, Installation, and Acceptance of Fire and Life Safety Systems

For broken hyperlinks or confirmation of most current version, contact TAMU EHS for additional information. The following sections provide additional supplementary requirements applicable to facilities on the RELLIS Campus.

The A/E shall identify on the drawings all areas that may be classified as hazardous in accordance with the latest edition of the NFPA Codes or that may pose a health hazard due to noise levels, radiation, chemical fumes, etc. The A/E shall describe how each such area will be treated in the building design in terms of fire protection.

FIRE PROTECTION SYSTEMS

General

All buildings shall have automatic sprinkler system protection throughout. This applies to new construction as well as major renovations and/or modifications. Clean Agent or Water Mist Systems are permitted as a first line of defense. However, it is the interpretation of the Texas State Fire Marshal's Office that sprinkler protection still be provided for all areas in accordance with NFPA 101.

Design and installation of fire protection systems shall meet the latest edition of, NFPA 13 "Standard for the Installation of Sprinkler Systems", NFPA 13R "Standard for the Installation of Sprinkler Systems In Low-Rise Residential Occupancies ", NFPA 14 "Standards for the Installation of Standpipe and Hose Systems", NFPA 20 "Standard for the Installation of Stationary Pumps for Fire Protection", NFPA 24 "Installation of Private Fire Service Mains and Their Appurtenances" and their referenced standards unless fire hazards are specifically addressed by other NFPA Codes and Standards. Fire protection drawings, calculations and listing of all equipment to be

installed should be submitted to the A/E team and the “Local Authority Having Jurisdiction” for review and acceptance prior to installation. Submittals shall be in accordance with the respective NFPA Codes and Standards and incorporate any special comments and notes applicable as identified within this Design Guidelines and the respective project specifications.

The A/E shall be responsible for modeling, using BIM authoring software, and included in the Construction Documents the Fire Protection Sprinkler System: sprinkler and main locations, plans, riser locations and diagrams. Risers shall include sprinkler piping with devices for monitoring by building Fire Detection and Alarm system identified. Drawing shall be laid out to allow for the addition at completion of construction as Record Documents (as built) piping to each sprinkler. Record Documents shall comply with the requirements of the respective NFPA standards.

The Fire Protection Sprinkler and Standpipe System shall be designed by a Registered Professional Engineer or an organization which possesses a valid Certificate of Registration as issued by the Texas State Fire Marshal’s Office and has at least one (1) person engaged in or working on the actual plans, who is licensed to perform the work authorized by the company certificate and the individual’s license issued by the Texas State Fire Marshal’s Office.

Reference Standards

The reference standards shall include the latest edition of the following as applicable:

1. ANSI-NEMA Standards: National Electrical Manufacturers Association
2. ANSI/ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 24, 125, 250, and 800.
3. ANSI/ASME B16.3 Malleable Iron Threaded Fittings, Class 150 and 300.
4. ANSI/ASME B16.5 Pipe Flanges and Flanged Fittings.
5. ANSI/ASME B16.9 Factory made Wrought Steel Butt welding Fittings.
6. ANSI/ASME B16.11 Forged Steel Fittings, Socket welding and Threaded
7. ANSI/ASME B16.25 Butt welding Ends
8. ANSI/ASME B36.10 Welded and Seamless Wrought Steel Pipe
9. ANSI/ASME Sec 9 Welding and Brazing Qualifications
10. ANSI/ASTM A135 Electric Resistance Welded Steel Pipe
11. ANSI/ASTM A47 Malleable Iron Castings.
12. ANSI/ASTM B32 Solder Metal
13. ANSI/AWS A5.8 Brazing Filler Metal
14. ANSI/AWWA C110 Ductile Iron and Gray Iron Fittings
15. ANSI/AWWA C151 Ductile Iron Pipe, Centrifugally Cast
16. ASTM A53 Pipe, Steel, Black and Hot Dipped, Zinc coated Welded and Seamless
17. ASTM A795 Black and Hot Dipped Zinc Coated Welded and Seamless Steel Pipe for Fire Protection Use.

18. AWS D10.9 Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.
19. NFPA 1 – “Fire Code”
20. NFPA 13 – “Installation of Sprinkler Systems”
21. NFPA 13R – “Installation of Sprinkler Systems In Low-Rise Residential Occupancies”
22. NFPA 14 – “Standpipe and Hose Systems”
23. NFPA 20 – “Standard for the Installation of Stationary Pumps for Fire Protection”
24. NFPA 24 – “Installation of Private Fire Service Mains and Their Appurtenances”
25. NFPA 25 – “Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems”
26. NFPA 45 – “Standard of Fire Protection for Laboratories Using Chemicals”
27. NFPA 70 – “National Electric Code”
28. NFPA 72 – “National Fire Alarm and Signaling Code”
29. NFPA 101 – “Life Safety Code”
30. UL Fire Protection Equipment Directory
31. Fire Code and any Standards, Guidelines, or Criteria adopted by the responding fire department. This is applicable to the extent of fire department access, water supply, fire department connections, standpipe systems and hose connections, etc.
32. State of Texas, State Fire Marshal Rules

General Underground Water Supply to Fire Protection Systems

Design and installation of water supply for fire protection systems shall meet NFPA 20 “*Standard for the Installation of Stationary Pumps for Fire Protection”*, NFPA 22 “*Standard for Water Tanks for Private Fire Protection”,* NFPA 24 “*Standard for the Installation of Private Fire Service Mains and Their Appurtenances”*, NFPA 25 “*Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems”* and their referenced standards.

New Fire Hydrants shall comply with NFPA 24. Fire Department Connection shall be within 100 feet of the nearest fire hydrant. The A/E shall verify with the Local AHJ if 5-inch quick connect devices (i.e. Storz type) are required on fire hydrants and department connections. Quick connect devices shall be UL Listed.

The underground fire protection supply should have a post indicator valve (PIV).

Underground piping for fire protection use shall have the acceptance requirements of NFPA 24 met. This includes flushing of piping based on the minimum flow rate identified by size of pipe within NFPA 24. If the piping will serve a fire pump, the minimum flow rate shall be in accordance with NFPA 20. Hydrostatic testing is also required. The Contractor shall provide a “Contractor’s Material and Test Certificate for Underground Piping” in accordance with NFPA 24. The “Contractor’s Material and Test Certificate for Underground Piping” shall be submitted by a licensed RME-U with the Texas State Fire Marshal’s Office or provide documentation of equal

qualifications. The “Local Authority Having Jurisdiction” shall be invited to witness flushing and hydrostatic testing.

Fire Pumps

Fire pumps shall be UL Listed and FM Approved. Provide concrete pads for the fire pump, fire pump controller, and pressure maintenance pump (jockey).

All elastomeric couplings are prohibited. Alignment of the fire pump shall be done by digital means. A report including the digital readings from alignment shall be included with the pre-test checklist.

Drain lines from the fire pump cup drain to the floor drain shall be CPVC piping. (This is ONLY for the drain line from the cup drain to the floor drain.)

Fire Pump start-up shall be performed, documented, and transmitted to all parties prior to the Acceptance test. Acceptance testing of fire pump to be witnessed by a combination of representatives from Texas A&M University System, the “Local Authority Having Jurisdiction”, and/or their designated representatives (Third Party Inspectors).

Standpipe System Design

Design of the Standpipe System shall be in accordance with NFPA 14 “*Standard for the Installation of Standpipe and Hose Systems”*:

- 500 gpm at the most hydraulically remote hose connection
- 250 gpm at the top of the other standpipes
- Total flow permitted to be 1,000 gpm IF building protected throughout with automatic sprinkler system (NFPA 13)
- Design with a minimum 100 psi residual pressure at the most hydraulically remote hose connection

System acceptance testing to include flow test of the standpipe system in accordance with the design criteria:

- 500 gpm flow at the most hydraulically remote hose connection
- 250 gpm flow at top of each of the remaining standpipes up to 1,000 gpm IF the building is protected by automatic sprinkler system throughout (NFPA 13)
- Measure minimum 100 psi residual pressure at the most hydraulically remote hose connection

Hoses need not be installed unless specifically required by other NFPA Codes and Standards.

Standpipe piping shall be Schedule 40 black steel pipe conforming to ASTM A-53 or ASTM A-795. Minimum size of standpipe piping shall be 4-inches in accordance with NFPA 14.

Air ejectors/air vents are required at the top of each standpipe as required by NFPA 14. Air ejectors shall be piped into main and express drains when required by the manufacturer's installation instructions.

All aboveground piping shall be flushed to verify no shipping caps, cutouts/coupons, or other debris is left within the pipe. Flushing shall be witnessed by the "Local Authority Having Jurisdiction" and/or their designated representatives.

Inspections and testing shall comply with NFPA 14, NFPA 20, NFPA 24, these Guidelines, and any insurance carrier requirements. The referenced pre-test checklists shall be used to verify systems are ready for final inspection and witnessing of integrated acceptance testing by the "Local Authority Having Jurisdiction" and/or their designated representatives.

AUTOMATIC SPRINKLER SYSTEM

Design Criteria

Provide water supply flow test data identifying the location, flow characteristics, and the source of the data. Specify that it is the Contractor's responsibility to verify the flow test information prior to completing the shop submittal hydraulic calculations. The flow test data shall not be more than one (1) year old.

Automatic sprinkler system design criteria shall meet the requirements of NFPA 13. During project design, the A/E shall consult with the Local AHJ and the insurance carrier to verify no additional criteria is required.

All materials shall be UL Listed and FM Approved products. The UL Certifications Directory and the FM Approval Guide are available online. Registration for access to the Approval Guide is free.

Fire Department Connection shall be within 100 feet of the nearest fire hydrant.

Pipe and Fittings

Compliance with Article 5.43.3 of the Texas Insurance Code and NFPA Codes and Standards is required. Test drains need to be located at the end of each run with a two-inch drain located at the main and piped to a drain. Drains can be piped directly to the outside only when approved in writing by the Owner representative and Local AHJ.

All piping less than 2.5" must be Schedule 40 black steel pipe in accordance with ASTM A-53 or ASTM A-795. Piping 2.5" and greater must be minimum Schedule 10 black steel pipe conforming to ASTM A-53 or ASTM A-795 unless noted otherwise per specific campus information. All pipe shall be fully reamed. All grooved pipe shall be roll grooved. Cut grooved pipe is not permitted.

Internally galvanized piping is not permitted other than for drain piping only. All piping exposed to the open atmosphere shall be treated. If internally galvanized pipe is the only option in the situation of being exposed to an open atmosphere, galvanized pipe may be utilized. However, no welding shall be performed after the hot dipped galvanized process.

Grooved pipe is acceptable for fire protection systems for piping 2 inches and greater in diameter. Piping less than 2 inches in diameter shall be threaded.

Provide insulation and heat tracing for fire protection piping in crawl spaces and other areas in which the temperature could drop below 40 degrees Fahrenheit such as loading docks, drive-throughs, exterior stairs, or canopies.

Provide a cleaning specification for sprinkler piping. Add to specification clear requirements for maintaining caps on pipe stored on the jobsite.

All piping for arm overs shall tie into the top or the side of the branch line instead of the bottom. Specify galvanized or cad plated rods and hangers for sprinkler piping. Do not allow black iron rods or shot anchors for hanging sprinkler piping.

Flexible sprinklers are permitted and must be UL Listed and FM Approved. Provide with product data, a copy of the UL Listing and FM Approval identifying the allowable bend radius and number of bends. Flexible piping must be limited to a maximum of 48 inches in length. Provide additional specification inspection criteria for flexible piping. Bend radius and number of bends shall not exceed that identified by UL Listing and FM Approval, whichever is most restrictive. Inspection shall be coordinated such that the ceiling grid is in as well as the ceiling tiles for the flexible piping sprinkler drop ONLY. All other tiles shall not be installed at the time of the flexible piping inspection. Inspection shall include support screws into the ceiling grid, deflector location below ceiling grid elevation, and support of sprinkler drop to support grid.

All fittings and couplings shall be UL Listed and FM Approved. Size on size (weld-o-let type) fittings are not acceptable. Snap joint couplings, mechanical-T style couplings, pressfit couplings, outlet couplings, reducing couplings, cut-in style couplings, and plain end type couplings are not permitted.

Piping 2-inches and greater may be rolled grooved with grooved fittings. Piping less than 2-inches shall be threaded malleable iron.

Bushings are prohibited.

Dry System & Pre-Action System Air Pressure

Nitrogen should be used to charge, maintain, or supervise sprinkler systems in accordance with NFPA 13 to maximize corrosion resistance. These systems should utilize black steel piping and piping must have protective corrosion-resistant coatings where corrosive conditions exist or where the piping is exposed to the weather.

Automatic Air Vents

Air ejectors are required on every floor with an automatic sprinkler system in accordance with NFPA 13. These air ejectors shall be located at the remote test drain assembly or at the highest elevation of the respective sprinkler system. These air vents are to be piped to the remote express drain or nearest suitable drain termination point in accordance with the manufacturer’s instructions.

Flushing, Inspections, and Integrated Acceptance Testing

All aboveground piping shall be flushed to verify no shipping caps, cutouts/coupons, or other debris is left within the pipe. The flushing shall occur before sprinklers are installed. The one exception is flushing when ONLY upright sprinklers are in place. Flushing shall be witnessed by the "Local Authority Having Jurisdiction" and/or their designated representatives.

Inspections and testing shall comply with NFPA 13, NFPA 20, NFPA 24, these Guidelines, and any insurance carrier requirements. The referenced pre-test checklists shall be used to verify systems are ready for final inspection and witnessing of integrated acceptance testing by the "Local Authority Having Jurisdiction" and/or their designated representatives.

FDC Signage

FDC signage shall comply with the requirements of the Texas State Fire Marshal's Office Notice dated May 2016. Fire Department Connection Signage shall include:

- Building Identification
- Building Location
- Fire Protection Systems served (Sprinkler and/or Standpipe system)
- Identify if there is a Fire Pump
- Identify main building riser location or fire pump room location
- Inlet pressure required by fire department equipment to meet system demand

SPECIAL OCCUPANCIES

Mechanical/HVAC Equipment Rooms

If the equipment room does not contain oil-filled electrical equipment or other flammable liquids, Fire protection should be designed to Ordinary Hazard Group 1.

Electrical Rooms/Switchgear Rooms

All electrical/switchgear rooms shall have automatic sprinkler protection except the Main Electrical Room and the Emergency Electrical Room. Note that the recommended preference of the Texas State Fire Marshal's Office is to provide automatic sprinkler protection in all electrical/switchgear rooms including the Main Electrical Room and the Emergency Electrical Room. When the exception is used, these two rooms shall comply with NFPA 13 and have the following features:

- The electrical/switchgear rooms are provided with a 2-hr fire rated enclosure. The enclosure shall include the floor/ceiling assembly separating the electrical/switchgear room from adjacent building areas above and below the respective electrical/switchgear room.
- UL Listed Monitored Smoke Detection is provided.
- All wall penetrations are properly sealed with fire-rated material.
- The area is kept free of combustibles, and housekeeping policies must be in effect.

- No oil-filled transformers or switchgear are present.

If oil-filled/oil-insulated switchgear or transformer equipment is present, fire protection shall be designed for Ordinary Hazard Group 2.

Data Centers

Wet sprinkler systems or UL Listed pre-action systems are recommended, and should include UL Listed smoke actuated fire detection or air-sampling type detectors, automatic emergency shutdown (*manual EPO can be installed for small or non-critical data centers*), and meet the design criteria outlined in NFPA 75 “Standard for the Fire Protection of Information Technology Equipment”, NFPA 76 “Standard for the Fire Protection of Telecommunications Facilities” where applicable, and NFPA 13 “Standard for the Installation of Sprinkler Systems”. A sprinkler density of Ordinary Hazard Group 1 shall be provided.

Clean Agent or Water Mist Systems are permitted as a first line of defense; however, it is the interpretation of the Texas State Fire Marshal’s Office that sprinkler protection still be provided for all areas in accordance with NFPA 101 Section 9.8.1.

Emergency Generator Rooms

Provide automatic sprinkler protection in the generator room designed for Ordinary Hazard Group 2.

SPECIALTY SYSTEMS

Clean Agent Fire Extinguishing Systems

All special protection systems should be installed in accordance with NFPA 2001 “*Standard on Clean Agent Fire Extinguishing Systems”*. These systems should not be installed in any area where moderate to heavy loading of ordinary combustibles will be present (i.e. special collections in libraries, storage areas for Data Centers, etc.)

If special protection systems are to be used in Data Centers, they must be designed in accordance with NFPA 2001 “*Standard on Clean Agent Fire Extinguishing Systems”*. Clean Agent Systems are permitted as a first line of defense; however, it is the interpretation of the Texas State Fire Marshal’s Office that sprinkler protection still be provided for all areas in accordance with NFPA 101 Section 9.8.1.

The clean agent fire extinguishing system shall be UL Listed and FM Approved.

The system shall be designed and installed by an experienced firm regularly engaged with automatic total flooding fire extinguishing systems. The firm shall have a minimum of five (5) years’ experience in design, installation, and testing of these systems and shall be certified and licensed by the Texas State Fire Marshal’s Office in accordance with Article 5.43.1 of the Texas Insurance Code.

The contractor must perform two (2) tests for total flooding fire suppression systems.

Water Mist Systems

A UL Listed and FM Approved Water Mist System is acceptable if all criteria outlined in NFPA 750 "*Standard on Water Mist Fire Protection Systems"* are satisfied. Water Mist Systems are permitted as a first line of defense; however, it is the interpretation of the Texas State Fire Marshal's Office that sprinkler protection still be provided for all areas in accordance with NFPA 101 Section 9.8.1. The Water Mist System must be UL Listed and FM Approved for that specific application. If not in accordance with a specific application, an Alternate Method of Compliance is required.

FIRE DEPARTMENT ACCESS AND LOCKBOXES

Fire Department Access Roads shall follow NFPA 1, Chapter 18. All parts of the structure shall be within 300 feet of a fire hydrant. All access roads shall be minimum 20 foot wide. For buildings exceeding 30 feet in height, an aerial apparatus access road shall be required parallel to one entire side of the buildings to provide access to the roof or structure. Aerial fire apparatus access roads shall be a minimum of 26 feet in width and be located a minimum of 15 feet and a maximum of 30 feet from the building.

Two separate Knox boxes shall be provided at the entrance to each facility; one keyed to Bryan Fire Department and one keyed to TAMU University Police Department. Boxes shall be Knox 4400 series single lock in color Dark Bronze. Boxes shall be recess mounted in all new construction projects. Surface mounted boxes may be utilized in renovation or retrofit applications.

FIRE DEPARTMENT CONNECTIONS, PIV, AND STANDPIPES

Fire Department Connections shall be a minimum of two NSH 2-1/2" inlets. Fire Department connections shall be locked with Knox Swivel-Guard Caps Model 3111.

Each underground gate valve on the fire suppression water service piping shall comply with NFPA 24 and include a vertical cast-iron indicator post, UL-Listed or FM Global-Approved.

Fire Department Hose Valves shall have Knox caps (Knox Standpipe Lock).

DIVISION 22 - PLUMBING

GENERAL REQUIREMENTS

TAMU Utilities and Energy Services published design standards apply to all construction and renovation projects on the RELLIS Campus. Refer to the most current version of these standards which are located here:

https://facilities.tamu.edu/departments/utilities-energy-services/design-standards.html

Specific TAMU UES design standards applicable to plumbing systems include:

- Backflow Preventer Assembly Devices
- Grease Traps and Interceptors
- Natural Gas Materials and Installation
- Piping, Equipment, and Structure Color and Identification
- Procedures for Receiving and Disconnecting Temporary and Permanent Utility Services
- Underground Piping Installations
- Underground Piping System Insulations
- Utility Metering

For broken hyperlinks or confirmation of most current versions, contact TAMU UES for additional information. Additional campus specific requirements are detailed further below.

All projects shall be designed to comply with the latest edition of the International Plumbing Code and with the Texas Water Conservation Design Standards for State Buildings and Institutions of Higher Education. The design of the hot water system shall comply with the applicable energy code; either the current version of the International Energy Conservation Code (IECC) or ASHRAE 90.1 as selected by the design team at the schematic design phase. (Note: The 2018 IECC is the minimum requirement by state law and the standard that RELLIS Campus currently follows. The latest version is the 2024 IECC and it imposes a significant additional compliance requirements.)

Submit plumbing calculations with the Design Development submittal. Performance data for all plumbing equipment shall be shown in schedules on the drawings. Provide riser diagrams with the design documents to show all waste, vent, supply piping, and cleanouts.

Room numbers must appear on plumbing plans and room names where space is available. Column lines or designations shall appear on all plumbing sheets as they appear on architectural and structural sheets. Plumbing and HVAC systems shall be drawn as separate sheets. These systems may be combined only with written permission of the Owner’s Representative.

Where piping systems are to be installed under floor, they shall be shown on an underfloor plan and not on the plan prepared for the space above. Floor plans for mechanical systems shall be drawn to show pipes, ducts, etc. on the floor in which they are installed. In general, underfloor plans shall be drawn to show all piping underfloor and, from there up, the systems between each floor slab shall be shown only on the appropriate floor plan.

All construction details shall be shown on the drawings and shall not be bound in the specifications. All equipment and material specifications shall be bound in the specifications and shall not be shown on the drawings.

The CM or GC shall provide as-built building information models of all plumbing piping and valves 2” and larger as well as any plumbing equipment.

All buildings shall be designed for utility metering in accordance with UES Design Standards. Reference link above for detailed requirements.

PLUMBING PIPING

Domestic Water

All domestic water systems shall be protected by a reduced pressure backflow preventer in accordance with UES design standards at the service entrance into the building. Domestic BFPs shall be located inside a mechanical space immediately downstream of the service entrance into the building.

All above slab domestic water piping interior to the building shall be type L copper with soft solder jointing. All below slab domestic water piping inside the building footprint shall be type K copper with no inaccessible joints unless silver soldered.

PEX-A piping with expansion fittings may be used with special prior approval from RELLIS Administration in unconditioned hangars or industrial spaces where greater resistance to freezing is of benefit. PEX-B or PEX-C is not permitted. Crimp, clamp, or shark bite fittings are not permitted. Any PEX-A piping inside the building shall transition to copper prior to exiting the wall cavity at all fixture supplies (i.e. sinks, lavatories, water closets, etc.).

All ball valves shall be two-piece full port with threaded ends stainless steel ball and stem. All butterfly valves shall be drilled and tapped lugged body or full flanged. Provide threaded wall stops at all lavatory and sink water supply piping.

Provide water hammer arrestors on all water piping in toilet battery chases with a valve upstream of the device for maintenance. Install either above an accessible ceiling or behind an access door for maintenance at the end of the header.

All domestic water systems shall be sterilized prior to substantial completion to meet health department requirements.

Sanitary Sewer

All above slab sanitary piping interior to the building shall be to be no hub cast iron. All below slab sanitary piping inside the building footprint shall be hub and spigot cast iron. PVC DWV solvent welded pipe and fittings may be used under slab with special prior approval from RELLIS Administration. Cleanouts shall be located at each bend and no more than every 50 feet in straight runs of pipe.

Where projects are designed with a structural slab-on-void forms, all sanitary sewer piping below the slab-on-void shall be installed within a utility isolation system similar or equal to PlumbingVoid or Mudskipper by VoidForm or Utility Protection System (UPS) by SuperVoid Systems.

Natural Gas

Natural gas piping above and below slab shall comply with UES' published design standard referenced above. All underground gas piping shall be polyethylene with fusion welded fittings. No steel gas pipe is permitted below grade.

Above slab gas lines inside the building shall be of all welded black steel construction to emergency shut-off valves. Gas lines from valve to lab table or appliances may be threaded black steel with M.I. fittings for 3/4" and smaller. All building gas piping shall be designed and installed in accordance with National Fuel Gas Code, NFPA 54, latest edition.

Reference the Division 33 section of this document for information on natural gas service to buildings upstream of the facility meter. The project A/E shall complete a Commercial Customer Load Requirements sheet (provided by Atmos) and properly locate the meter based on current Atmos guidelines for meter location and meter clearances with respect to building features.

Roof Drains and Storm Water

Roof drain piping interior to the building shall be no hub cast iron. All no-hub cast iron shall be provided with hangers within 18" of the hubs on each side. Provide insulation starting at the underside of roof drain bodies and for a minimum of 25 feet along first horizontal piping run. Provide insulation on all roof drain lines that accept condensate. Roof drains shall be run separately from all other storm water sources to the outside of the building. All secondary overflow drains shall be piped independently of the primary roof drain system and daylighted to the building exterior.

All primary roof drains and/or downspouts shall be connected to the underground storm drainage system. Spilling of primary roof drainage directly to grade at the building perimeter is not permitted without special prior approval from RELLIS Administration.

Condensate

All exposed condensate piping inside mechanical rooms from the air handling unit drain pan to the hub drain shall be type L copper with soldered fittings. Exposed piping shall be fully insulated.

Above ceiling pumped or gravity drained condensate piping from fan coil units, mini-split units, etc., may be copper or schedule 40 PVC with solvent welded fittings. Piping shall be fully insulated and all insulation within plenums shall meet the requirements of ASTM E84 and have a flame spread classification of less than 25 and a smoke development rating of less than 50.

Buildings which are connected to the RELLIS Campus thermal distribution loop shall also provide condensate reclamation unless special prior approval is granted by RELLIS Administration to discharge condensate to the sanitary sewer system. Where applicable, underground condensate reclamation pipe shall be PVC. Piping shall be marked appropriately as “NON-POTABLE” and

shall be purple in color. Interior condensate reclamation pipe shall be CPVC. Piping shall be marked appropriately as “NON-POTABLE” and shall be purple in color.

Laboratory Piping

All laboratory gas piping shall be installed with type L copper or stainless steel piping with Swagelock fittings appropriate to the type of gas being conveyed. Provide drum sediment traps for all fume hoods and lab sink drains.

FIXTURES AND EQUIPMENT

General Requirements

Provide frost proof hose bibbs with loose key operator on exterior of buildings. Major buildings should have a minimum of one hose bibb on each primary face of the building.

Buildings shall be designed to permit gravity flow of sanitary and storm drainage (12 inch maximum storm drain size). Where sewage ejectors or sump pumps are required, they shall be located to have sufficient headroom to pull the pump shaft straight up through the floor plate. Lifting eyes or trolley beams shall be provided to facilitate the removal of the equipment. Emergency power shall be provided if failure of pump would damage or flood electrical or mechanical equipment. A high level alarm shall also be provided.

Access shall be provided to all working parts of plumbing devices. Do not permanently seal in wall any plumbing items requiring periodic operation or maintenance.

Mechanical and Equipment Rooms

Provide at least one (1) 4" floor drain with trap seal protection in each equipment room connected to the sanitary sewer system. Locate out of the walking area, but not under equipment. Locate one (1) domestic water line hose bibb with vacuum breaker in each equipment room for coil washing.

Restrooms

Provide individual isolation valves on hot and cold supply lines serving each restroom to permit shutoff and maintenance without affecting other areas of the building. Provide a single hose bibb with vacuum breaker and loose key operator under the lavatories in each restroom. Caulk all toilets, urinals, and lavatories at the wall interface. All toilet bowls and urinals to be set within 1/16" of the finished wall. Provide 1-1/2" P-trap for all lavatories and provide ADA trap guards where required.

Each restroom should have at least one 4" floor drain when serving 80 or more square ft. and 3" min. for less area. Coordinate the location of toilet partitions and floor drains. The drain shall be under the partition but not adjacent to the support. Floor drains shall be provided with automatic trap seal protection. For sanitary cleanouts in or near restrooms, place the cleanout(s) at a higher elevation than the flood rim of the surrounding fixtures.

Plumbing Fixtures

All fixtures shall be selected by the A/E Design team and submitted for review and approval at Design Development.

All water closets shall be wall hung on carriers. Floor mounted water closets are not permitted in institutional facilities without prior approval from RELLIS Administration. If specified, sensor operated faucets and flush valves must be hardwired. Battery operated devices are not permitted.

Drinking Fountains shall include integral bottle fillers.

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING

CAMPUS INFORMATION

TAMU UES operates and maintains a campus central utility plant (CUP) on behalf of RELLIS to provide chilled water and heating hot water to campus buildings via underground thermal piping loops. As of mid-2026, the existing CUP equipment includes four (4) 800-ton water cooled chillers and associated cooling towers and six (6) 2,850 MBTU gas fired boilers. An upgrade project was approved in February 2026 to provide the addition of two more chillers and supporting equipment as well as six additional boilers. CUP infrastructure also includes a nominal 1,500,000 gallon thermal storage tank which provides 12,800 tons/hour of usable thermal storage.

The chilled water supply temperature is currently 42°F with a 14°F ΔT. Distribution mains for chilled water supply and return are 24" HDPE across campus. The heating hot water supply temperature is currently 150°F with campus buildings designed for 30°F ΔT. Distribution mains for heating hot water supply and return are 12" HDPE across campus. All thermal loops also include 3" condensate return piping.

Two primary underground thermal loops currently exist to serve the northern portion of the campus. One loop serves the northwest portion of the campus via Avenue A, RELLIS Parkway and across the runways. The other loop serves the northeast portion of the campus via Avenue A, RELLIS Parkway, Bryan Road, and 4th Street. All projects shall consult with RELLIS Administration for specifics on both current and future planned thermal piping routes throughout campus as well as available plant capacity during project design.

TAMU Utilities and Energy Services published design standards apply to all construction and renovation projects on the RELLIS Campus. Refer to the most current version of these standards which are located here:

https://facilities.tamu.edu/departments/utilities-energy-services/design-standards.html

Specific TAMU UES design standards applicable to HVAC systems include:

- Building Automation Systems
- Building Energy Efficiency
- Hydronic Piping in Buildings
- Interconnection of Building Hydronic Systems to Campus Thermal Utility Infrastructure
- Laboratory Control Systems
- Piping, Equipment, and Structure Color and Identification
- Procedures for Receiving and Disconnecting Temporary and Permanent Utility Services
- Thermal Systems (Chilled Water & Hot Water)
- Underground Piping Installations
- Underground Piping System Insulations
- Utility Metering

For broken hyperlinks or confirmation of most current versions, contact TAMU UES for additional information. Additional campus specific requirements are detailed further below.

PERFORMANCE REQUIREMENTS

The following are baseline minimum performance requirements for mechanical systems. It is possible for the project Program of Requirements to have requirements that deviate from or exceed these minimums:

A. Energy Code: The energy code will be selected as a part of the Schematic Design process. The project shall comply with the energy code and shall exceed the code as required in other sections of the Facility Design Guidelines. The Energy Code will be either the current version of the International Energy Conservation Code (IECC) or ASHRAE 90.1.

B. Mechanical Code: The design shall comply with the latest edition of the International Mechanical Code.

C. Dry Bulb Temperature: For offices, conference Rooms, and classrooms the indoor design conditions shall be a maximum 72 degrees F for heating and a minimum 75 degrees F for cooling. The controls shall provide for seasonal and unoccupied temperature reset. For laboratories that are driven by minimum ventilation requirements the minimum cooling design condition shall be 72 degrees F to minimize the amount of reheat required. For Mechanical Rooms, Electrical Rooms, Custodial Rooms, and Storage Rooms the minimum cooling design temperature shall be 80 degrees F. For stairwells, the design conditions shall be specified by the engineer of record.

D. Humidity: Provide a maximum 55 degrees F dew point.

E. Air Movement: Provide less than 40 feet per minute air speed at the occupied level.

F. Pressurization: Provide building positive pressure when occupied and when outside dew point is greater than 47 degrees F. Laboratories generally are maintained under negative pressure in relation to the corridor or other less hazardous spaces. Specific laboratory pressurization requirements are to be confirmed with the Environmental, Safety, and Health officer for the campus.

G. Ventilation: Provide ventilation rates per the International Mechanical Code (or ASHRAE 62.2 if the ASHRAE 90.1 energy code is being used). Provide demand-controlled ventilation when required by IECC or ASHRAE 90.1. Laboratory ventilation rates are established by the RELLIS Environmental Safety and Health Officer. If the EHS officer has no specific requirements then the baseline design shall be a maximum of 8 and a minimum of 4 air changes per hour. Lighting occupancy sensors shall detect occupancy and operate the lights and adjust ACH based on occupancy. Laboratory fume hoods shall maintain a minimum face velocity of 100 fpm with no measure point less than 80 fpm when the sash is open 18 inches.

H. Filtration: Filtration performance requirements are to be specified by the engineer of record but shall at a minimum meet requirements of ASHRAE 62.1.

PRESCRIPTIVE DESIGN AND SPECIFICATION REQUIREMENTS

The outdoor design condition criteria are to be established by the engineer of record using the latest edition of the ASHRAE Handbook of Fundamentals. The design criteria shall be shown on the General Information sheet of the mechanical drawings and be included in the Basis of Design narrative.

The following items shall all be included in the Basis of Design narrative and/or on the drawings at both the Design Development and the Construction Documents Phase:

A. Building Ventilation Schedule
B. Building Pressurization Table
C. Occupancy Loads
D. HVAC Load Calculations
E. Energy Analysis
F. Schematic Flow Diagrams for air, cooling water, and heating water systems
G. Site Plans showing new and existing thermal lines and the limits of construction
H. Floor plans showing layout for supply air, return air, and exhaust air systems
I. Enlarged mechanical room plans showing all equipment and access

HYDRONIC PIPING

The following requirements shall apply in addition to UES' design standards.

Insulation and Hangers

Pipes in crawl spaces and other spaces subject to condensation must be insulated with non-permeable insulation such as cellular glass. All condensate drain lines shall be insulated to the vertical main. In exposed areas insulation shall be pre-molded. In unexposed areas the insulation can be foil wrapped. Provide metal jacket on all crawl space piping, exterior insulate piping and mechanical room piping (up to 8'-0" AFF) insulation. Density of fittings for insulated piping shall be the same as the specified pipe insulation. Use pre-molded fitting insulation; loose fill is not acceptable.

All hangers on domestic water and hydronic lines shall be installed on the exterior of the insulation. All hangers shall be hot dipped galvanized in the crawl space and wet areas and cad plated otherwise.

Piping and Valves

3/4" is the smallest size for a hydronic pipe to a coil. All pressure piping shall be tested at 150 psi or greater for 4 hour minimum. Anchor all condensate lines to the floor. Do not gang condensate lines together.

Do not use gate valves in hydronic piping, use ball valves 2" and smaller (e.g. stainless steel ball and stem) and butterfly valves for 2-1/2" and larger. Butterfly valves shall have ductile iron disc

and stainless steel nosing and stem. All ball valves shall be two piece threaded 600 with stainless steel ball and stem. All ball valves on insulated piping to have extension handles. All auto air vents shall be constructed with a cast iron body and stainless steel ball and seat. All manual air vents shall be plugged. All valves preceding pressure gauges shall be needle type with snubbers installed on the discharge side of the pump.

Do not use red rubber gaskets on hot water lines and heat exchangers. Instead use EPDM or hard Garlock gaskets. Use EPDM gaskets in "push on" joints.

Hydronic Piping Cleaning Guidelines:

UES guidelines referenced above provide prescriptive standards for cleaning and flushing of hydronic piping systems prior to placing them into service. These procedures must be strictly followed. Refer to the most current guideline at the link provided above for additional information.

DUCT SYSTEMS

All ducts shall be fabricated from G-90 galvanized materials. All metal components on galvanized sheet metal ducts shall be galvanized materials including but not limited to angle stiffeners, trapeze hangers, rods, straps, etc. Provide airfoil turning vanes at transitions where applicable.

All large round ducts to be hung with half-round saddles and rods. Cable hangers are NOT acceptable. Provide hangers for all slot diffusers and insulate. Provide hinged access doors for duct access.

All spin-ins shall be of the conical type with damper shaft mounted horizontally. All grilles shall be regulated by a volume damper, when possible, in lieu of an opposed blade damper. Provide cover plates with appropriate finish for all recessed damper operators.

All transfer air openings shall be sized with no more than 300 feet per minute air velocity.

Provide a duct leakage test procedure in the project specifications.

Type 316 stainless steel should be used for all parts of the laboratory and/or fume hood exhaust system. The exhaust duct should have as few bends as possible and minimal horizontal runs. Refer to Division 11 of these guidelines for additional laboratory equipment and fume hood requirements.

Insulation

Foil backed tape on ducts is not permitted. Use fiberglass and Benjamin Foster sealant with fiberglass mat embedded in sealant. All exterior duct insulation shall have a vapor seal and metal jacket applied with fiberglass mesh installed and resealed with vapor barrier sealer.

All exposed ductwork to have internal insulation and metal liner and be fabricated from paint grip metal. The use of fiberglass internal duct liner is prohibited.

Acoustic duct lining used in air systems shall be non-fiberglass material impregnated with an antimicrobial agent.

MECHANICAL EQUIPMENT ROOMS

Provide a curb around all penetrations through the mechanical room floor. All floor penetrations shall be sealed with appropriate fire stopping material. Depress the floor of all mechanical rooms 1-1/2" and uniformly slope entire floor to minimum 4-inch floor drain(s). All floor drains in mechanical rooms shall have trap primers and be connected to building sanitary sewer system.

Provide positive ventilation in all equipment rooms that are not return air plenums. Mechanical rooms with equipment other than those items directly related to air handling equipment shall not be used for return air plenums. The use of rooms as plenums is permissible provided outside air and return air are directed to the plenum and volume control dampers are provided to control the quantity of each entering the plenum.

Each component of an air handling system shall be spaced so there is ample room on all sides for inspection and maintenance (filter removal, bearing replacement, coil replacement, cleaning, etc.) and personnel sized hinged access doors shall be provided for ready access to the spaces in the air handling equipment.

Any air handling unit suspended above the finished floor must be provided with a permanent platform for maintenance. The maintenance platform must be a minimum of 7'-0" clear from the floor below.

Provide conditioned supply air into each mechanical room and electrical room for tempering the air in the space. Provide dedicated 120 VAC duplex electrical outlets in every mechanical room for maintenance of equipment. All mechanical rooms shall be keyed to the appropriate maintenance zone mechanical master key. Refer to division 8 guidelines for additional requirements on mechanical room keying.

Housekeeping pads for the floor mounted equipment shall be a minimum of 6 inches high and shall extend a minimum of 4 inches beyond all sides of the equipment they support.

Refer the Architectural Design section of the Facility Design Guidelines for additional mechanical room requirements.

BOILERS

For buildings with dedicated heating water boiler plants: Modular boilers are to be used with a minimum of two equally sized boilers sized at 67 percent of peak demand. Specifications for boilers shall include the following:

- Chemically treat and flush the boiler system prior to initial startup.
- Provide and install an automatic blowdown system.
- Provide and install a conductivity meter.
- Provide and install means for future chemical treatment.

UES guidelines referenced above provide prescriptive standards for cleaning and flushing of hydronic piping systems prior to placing them into service. These procedures must be strictly followed. Refer to the most current guideline at the link provided above for additional information.

CHILLER PLANTS

Where needed and for buildings that have dedicated chiller plants: If the total cooling load is 1,000 tons or more a minimum of three chillers must be provided. If less than 1,000 tons, a minimum of two equally sized chillers at 67 percent of the peak capacity shall be provided.

ROOF MOUNTED EQUIPMENT

Roof mounted equipment other than exhaust fans is not permitted in new facilities or major renovations on the RELLIS campus unless the following design strategies are utilized:

- Conditioned mechanical penthouse
- Fully screened mechanical roof well
- Roof mounted equipment screens (subject to RELLIS Administration approval)

Access to roof-mounted equipment other than exhaust fans must be by stairs or freight elevator; ships ladders are not permitted.

TESTING, ADJUSTING, AND BALANCING

Testing, adjusting and balancing of the air conditioning system, including both air side and water side systems, shall be performed by an impartial technical TAB firm. Consult with the Owner's representative during the design phase to determine if TAB services will be included in the Contractor's scope or hired directly by TAMUS.

AIR HANDLING UNITS

Casings

AHU housing must consist of formed and reinforced insulated panels, fabricated to allow removal for access to internal parts and components. Units shall have access doors, minimum 15-1/2" width, to access both sides of the coils, filters, fan section and mixing box sections. Safety latches shall be required for the fan section. All parts of the unit shall be G90 galvanized inside and out, including supports. AHUs shall be built on a minimum of six-inch-high rails. Air handling units shall be constructed to facilitate easy removal of the coil without disassembly of the cabinet. At the manufacturer's option, the coils may be installed on tracks to facilitate removal.

Drain pans shall be of stainless-steel double wall construction, sloped both ways to a single outlet with a minimum of 2" of uncompressed insulation, with a minimum condensate connection of 1" NPT stainless steel. Drain pans shall extend downstream of the coil far enough to contain moisture carry-over. Drain pans must be accessible for inspection and cleaning.

The Engineer of Record shall specify AHU casing leakage and deflection limits that satisfy the equipment service life specified in the program of requirements. At a minimum, AHUs shall be constructed for a maximum 1% allowable leakage of the rated air flow at +/- 8 inch w.g. The contractor's scope shall include field leakage testing of one unit of each type that is used in the project.

Fans

The fans shall be specified by the engineer of record.

Coils

Cooling coils must be selected at or below 500 feet per minute face velocity. Heating coils must be selected at or below 750 feet per minute face velocity. HVAC coils subject to outside air in hot humid climates shall be provided with copper tubes and copper fins or electro coated copper tubes with electro coated aluminum fins with a coating thickness to be maintained between 0.6 mil and 1.2 mil and with a minimum salt spray resistance of 6,000 hours.

Individual finned-tube cooling coils, five or fewer rows may have a maximum 12 fins per inch. Individual finned-tube cooling coils of six rows or more shall not exceed 10 fins per inch. Coil casing shall be stainless steel for chilled water coils. Any penetrations shall have rubber grommets and fully sealed for pressurization and insulated from the casing insulation.

Filters

The filters shall be specified by the engineer of record.

Controls

The A/E shall require the controls contractor to supply one or more temperature-sensing element(s) in each Air Handling Unit. The sensor shall be installed in a serpentine manner so that at least 75% of the coil's surface is covered and a representative average temperature can be transmitted to the Energy Management System (EMS). The length of sensor should be one (1) foot of length per square foot of coil area.

Electrical

All units with a motor rated at 10 horsepower and larger, shall be furnished with an internal 120 VAC light. All units shall have a single point of connection for the electrical service to the unit. The manufacturer shall seal the conduit to the motor with liquid-tight flexible conduit to prevent condensation in the motor connection housing.

VARIABLE AIR VOLUME TERMINAL UNITS

Single duct terminal boxes shall be selected with the maximum scheduled CFM to be lower than 80 percent of the box listed capacity.

Boxes are to be delivered to the jobsite fully assembled with air dampers, heating coil, self-contained volume regulator, flow sensor, and disconnect switch. All controls shall be supplied by the HVAC Controls Contractor to the box manufacturer for factory installation.

The damper actuator must be factory installed by the box manufacturer. All required linkages must be furnished and factory installed and performance tested by the box manufacturer.

Samples of each type of terminal unit will be selected by the Owner for testing of case and damper leakage. The test will be done at the Testing and Balancing firm's facility. The engineer of record shall provide leakage requirements in the specifications.

DIVISION 25 – INTEGRATED AUTOMATION

BUILDING AUTOMATION SYSTEMS

TAMU Utilities and Energy Services manages all building automation systems on the RELLIS Campus via intra-system agreement. UES' published design standards apply to all construction and renovation projects on the RELLIS Campus. Refer to the most current version of these standards which are located here:

https://facilities.tamu.edu/departments/utilities-energy-services/design-standards.html

All new facilities and major renovation projects shall include provision for a building automation system in accordance with UES guidelines. The system shall include a stand-alone Direct Digital Control (DDC) System. This system shall communicate with the UES Central Energy Management System via connection to the RELLIS Campus network.

The building automation system must be compatible with the existing campus system. Systems or building components to be monitored and/or controlled by the central campus systems include, but are not limited to, the following: temperature and humidity control, fire alarm, lighting, and the status of major equipment. Monitoring specific mechanical equipment and systems will be dependent on input and recommendations of UES and RELLIS Administration during project design.

During the Design Development and Construction Documents phases, consult with the respective controls firm to determine the number of DDC Panels required and the location for each panel. The panel locations shall be shown on the detailed design drawings.

In addition to the published design standards, UES has undocumented requirements for sequences of operation, design details, and control network architecture. These requirements are fluid and the engineer shall initiate a meeting with UES and RELLIS Administration at the beginning of the project to discover and document these requirements.

DIVISION 26 - ELECTRICAL

GENERAL

The A/E shall not leave engineering calculations to the contractor. Calculations such as load flow, short circuit, arc-flash, K-factor, THD, duct bank heat analysis, and pull calculations shall be the responsibility of the A/E. All studies shall be performed by or under the direct supervision of a Licensed Professional Electrical Engineer (PE).

Where the NEC uses terms like “by special permission,” obtain written permission from TAMUS.

POWER SYSTEM STUDIES

The scope of all power system studies shall begin at the project connection to the medium-voltage utility system (including the primary fuse or circuit breaker) and extend to the low-voltage distribution system branch-circuit overcurrent protective devices. The results of all studies should be displayed as paired with equipment on one-line diagrams at 100% CD.

Perform power system studies and analyses according to the methods of IEEE 399. For power system networks having parallel paths, perform a load flow analysis in accordance with IEEE 399, Chapter 6 using a static (positive sequence) model.

Load Analysis

Include in each load summary a load growth factor of 20% or higher for future load growth.

Fault Current

Use IEEE 242 and IEEE 551. Extend calculations to address all areas spelled out NFPA 70E under arc-flash study. A preliminary study should be performed at 100% CD design review.

Overcurrent Protective Device Coordination

Use IEEE 241 and IEEE 242. Study will need to be performed in conjunction with arc-flash study to achieve desired worker safety levels. Following approval of switchgear construction submittals, perform a final coordination study for the actual equipment to determine the final overcurrent protective device settings.

Arc-Flash Hazard Analysis

Use procedures and deliverable outlined in NFPA 70E and IEEE 1584. Further guidance and expected safety levels are listed below.

All customer-owned cabling shall utilize the underground pathway system identified in this document and referred to in ANSI/TIA. Entrance point diversity is highly desirable.

A. Specify overcurrent protective device settings to achieve the required arc-flash results. Include a time over current coordination curve for each relay.
B. Where possible, design the electrical system to limit arc-flash incident energy to a level that does not exceed category 2 personal protective equipment (PPE). Arc-flash hazard PPE categories are defined in NFPA 70E-2015, Table 130.7(C)(15)(A)(b).

C. At areas where category 2 cannot be achieved, use one of the following methods to reduce risk to personnel:
    1. Upstream breaker
    2. Upstream current limiting fuse
    3. Differential relay (where proximity allows)
    4. Maintenance switch; include alarm when in maintenance mode
    5. Arc resistant gear
    6. Note: While on-board breaker controls, “Smart Gear”, a control umbilical, and a remote break control are excellent ways to reduce worker risk for breaker operations, it will not eliminate the arc hazard risk.
D. Provide the final model back to Owner upon completion of project with record drawings.

EQUIPMENT RATINGS

Main Service should be designed on an infinite bus for fault ratings. Minimum fault ratings should be 10,000A RMS symmetrical for 100V-250V and 14,000A RMS symmetrical; minimum 251V-1000V.

Do not use series rated equipment.

Unless otherwise required by code, use a solidly grounded, 480Y/277V, 3-phase, 4-wire service and distribution system. Specify a 208Y/120V, 3-phase, 4-wire service only if justifiable by a LCCA comparison to a 480V system. Load voltages should generally be as follows:

A. Connect major 3-phase motor and power loads at the service line-to-line voltage.
B. Connect large to moderate lighting loads at the service line-to-neutral voltage.
C. Connect 120V receptacles, small general loads, and 208V single-phase and 3-phase equipment to separately derived 208/Y120V systems using dry-type transformers if the service is 480Y/277V.
D. Control voltages should match current facility and be below 120V.
E. Provide correct equipment for voltage. Do not correct equipment voltage level using an auto or buck boost transformer.
F. Where equipment is capable, specify equipment to have a voltage range or multiple voltage taps.
G. Where high single phase or high harmonic loads are present, size neutral bus and/or cable accordingly.

Provide for future expansion:

A. Provide a minimum of 20% spare capacity (ampacity or VA) on all transformer feeder circuits and bus equipment (i.e. panelboards, switch gear)
B. For LV equipment, provide a minimum of 10% spare breakers across facility.
C. For switchgear and switchboards provide one “equipped space” per bus.

D. For panelboards provide 10% spare space.

E. Provide minimum 20% spare raceway capacity. Do not include remainder of % fill on conduits less than 2”.

POWER QUALITY AND SYSTEM RELIABILITY

Separate loads as a minimum into HVAC, Lighting, Receptacle, Lab/Health/Sensitive Equipment (when applicable).

Using IEEE 519, provide adequate passive or active filtering to keep total harmonic distortion below 5% while on normal power and 10% on high harmonic. The point of common coupling shall be the main breaker. Use a correct K-rated transformer for all such instances.

Provide a power-factor correction system (PFCS) for buildings where the service entrance equipment is rated 1200A or higher and the uncorrected average power factor of the system is expected to be below 0.95. Target the corrected power factor to be 0.95. Specify an automatically-controlled capacitor bank type PFCS where the VAR rating of the capacitors is less than or equal to 15% of the service transformer capacity (VA) rating or as recommended by the PFCS manufacturer.

STANDARDS FOR MATERIAL AND EQUIPMENT

Use electrical materials and equipment that are constructed and tested in accordance with the standards of NEMA, ANSI, ASTM, or another recognized commercial standard. A complete current listing is published on http://www.osha.gov/dts/otpca/nrtl/. Where a piece of equipment is not labeled, listed, or recognized by any NRTL, provide a manufacturer’s Certificate of Compliance indicating complete compliance of each item.

Do not install or use electrical equipment for any application other than that for which it was designed, labeled, listed, or identified unless formally approved for such use by TAMUS.

A. Use only Copper for all electrical bus, grounding, interior wiring, and wires smaller than 1/0. For all other areas perform LCCA to determine materials.

B. Include a main breaker on all switchgear, switchboards, panelboards, motor control centers and other similar equipment. (except for sub-panelboards being fed from a panel in the same room).

C. Where allowed by code and interrupt capacity, use circuit breakers.

D. Arc-energy reduction employing zone-selective interlocking for switchgear and switchboards rated 1200A.

E. For all equipment rated above 1200A or 1000V and for motors rated above 300A use electronic multifunction protective relay.

F. Where equipment maintenance requires temperature readings from internal parts, include infrared viewing windows.

G. When available used hinged doors over bolt on panels.

EQUIPMENT LOCATION AND LAYOUT

Locate electrical equipment:

A. So it will be accessible for inspection, testing, service, repair, and replacement.

B. So it can be removed without requiring disconnection of any other equipment, except that which is specifically connected to the piece of equipment.

C. Provide adequate space for ventilation and avoid stacking heat producing electrical equipment. Provide a minimum of 6” unobstructed area around such equipment.

D. Avoid suspending electrical equipment (except necessary air handling equipment).

Locate generators so exhaust does not enter occupied spaces through outside air intakes. Provide a fire barrier constructed between the normal power supply (utility transformer) and emergency generator if both units are located within 20 feet. Do not use overhead power.

Do not install electrical equipment below piping or other means of liquid conveyance except where equipment is rated or a mechanical connection dictates location (i.e. motor coupled with pump).

All electrical equipment including in-line disconnects and controls necessary for a fire pump shall be rated NEMA 2 or above.

Provide means of replacing gear without the need of a crane for all indoor electrical equipment. Do not locate electrical distribution or control equipment in stairways, custodial closets, or restrooms. Do not install transformers in open kitchens or cooking areas.

Show the minimum working clearances and dedicated equipment space around each electrical equipment on all drawings.

COMPONENT IDENTIFICATION

Place an equipment code on the electrical symbols legend sheet that defines the nomenclature of all major electrical equipment specified for the project. Alternate component identification systems are acceptable but must include the following information:

A. Location by building level, e.g. basement, first floor, penthouse

B. Location by building area (if assigned by architect), e.g. A, B, C

C. Power system class, e.g. normal, emergency, standby

D. System voltage, e.g. 208/120V, 480/277V, 12.47kV

E. Equipment type, e.g. switchgear, switchboard, transformer, panelboard

F. A number at the end of the equipment designator to distinguish specific equipment from other equipment of the same type, i.e. 1, 2, 3.

ARC FLASH HAZARD WARNING LABELS

Provide an arc-flash warning label on all electrical equipment that contains a switching component. Label must be a minimum of 4”x6”. Where equipment incident energy level is equal

to or less than 40 cal/cm^2, provide an orange warning label. For equipment with incident energy levels greater than 40 cal/cm^2, provide red danger label and include a label stating Discounting Device upstream. Label in accordance with NFPA 70E.

CIRCUIT IDENTIFICATION

Provide a circuit directory for each switchboard, switchgear, and panelboard as described in NEC 408.4 and as follows:

A. Upon final installation, place a neatly typed circuit directory using text no smaller than 1/8 inch high behind clear heat-resistant plastic in a metal frame door to the inside door of the equipment. Adhesive-mounted directory pockets are not acceptable.

B. The directory shall contain all the information contained in the panel schedule except load calculations, plus any field modifications.

Specify labels containing circuit numbers for receptacles in plants and laboratory areas and where requested by the user.

WORKING SPACE MARKERS

In electrical rooms and areas where electrical equipment is located, permanently mark the floor with the NEC-required clear space in front of and behind switchgear, switchboards, transformers, panelboards, motor control centers, motor starters, and disconnect switches. Install marking on the floor using color schemes conforming to ANSI Z535.1 for black and white striped border.

EQUIPMENT FOUNDATIONS

Design concrete bases (“housekeeping pads”) for indoor equipment to be not less than 4 inches high, and not less than 6 inches above grade for outdoor equipment. Extend floor pads to not less than 4 inches beyond the supported equipment in both directions. Specify foundations to be within manufacturer’s tolerances.

Provide vibration isolating pads for transformers and other vibrating electrical equipment, if not integral to equipment.

ELECTRICAL DEMOLITION

Remove abandoned electrical distribution equipment, utilization equipment, outlets, and the accessible portions of wiring, raceway systems, and cables back to the source panelboard, switchboard, switchgear, telecommunications, or cabinet. Remove conduits, including those above accessible ceilings, to the point that building construction, earth, or paving covers them. Cut conduit beneath or flush with building construction or paving. Plug, cap, or seal the remaining unused conduits. Install blank covers for abandoned boxes and enclosures not removed. Leave abandoned electrical equipment, conductors, and material in place only if one or more of the following conditions exist:

A. The removal requires the demolition of other structures, finishes, or equipment that is still in use (an example is abandoned conduit above an existing plaster ceiling).

B. Removal of abandoned conductors may damage conductors that must remain operational.

Extend existing equipment connections using materials and methods compatible with the existing electrical installation and this Division. Restore the original fire rating of floors, walls, and ceilings after electrical demolition.

ELECTRICAL ACCEPTANCE TESTING

Perform electrical acceptance testing in accordance with the current edition of the International (National) Electrical Testing Association (NETA) “Acceptance Testing Specification ATS.”

MEDIUM VOLTAGE SERVICE AND DISTRIBUTION

The RELLIS Campus is currently fed from incoming Bryan Texas Utilities (BTU) overhead distribution lines on the northeast side of the campus near the SH 21 and Hwy 47 interchange. Service is routed underground from the BTU terminal pole via concrete encased primary duct bank to 15kV switchgear located at the RELLIS Central Utility Plant (CUP).

A new BTU substation located on the northwest portion of the campus will provide a second redundant feed into the CUP switchgear. This feed is expected to be energized in late 2026. New 138kV service to the BTU substation routed through campus via both aerial and underground routes is also in planning stages as of 2026.

The current electrical distribution system consists of some sections of existing pole mounted aerial service and some new concrete encased underground duct bank. Existing facilities, which are currently served overhead, will be converted to underground service with pad-mounted transformers as they are renovated, and as new electrical infrastructure is extended through the campus. New facilities are required to connect to and/or extend concrete encased underground duct bank as required.

The medium voltage service and distribution system on the RELLIS Campus is managed and maintained by Texas A&M Utilities and Energy Services (TAMU UES) through an intra-system cooperation agreement. TAMU UES’ published design standards apply to all construction and renovation projects on the RELLIS Campus. Refer to the most current version of these standards which are located here:

https://facilities.tamu.edu/departments/utilities-energy-services/design-standards.html

Specific TAMU UES design standards applicable to medium voltage service and distribution include:

- 15kV Switches – Pad Mounted
- 15kV Switches – Underground
- Cable Splicing & Termination Qualifications
- Capacitor Bank

- Electrical Utility Raceway (Duct Bank)
- General Overhead Electrical Distribution Systems
- Medium Voltage Electrical Service and Distribution
- Medium Voltage Power Systems

For broken hyperlinks or confirmation of most current versions, contact TAMU UES for additional information. Additional campus specific requirements are detailed further below.

Permanent overhead distribution for medium voltage and low voltage systems is prohibited for all new construction unless written approval is granted by RELLIS Administration. Unless noted otherwise in the project Program of Requirements (POR), any modifications necessary to extend or upgrade the campus utility distribution system to supply electrical service to a new project or project site must be fully funded by that project.

Exterior metal enclosures for all exterior pad mounted switches and transformers shall have a manufacturer applied finish to match “RELLIS Tan” (Sherwin Williams color SW6114 Bagel).

RELLIS CAMPUS COMBINED ELECTRICAL & TELECOMMUNICATIONS DUCT BANK

New medium voltage distribution throughout the campus is required to be placed in reinforced concrete duct bank (RCDB). To the extent possible, campus telecommunications cabling shall also be installed in a parallel RCDB with the medium voltage distribution. Each system shall have separate isolated manholes. Additional requirements regarding the size and quantity of conduits is specified in other related sections of this document.

MEDIUM VOLTAGE CABLE TESTING

The guidelines below are supplemental to cable testing requirements specified in TAMU UES design standard for Medium Voltage Power Systems.

Factory Tests

The cable manufacturer shall perform non-destructive factory tests on all medium-voltage conductors in accordance with ICEA, NETA ATS, and IEEE standards and shall furnish certified test reports to TAMUS.

Contractor Responsibilities

A. Field-test cables prior to energization and verify with Factory Test reports.

B. During construction (typically during the Acceptance Testing phase), notify TAMUS 14 days in advance of the time that the cables will be ready for field testing. This will allow time for TAMUS to contract the services of a certified cable testing firm to conduct the tests described below.

C. Complete the TAMUS Medium Voltage Cable Testing Information and submit to TAMUS 14 days prior to testing date. TAMUS will provide the completed form to the cable testing firm.

D. Cooperate with and give all necessary assistance to this firm while the tests are conducted.

E. Provide means to ensure safety during the tests.

F. If a cable fails any of the required testing, remove all cables in the conduit between the nearest pulling points on each side of the failure. If, in the opinion of TAMUS, the other cables in the same conduit have not been damaged, they may be reinstalled, but the cable which failed shall be replaced with a new and unused cable. After the faulted cable and any other damaged cables have been replaced and installed, re-test all cables in the faulted section or circuit at the same voltage levels and durations as the original test.

G. During the period of warranty, any failure in medium voltage cable, terminations, or splices shall require immediate correction. In the event of a cable failure creating interruption in electrical service, furnish and install all labor and materials for temporary services to return the electrical system to service. Work shall begin immediately upon notification of a failure, regardless of time. TAMUS will not pay any costs associated with a cable failure.

Testing Firm Responsibilities

Perform full test report on all cables and terminations (non-destructive). Compare results to factory test reports, reject any cable not within margins set forth by the manufacturer. When factory does not provide test reports, or when required, preform a “proof test” (High-Voltage Withstand Test – Destructive). Use the appropriate voltage and durations in accordance with IEEE 576-2000 and the cable manufacturer’s recommendations.

LOW VOLTAGE SERVICE AND DISTRIBUTION

Convert existing facilities with ungrounded service systems to solidly grounded service systems during major renovations or service equipment replacements.

Note: The service point, as defined in the NEC, is at the secondary terminals for the utility transformer for projects served by TAMU Utilities and Energy Services.

Building Service

Electrical service shall be design in a manner such that the “Conductors Considered Outside the Building” (NEC 230.6) run to the service equipment disconnect. The service equipment disconnect shall be a 100%-rated, single, main circuit breaker integral to the service equipment.

Do not splice service conductors between normal and emergency/standby power supplies (e.g. utility transformers and generators) and the service or power transfer equipment.

All facilities require a main electrical meter. Refer to the online TAMU UES Design Standards for additional metering requirements.

A. Contact TAMU UES for meter selection specific to each project or installation.

B. Provide an Ethernet data port at the main meter location for connection to the UES power metering LAN.

C. TAMU UES’ “WAGES” panel shall be furnished and installed by the electrical contractor under Division 26.

Low Voltage Surge Protection

Provide permanently installed surge protection for electrical power systems, control circuits, communications systems (including but not limited to CATV, alarm, and data circuits), and antenna systems entering and exiting all buildings and other structures, including buildings and structures that may not have lightning protection on the roof.

Specify UL 1449 4th edition, permanently connected, hard-wired type surge protective devices (SPDs) for low-voltage service and distribution equipment, IEEE 1100, NFPA 780, NEC 285, and NEC 700.8 Show all SPDs on the one-line diagram down to the branch-circuit panelboards.

A. Provide surge protection for all low voltage building services; connect a Type 1 or Type 2 SPD to the main bus of the service equipment on the load side of the main breaker.
B. Install SPDs outside the enclosures of panelboards and switchboards; however, SPDs may be installed in separate compartments of a switchgear assembly (UL 1558) if supplied by a dedicated circuit breaker.
C. Specify visual indication that the unit has malfunctioned or requires replacement. Provide Form C dry contacts in the SPD and extend wiring to the building automation system for remote monitoring.
D. Specify not less than a 5-year warranty and include unlimited free replacements of the unit if destroyed by lightning or other transients during the warranty period.

Low Voltage Switchgear

Design metal-enclosed low-voltage power circuit breaker switchgear per IEEE C37.20.1, NEMA SG-5, and UL 1558.

A. Specify electrically operated, individually mounted draw-out type circuit breakers.
B. The switchgear and circuit breakers shall be the product of the same manufacturer.
C. All breakers shall have a remote trip and close either with a permanently mounted control panel or by umbilical.

Low Voltage Switchboards

Design switchboards in accordance with NEMA PB2 and UL 891.

A. Specify switchboard assemblies to be front- and rear-aligned.
B. Devices shall be completely isolated between sections by vertical steel barriers.
C. Do not use Switchboards rated above 3000 amps.
D. Main breaker shall have a remote trip and close either with a permanently mounted control panel or by umbilical.

Low Voltage Panelboards

Design panelboards in accordance with NEMA PB1 and UL 67.

A. Panelboard enclosures shall be wall-mount type.

B. Specify Type 304 or 316 stainless steel covers for panelboards located in open kitchens, cooking areas, and wash-down areas.

C. Specify panelboards with bolt-on breakers; load center-style panelboards and plug-in type breakers are not permitted.

D. Do not use panel boards for service entrance equipment unless service is rated for less than 800A.

E. If ground-fault protection is required for the service disconnecting means on 480/277V services, provide an additional step of ground-fault protection in the next level of feeders.

F. Do not use series-combination-rated circuit breakers, tandem circuit breakers, Stab-on breakers, and/or feed-through (“sub-feed”) breakers.

G. Breakers 400A and above shall be 100% continuous current rated, with electronic strip (shunt trip) and LSIG. Breakers shall also be identified on the one-line diagram.

H. Use common-trip type 2- and 3-pole breakers so that an overload or fault on one pole will trip all poles simultaneously; handle ties are not acceptable.

Low Voltage Motor Controllers & Motor Control Center

Use source transformer or generator performance curve as well as motor starting curve to determine if a reduced voltage starter, soft start or VFD is required.

A. Provide controllers having a UL 508 short-circuit withstand rating that exceeds the fault current available

B. Provide color-coded and labeled LED type indicator lights on the front of each magnetic controller.

C. Provide start-stop switch function on the front of each magnetic controller not connected to automatic controls. Arrange control circuit to include emergency stop functions, such as fire alarm interlocks.

D. Specify selector switches on motor controllers for the purposes of testing or manually controlling the equipment.

E. Use solid-state motor starter overloads.

F. Except for packaged equipment with integral controllers, do not locate motor controllers above ceilings.

Low Voltage Dry-Type Distribution Transformers

Specify low-voltage transformers to comply with the efficiency requirements of 10 CFR 431.196 (DOE 2016). For additional sizing and ratings see IEEE C57.96 IEEE 1100, IEEE 519, IEEE C57.110, and UL 1561.

A. Limit the capacity rating of each low-voltage transformer to 112.5 kVA or less.

B. Do not use step-up, auto transformers or field-installed “buck-boost” transformers.

C. Do not locate 3-phase dry-type transformers supplying building loads outdoors.

D. Design the installation such that transformer vibrations are not transmitted to the surrounding structure or where sound level is not increased by sound reflection. Use flexible couplings and conduit to minimize transmission through the connection points.

E. Bond the transformer secondary neutral (X_0) directly to the grounding electrode by means of a listed bonding kit.

Low Voltage Variable Frequency Drives

Variable-frequency drives (VFDs) shall Comply with IEEE 519, IEEE C37.96, and NEMA ICS 7.0 in the selection of VFDs. In addition to this section, refer to UFC 3-520-01, Appendix B "Adjustable Speed Drives" for additional design guidance on the use of VFDs. For Specific application see the NIH Design Requirements Manual. VFDs shall meet the following requirements:

A. Contactor bypass option, or spare VFD per size on project.

B. Overcurrent protection.

C. BACnet communications capability for interface with building automation system.

D. Shaft grounding rings (SGRs) or common-mode filters to eliminate high frequency damage to motor bearings.

E. Minimum 6-pulse width modulation (PWM) design.

F. Provide VFD-rated cable between the VFD and the motor supplied.

G. Where a disconnect switch exists between VFD and Motor, provide an interlock scheme to prevent damage to VFD.

Low Voltage Receptacles and Wiring Devices

Determine final receptacle types, ratings, NEMA configuration, and quantities as per user and code requirements.

A. Do not connect more than 5 single duplex receptacles (or equivalent) per 20A breaker.

B. Specify emergency-powered receptacles with red colored faceplates engraved with 0.25-inch white letters to read "EMERGENCY."

C. Specify metallic weatherproof covers for receptacles located outdoors.

D. If required, provide 120V, 20A isolated ground receptacle outlets for electronic equipment.

E. All devices shall be specification-grade and rated at 20A minimum.

F. Specify stainless steel device plates in laboratory spaces; nonmetallic plates, if used, shall be nylon. Coordinate style selections with architect.

G. Group power and communications outlets and light switches in a symmetrical fashion.

H. Show all wiring devices on the design drawings and any changes on the as-built drawings.

I. Do not place outlet boxes back-to-back; provide at least 12 inches of separation between outlet boxes located on opposite sides on common walls.

J. Avoid placing receptacles and lights under windows.

Low Voltage Power Conductors

Calculate the ampacity of low voltage power conductors installed in parallel underground ducts within the same trench or concrete envelope in accordance with NEC 310.15, IEEE 835, IEEE 399, or approved software.

Use IEEE 241 and ANSI 90.1 for Voltage drop calculation and standards.

Identify all power wiring system conductors (phase, grounded (neutral), and grounding conductors) at each accessible location using color-coding that is consistent throughout the building. Refer to table below for standard color-coding of wiring according to system operating voltage level and number of phases.

COLOR CODE FOR LOW-VOLTAGE POWER CONDUCTORS

CONDUCTOR	240 / 120V	208 / 120V	480 / 277V
PHASE A	BLACK	BLACK	BROWN
PHASE B	RED	RED	PURPLE
PHASE C	N/A	BLUE	YELLOW
NEUTRAL	WHITE	WHITE	GRAY
EQUIPMENT GROUND	GREEN	GREEN	GREEN
ISOLATED GROUND	N/A	GREEN /YELLOW	N/A
SWITCHED LEG	PINK	PINK	PINK
HIGH LEG (prohibited for new insulation)	N/A	ORANGE	N/A

Low Voltage Building Wire and Cable

All conductors shall be soft-drawn annealed copper class B, C, or D stranded. Specify as follows:

A. General power and lighting: Minimum size #12 AWG; solid conductors for #12 AWG and #10 AWG and stranded conductors for #8 AWG and larger.

B. Stranded conductors for connections to motors, generators, and other vibrating equipment (all sizes).

C. Control (field-installed): Minimum size #14 AWG; stranded conductors all sizes.

Specify 600V Type XHHW-2 insulated copper conductors where installed outdoors above and below grade.

Install building wire and cable as follows:

A. Do not install building wiring, equipment, and devices that are listed for dry/indoor locations only until the building is dried in.

B. Do not use multiwire branch circuits. Provide a dedicated grounded (neutral) conductor for each branch circuit that requires a neutral.

C. Do not direct bury conductors; install all underground conductors in conduits.

D. Metal-Clad Cable or MC Cable is allowed as follows:

1. Do not use in hard ceilings.
2. Do not use in visible locations.

3. Do not use in mechanical rooms, electrical rooms, laboratories or other major equipment rooms.
4. May be used as lighting whips of no more than 6’ in length.
5. May be used as the final run between a junction box and either a receptacle or switch that is no more than 25’ in length.
6. Do not zig-zag cable through walls.
7. MC Cable must be installed to a minimum of NECA standards, additionally must be installed in straight runs with definite bends only and must be well secured. Well secured shall be defined as no more than 1” deflection for straight runs and 3” of defection for bends at 3 lbs of force.

E. For power limited circuits and/ or control wiring, all routes that move through an area that would impede the re-feeding of circuit shall be in a raceway. Example of impediments: insulated wall and chase with other conduits/ piping / ducts.

Low Voltage Raceway Systems

Specify raceway systems to contain low-voltage service, feeder, and premises branch-circuit wiring systems. Maintain minimum separations between power levels as described in IEEE 518.

Raceways, boxes and fittings used under raised floors (e.g., computer rooms, server rooms) must have low flame spread, low smoke, and zero halogen characteristics determined in accordance with ASTM E 162, ASTM E 662, or Bombardier SMP-800C, *Toxic Gas Generation*.

Unless otherwise specified, do not apply spray-on or other types of insulating material on the outside of conduits and other raceways installed above ceilings.

Raceway and fitting requirements:

A. Do not specify nonmetallic conduit or tubing above grade in indoor or outdoor locations except for grounding electrode conductors where permitted by NEC. (Exception permitted for crawl spaces.)
B. Do not exceed 270° between pull points.
C. Use Minimum 3/4” conduit for electrical power, unless unique device only allows for small entry.
D. Use Minimum 1/2” Conduit for power limited circuits and/ or control wiring.
E. Use IMC or RMC where subject to major physical damage, such as that done by a vehicle.
F. Where floor boxes are used on the first floor, specify corrosion-resistant cast-in-place type.
G. Seal entries into floor boxes and “poke-through” fittings installed over unconditioned spaces by a means approved by TAMUS.
H. Install a nylon pull rope with not less than 200 pounds tensile strength in all empty conduit runs.
I. Connections to luminaires (fixture whips): 1/2-inch flexible metal conduit may be used in 6-foot maximum lengths for tap conductors to luminaires above accessible suspended ceilings.

J. Only use ARC, RTRC, corrosive resistant RMC, or corrosive resistant IMC in cooling towers, or in other corrosive environments

   1. Where polyvinyl chloride (PVC) coating is used for supplementary protection, it shall consist of a minimum of 20 mils thick, 2-inch wide field-applied PVC tape wrap, or 40 mils thick factory-applied PVC coating.

K. Do not mix PVC schedule 40 and 80.

L. Use FMC or LFMC for connections to vibrating or moving equipment such as motors and transformers. Minimum length shall be 18 inches, maximum length 72 inches.

M. Do not use set-screw fittings.

N. All conduits shall be marked by color code at minimum before each box and before and after any poke-through. Mark shall be minimum 3/8-inch band that completely wraps conduit.

Electrical Boxes

Use all ANSI and NEMA standards for electrical boxes. Additional requirements:

A. Masonry Boxes shall be galvanized.

B. Boxes larger than 4”x4” located outdoors and below grade shall be rated NEMA 4 at minimum.

C. All junction and pull box covers shall be labeled.

D. Label shall include all circuits contained within box as well as panel and circuit number.

E. Boxes and box covers shall be painted to match color code in table below, unless excluded for aesthetic purposes.

COLOR CODE FOR BOXES

SYSTEM	CONDUIT BAND COLOR	BOX COVER	
		IDENTIFICATION	COLOR
FIRE ALARM	RED	FA	RED
EMERGENCY POWER (ALL VOLTAGES)	WHITE	EM / PANEL ID / CKT. NO.	WHITE
208/120V NORMAL POWER	BLUE	PANEL ID / CKT. NO.	BLUE
480/277V NORMAL POWER	YELLOW	PANEL ID / CKT. NO.	YELLOW
DATA, TELECOM, FIBER OPTIC, A/V	ORANGE	DATA, TELE, FIBER OPTIC, AV	ORANGE
HVAC CONTROLS	GREEN	HVAC	GREEN
SECURITY	PURPLE	SEC	PURPLE

INTERIOR AND EXTERIOR LIGHTING

TAMU UES Design Standards apply to general interior and exterior lighting and associated controls for projects on the RELLIS Campus. Current UES Guidelines can be accessed here:

https://facilities.tamu.edu/departments/utilities-energy-services/design-standards.html

Specific TAMU UES design standards applicable to lighting include:

- Exterior Lighting and Installation
- Lighting – Interior
- Lighting – Lighting Controls

UES design standards shall be used as a general reference only. Additional RELLIS specific requirements are indicated below.

Controls for Interior Lighting

Interior lighting controls shall be designed for the highest level of simplicity while still meeting code requirements. Complex and sophisticated networked lighting control panels should be avoided. Campus preference for most typical spaces is stand-alone room controllers with simple wall switch(es) and occupancy sensors.

Wireless and/or battery-operated switches are not permitted for any type of interior lighting control.

Prior to substantial completion for every project, the Contractor and/or their Electrical Subcontractor shall provide an additional final setting/readjustment of time-out settings for all interior lighting occupancy sensors.

Exterior Building Lighting

Outdoor lighting shall comply with “dark skies” requirements published by the State of Texas in its Health and Safety Code, Chapter 425, Regulation of Certain Outdoor Lighting. The International Dark Sky Association "Lighting Code Handbook" provides useful design guidance.

Design building-mounted safety and security lighting for exterior doors, stairways, loading docks, and mechanical equipment yards, plus parking lots and pedestrian walkways located adjacent to the building.

Roadway and Site Lighting

TAMU UES Design Standards apply to all roadway and site lighting on the RELLIS Campus. Refer to guidelines referenced above for additional information.

BACKUP AND ALTERNATIVE POWER

The RELLIS Campus has entered into an On Demand Electrical Reliability Services Agreement with Enchanted Rock Electric to provide Utility Grade Backup Power (UGBP) to the entirety of the campus via a natural gas generation farm located adjacent to the campus central utility plant (CUP). This system provides 100% availability (up to limits specified in the agreement) of the campus distribution network downstream of the medium voltage switchgear at the CUP in the event of a BTU outage upstream of the incoming campus utility feed.

Note that this generation farm does not protect against outages internal to the campus distribution system including weather related failures of aerial lines inside the campus or other faults

downstream of the medium voltage switchgear at the CUP. Projects and/or facilities with critical emergency or standby power requirements are still encouraged to plan for on-site backup systems where appropriate.

Energy sources that may be used to supply backup power to TAMUS building and facility loads if the primary (utility or normal) power source fails include on-site engine-generator systems (EGSs), central battery systems, and uninterruptible power supply systems.

Identify all loads connected to backup power sources (generators, battery systems, UPSs, etc.) in the load analysis summary including NEC power class associated with each load type (Emergency, legally required standby, optional standby, COPS, etc.). The terms “emergency system,” “legally required standby system,” and “optional standby system” used in this section are the same as the terms defined in NEC 700, 701, and 702, respectively.

Multiple methods exist to supply emergency power supply systems (EPSS) to any facility. Use LCCA to identify the most cost-effective option; include all maintenance costs in the analysis.

Other than an EGS, locate all other emergency power systems in a fire rated Emergency Electrical Room.

Engine-Generator System

Size the EGS to supply all the connected loads simultaneously, starting connected motor loads, and providing not less than 20 percent future load growth.

A. If the EGS will be an alternate supply to variable frequency drives or similar harmonic-generating loads exceeding 25 percent of the EGS nameplate rating, assure that the non-linear loads can operate successfully when powered by the EGS.
B. If the EGS will be an alternate supply to elevator loads exceeding 25 percent of the EGS nameplate rating, ensure that elevator controller has provisions to absorb regenerative power. Coordinate EGS selection and provisions with elevator and EGS manufacturers.

Coordinate the EGS electrical design with the mechanical and architectural design. Diesel EGSs shall be located outdoors and on grade, preferably within the same service yard as the utility (normal supply) transformer, with a fire barrier separating the EGS from the transformer as described under “Outdoor Equipment”. Allow adequate clearances for operations and maintenance.

EGSs may be designed to operate in parallel with the local utility.

Refer to UES Design Standards for current specifications and other requirements for diesel EGSs, load banks, and automatic transfer switches.

Specify that all malfunctions of EGS be transmitted to the building automation system (BAS). Provide a contact for the EGS output breaker to be connected to the BAS, indicating output breaker position, to allow annunciation of the open position on the BAS.

Legally Required Stand by Systems

Specify a minimum Class 24 emergency power supply system (EPSS) to supply building loads, where 24 is the minimum time in hours for which the EPSS is designed to operate at its rated load without being refueled (see NFPA 110, Chapter 4).

Specify a Type 10 EPSS, where 10 is the maximum time in seconds that the EPSS will permit the load terminals of the transfer switch to be less than 90 percent of the rated voltage (see NFPA 110, Chapter 4).

Optional Standby System

For facilities that have an NEC classified Optional Standby System; specify transfer of power from normal to on-site generated power in no less than 60 seconds of normal power failure. Note: Unless disallowed by code, the same transfer scheme may be used to supply both legally required and optional standby loads.

Automatic Transfer Switches

Refer to UES Design Standards for requirements related to Automatic Transfer Switches (ATSs).

Central Battery System

Design, install, and test the Central Battery Systems (CBSs) in accordance with IEEE 446, NFPA 70, NFPA 101, NFPA 111, and UL 924. CBSs shall:

A. Comply with the requirements for Level 1, Type 10 stored energy.
B. Be designed for a minimum time of 90 minutes.
C. Use batteries with a minimum 20-year design life.
D. Be sized with proper de-rating based on ambient temperature, altitude, and design life.
E. Include an external bypass maintenance switch, to connect load directly to normal power.
F. Be designed not to have any exposed live parts.
G. Be designed with a safe means of testing and maintenance, per NFPA 111.
H. Shall self-execute all NFPA required maintenance tests and issue report both as an email as a downloadable file, with 4 year of internal memory.

Uninterruptible Power Supply Systems (Non-EPSS)

Evaluate requirements for Uninterruptible Power Supply (UPS) systems on a case-by-case basis. If a UPS is required, it may or may not require generator backup. Provide sufficient battery capacity to accomplish an orderly shutdown of UPS loads when generator backup is unnecessary.

If the nature, magnitude, and locations of critical loads to be supplied by the UPS are not identified in the POR, the A/E shall determine these requirements during the Design Development phase of the project.

Design, install, and test UPS systems in accordance with IEEE 446, IEEE 493, IEEE 944, IEEE 1100, NFPA 70, NFPA 111, NEMA PE 1, and UL 1778.

Additional design requirements:

A. If required by NFPA, equipment shall self-execute all NFPA required maintenance test and issue report both as an email as a downloadable file, with 4 years of internal memory.

B. Determine UPS type by listed requirements as well as a LCCA based on a 20-year life.

C. Include initial cost in both hardware and floor space and maintenance cost for both unit maintenance and conditioned space requirements.

D. Do not supply AC motors from a static type UPS system; specify a rotary or flywheel type UPS or use DC motors supplied directly from static source.

E. If UPS connects to an EGS as a load, limit UPS recharge while on Emergency power.

F. If UPS is backed up by an EGS to provide for continuous operation, specify the EGS to supply all necessary auxiliary UPS equipment, i.e., the lighting, ventilation, and air-conditioning.

G. Size the UPS system with spare capacity of at least 25% (amp-hour) in stored energy and 10% in supplied power (kVA).

H. Specify a redundant UPS module depending on the criticality of the supplied loads.

I. Provide both a local and a remote system status and alarm panel, with both audio and visual status/alarms. Specify that all alarms be transmitted to the building automation system (BAS). Include status /alarms, as a minimum:

    1. System on
    2. System bypassed
    3. System fault
    4. Out-of-phase utility/line fault
    5. Closed generator output breaker
    6. Audible alarm and alarm silencer button

Locate UPS systems as follows:

A. UPSs used as part of EPSS may be located in the Emergency Electrical Room.

B. For UPS systems over 100 kVA and of a battery type, provide rack-mount batteries in a dedicated battery room in accordance with applicable codes.

C. For UPS systems rated over 15 kVA and of a battery type, batteries shall be separate from charger and inverter.

D. UPS room shall:

    1. Isolate noise of UPS.
    2. Will be an unoccupied space for UPS systems louder than 60dBA.
    3. Maintain a temperature of based on manufacturer specification at all times.
    4. Be provided with a minimum 30% efficiency air filtration.
    5. Include necessary fire and personnel safety equipment.
    6. Include an area for all spare parts and maintenance equipment.

UNDERGROUND RACEWAYS

Underground raceways shall be either reinforced concrete duct bank (RCDB) or direct buried conduit; difference shall be determined by use. Concrete encasement shall be required if any of the following conditions are met:

A. Conduit's intended use either now or in the future is for 1000V or greater.

B. Conduit's intended use either now or in the future is part of a 1000V or greater system. (i.e. 2" conduits added to campus distribution duct bank for power or communications)

C. Conduit is greater than 3" trade size, this includes communication conduits. (3" and larger will be concrete encased)

D. Conduit is Part of The RELLIS Campus Communications Infrastructure, now or in the future. This is before the point of demarcation. See Division 27 Guidelines for additional details.

E. The Owner requests concrete encasement.

Direct buried conduits are allowed for all conduits not falling in to one of these categories.

Coordinate the placement of proposed underground duct banks and manholes with RELLIS Administration.

General Requirements for Underground Raceways

A. Install warning tape above all underground raceways for low-voltage conductors as described in "Underground Warning Tape"

B. Specify a metallic tape or material containing a metallic strip integral to the tape so that it is detectable from above the ground surface.

C. Tape color shall be bright red and be marked in black letters "CAUTION: BURIED ELECTRIC LINE BELOW."

D. In grassy areas, place tape approximately 12 inches below finished grade; in areas where duct bank will be below concrete or stabilization material, coordinate tape placement with civil engineer.

E. Extend warning tape continuously for the full length of the run.

F. Maintain minimum separations between power levels as described in IEEE 518.

G. Do not combine MV and LV duct banks. Electrical and telecommunications may share common duct bank but not pull boxes or manholes.

H. Maintain 36 inches separation between electrical and other services/utilities for parallel routes and 12 inches separation at vertical crossings.

I. Maintain minimum of 3 inches between conduits.

J. Specify bending radius equal to or greater than the minimum bending radius of the conductors.

K. Where RGS conduits are used underground specify polyvinyl chloride (PVC) coating for supplementary protection, with a minimum of 20 mils thick, 2-inch-wide field-applied PVC tape wrap, or 40 mils thick factory-applied PVC coating.

L. Install a nylon pull rope rated for the appropriate tensile strength in all spare conduits and conduits in which percent fill is less than 50%.

M. Include a minimum 33% spare capacity.

N. Show cross-section details on the drawings for each conduit configuration including section cuts referenced from plans; indicate spares.

O. Perform initial cable calculations in accordance with IEEE 576.

P. Specify long couplings.

Q. Specify that the contractor gives notice to TAMUS before cables are pulled so that the TAMUS inspector may observe the pull.

R. Do not assume free use of spare conduits.

Reinforced Concrete Duct Bank (RCDB)

Design RCDB to meet the requirements as follows:

A. For all duct banks that are utility in nature or contain conductor rated a 1000V and above, reference and comply with UES standard for electrical utility raceways.

B. Do not route MV or communications lines beneath building foundations expect for conduits that terminate inside building.

C. Minimum conduit size shall be 2” trade size.

D. Specify a minimum cover of 30 inches from grade to the top of the concrete duct bank.

E. Design duct bank and manhole systems to slope away from the building and toward manholes with sumps at a minimum of 4 inches per 100 feet (0.33%).

F. When multiple manholes are used (on same duct bank system), design system to slope to common manhole.

G. Where cables enter manholes, handholes, or underground pull boxes, fill the lower rows of ducts and leave the upper rows of ducts spare to facilitate future cable pulls.

H. Locate spare conduit stub-ups into equipment to facilitate future cable installation.

I. Specify minimum Schedule 40 polyvinyl chloride conduit (PVC).

J. Concrete shall have a minimum compressive strength of 2,500 psi at 28 days.

K. Specify steel rebar at each corner and rebar stirrups at sizes and intervals for the entire length of the duct bank. Provide reinforcement at the point where duct banks enter manhole or building walls. Reinforcement may consist of PVC-coated or tape-wrapped hot-dipped RGS conduits or 1/4-inch-thick wall fiberglass-reinforced (RTRC) conduits extending to a minimum of 10 feet from point of entry into duct bank.

L. Specify bell ends manufactured of heavy-wall fiberglass or Schedule 80 PVC at the points of penetration/termination.

M. Specify all bends over 30 degrees to be RTRC / IMC, or RGS.

N. Provide 6 inches concrete around the exterior of duct bank.

O. Specify factory-fabricated, interlocking, cast-in-place spacers designed to arrange, support, and fix conduits in concrete encasements, every 4 ft. Spacers shall interlock vertically and horizontally.

P. Specify bend radius of 48 inch.

Q. Arrange spare conduits to facilitate future cable installation where duct banks enter manholes, handholes, equipment enclosures, or other pulling spaces.

R. Install a continuous bare #2/0 AWG copper conductor centered within duct bank that runs the full length (to serve as Ufer-ground).

S. Low-Voltage duct banks may exclude steel reinforcement based on soil reports and civil engineer's approval.

T. Warning tape for telecommunications duct bank shall be bright orange and be marked "CAUTION: BURIED COMMUNICATIONS LINE BELOW."

Refer to Appendix below for RELLIS Campus standard RCDB details.

Duct Blockage Tests

Specify that the contractor perform a test for duct blockage or deformation for all duct banks after the concrete has cured for minimum 24 hours.

A. Use a flexible mandrel/scraper no smaller than 1/4 inch less than or 80% of the internal diameter of the duct to be tested, or other TAMUS-approved means.

B. Replace any duct section found blocked.

C. Notify TAMUS inspector not less than 14 working days before duct tests.

D. Submit written reports of tests to TAMUS inspector using Duct Blockage Test Form and foldout diagram of each manhole identifying each duct subject to test.

Direct-Buried Conduit

A. Specify Schedule 80 PVC conduits where installed outside the building perimeter.

B. Specify Schedule 40 PVC conduits where installed inside the building perimeter.

C. Do not mix Schedule sizes on the same route.

D. Specify minimum trade size 1-inch.

E. Bury conduits at a minimum depth of 24 inches.

F. Support conduit with spacers as described in the RCDB requirements above.

G. Encase all sides of the conduits in a minimum 3" sand bedding within the trench; use cement-stabilized sand where routed below pavement. Add backfill material above the sand bedding up to finished grade and compact per engineer-of-record.

H. Install a concrete cap, minimum thickness of 2 inches, above conduits where not under other concrete (or equal) surface.

Manholes and Vaults

Provide precast concrete manholes and vaults dedicated to the campus medium-voltage utility and distribution system. Include all standard hardware and accessories. Design manholes/vaults in accordance with IEEE C2 Rule 323.

A. Use 400 feet as standard spacing between manholes.
B. Arrange manholes so conduits enter on same relative height of manhole.
C. Conduits shall enter a minimum of 12 inches above manhole floor.
D. Provide with manhole as a minimum:
    1. Thin-wall knock-outs on every wall
    2. Hot-dip Galvanized ladder anchored to floor and wall.
    3. Ground rods and Ground ring (see TAMU UES standard)
    4. Sump pit with floor grate
    5. Sump pump (required for manholes designed to contain submersible switchgear)
    6. Non-corrosive/corrosion-resistant ladder-up safety post
    7. Heavy-duty fiberglass cable racks and arms
    8. Non-corrosive/corrosion-resistant pulling irons
E. All Vaults (for switches, transformers, and other gear) shall have:
    1. Minimum 8 inch thick walls, and minimum 18 inch depth basin.
    2. One 3/4 inch copper clad ground rod (two on main campus)
    3. Minimum 2/0 ground ring that wraps along the walls of the interior of vault.
    4. Opening should leave a minimum of 6 inches, from walls, around all theoretical conduits. Do not decrease 3 inch spacing of conduits.
F. Requirements for communications manholes and handholes are covered in Division 27 - Communications.

Refer to Appendix below for RELLIS Campus standard manhole details.

GROUNDING AND BONDING

Show bonding and grounding of medium-voltage and low-voltage equipment on one grounding system diagram prepared for each project.

Install grounding systems for medium-voltage systems and equipment in accordance with NEC 250 Part X, IEEE 142, IEEE C2, IEEE 81 and IEEE 1100.

Soil resistivity should be determined for each site as part of geotechnical report. Use a reliable measurement to determine the soil resistivity such as the four-electrode Wenner Method as described in ASTM G57-06. Perform calculations of grounding electrode resistance using the measured soil resistivity values and the methods outlined in IEEE 142.

Grounding and Bonding for Medium-Voltage Systems

Design the facility to have a single-point grounded-neutral systems. The A/E will need to evaluate the soil resistivity and potential fault levels at the campus location and make recommendations as to whether a solidly grounded-neutral or an impedance grounded-neutral system is more suitable. IEEE 142 provides guidelines in the selection of these types of grounding systems.

A. Bond the shields of medium-voltage cables to the equipment grounding means (lug or bus bar) inside each equipment enclosure where terminations, splices, and bonding connections are made.
B. For solidly grounded medium-voltage systems, install a #2 AWG minimum, 600V Type XHHW-2 equipment grounding conductor within the raceway (e.g., duct or conduit) with the circuit conductors and bond to equipment.
C. Provide a dedicated ground rod at each outdoor medium-voltage switchgear and transformer.

Grounding and Bonding for Low-Voltage Systems

The low-voltage portion of the grounding system will typically originate at the secondary side of the service (utility) transformer and extend to the neutral and equipment grounding buses in a branch-circuit panelboard. Grounding system shall have a ground resistance not to exceed 5 ohms for low voltage. Data Centers shall have a ground resistance not to exceed 1 ohm.

Design a main grounding electrode (MGE) as:

A. A “Ground Ring” completely around the perimeter of the building, 3 feet below grade and at a minimum distance of 3 feet outside the structure foundation.
B. Ground Ring should be sized based on ground study but as a minimum of 4/0.
C. Ground Ring should be bare copper.
D. Bond each perimeter structural steel column to the MGE ground ring. Specify an IEEE 837-compliant high-compression type connector listed for the purpose.
E. Specify all bonds below grade to be an exothermic weld.
F. Specify ground rods to be a minimum 3/4-inch diameter 10 ft long.
G. As a single point ground, specify a copper “Ground Bar: located in the Main Electrical Room adjacent to the service-entrance equipment.
H. Minimum dimensions: 1/4 inch by 2 inches, but with a cross-sectional area not less than 25% of the aggregated cross-sectional area of the connected feeders.
I. Specify pre-drilled and tapped NEMA 2-hole connections with minimum 25% spare.
J. Label each connection.
K. Mount on insulated supports.
L. Use a dedicated ground electrode to connect to “Ground Ring”.
M. Include a like ground bar in all other electrical rooms, connecting back to Main.
N. Main transformer shall have a minimum of one ground rod, and unless otherwise noted shall be a solidly bonded neutral. Use minimum 4/0 to bond to “Ground Ring”.

O. Use bonding Jumpers from all electrical switchgear, switchboard, and panelboards to system “Ground Bars”. Do not use factory-furnished bonding screws.

P. Bond and ground all separately derived systems to nearest “Ground Bar” or “Ground Ring”. Do not exceed system ground resistance requirements.

Isolated-Ground Systems (IG):

A. Derive each IG power system using a K-rated, dry-type transformer with electrostatic shielding between primary and secondary windings and supplied by a dedicated feeder.

B. Specify a 200%-rated neutral bus, and a 1005 rated Ground Bus.

C. Use bonding jumpers; do not use a factory-furnished bonding strap or bonding screws.

D. In addition to the equipment grounding conductor, install a dedicated full current rated 600V insulated (green/yellow) IG grounding conductor for each IG branch-circuit and feeder.

E. Show all IG conductors on wiring diagrams.

LIGHTNING PROTECTION SYSTEMS

Provide a lightning protection system (LPS), including surge protection as described below for every new building and structure. Exemptions will be considered only if the results of a Lightning Risk Assessment performed by the A/E in accordance with NFPA 780, Annex L indicate a low risk of damage or injury that is acceptable to TAMUS.

Design LPSs in accordance with NFPA 780, LPI-175, and UL 96A.

A. For building additions, extend the existing LPS to the addition structure if the addition is not within the zone of protection.

B. Specify UL 96A Class II materials for all LPSs regardless of structure height. Refer to NFPA 780, Table 4.1.1.1.2 for a list of Class II minimum material requirements.

C. Coordinate roof wall penetrations with other disciplines to ensure that the integrity of the facility envelope is not compromised.

D. A/E shall provide:

1. LPS Lightning Risk Assessment in accordance with NFPA 780, Annex L.
2. Performance specification.
3. Preliminary lightning protection roof plan including conductors, air terminals, and connections to roof-mounted mechanical equipment.
4. Building grounding plan (same plan as described in “Grounding and Bonding for Low-Voltage Systems” [3.12]) showing locations of MGE ground ring, down-conductors, ground rods, and ground test wells.
5. Typical connection details for air terminals, Ground Ring, ground rods, down conductors, parapet wall penetrations, and ground test wells.

E. Specify use of Building ground ring. Do not install 2 ground rings.

F. Terminate each LPS down-conductor at a dedicated ground rod and bond both the down-conductor and ground rod to the building MGE ground ring.

G. Bond all metallic objects such as pipes and conduits crossing the ground ring.

H. Provide ground test wells at accessible locations along the ground ring.

I. Install LPS conductors in Schedule 80 PVC conduit if routed inside the building or structure.

J. Consult building envelope designer on best means of entry.

K. New buildings or buildings whose master envelope is being altered shall be certified with minimum of either a Master C label from UL or Inspection Program Label from LPI upon installation of the system.

APPENDIX A

List of Contents

Figure 26A-1: Sample Arc-Flash Warning Label

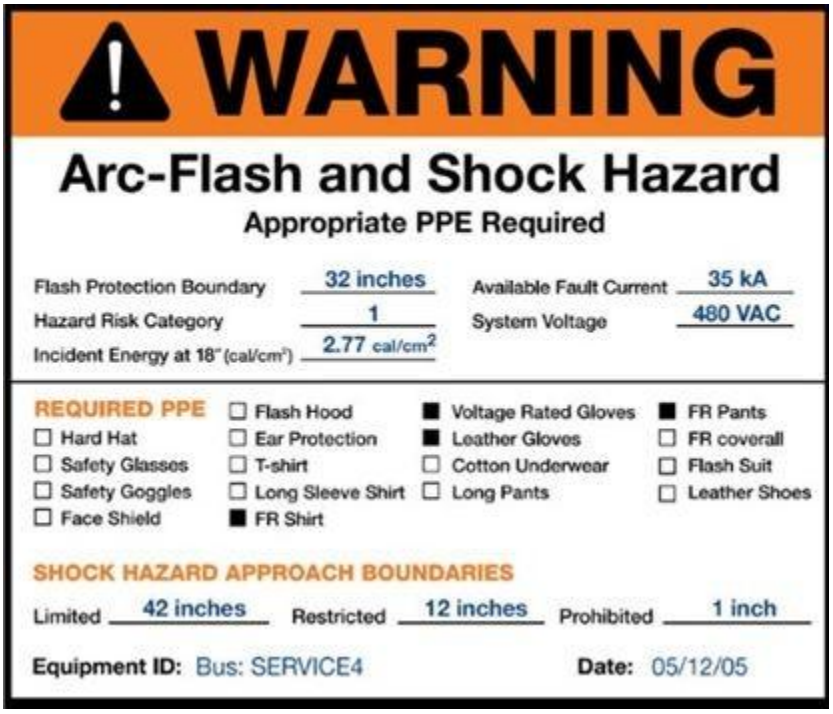
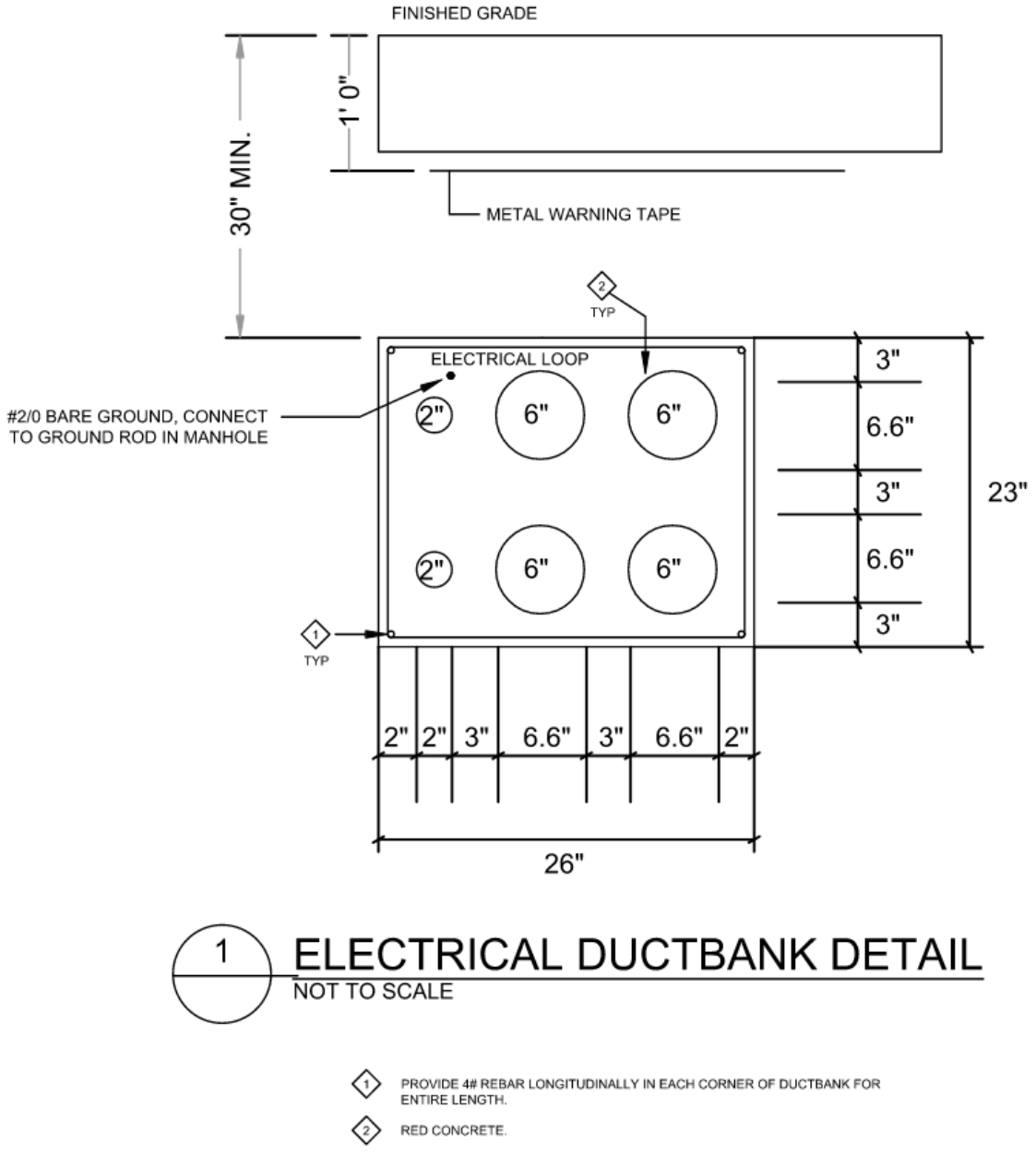
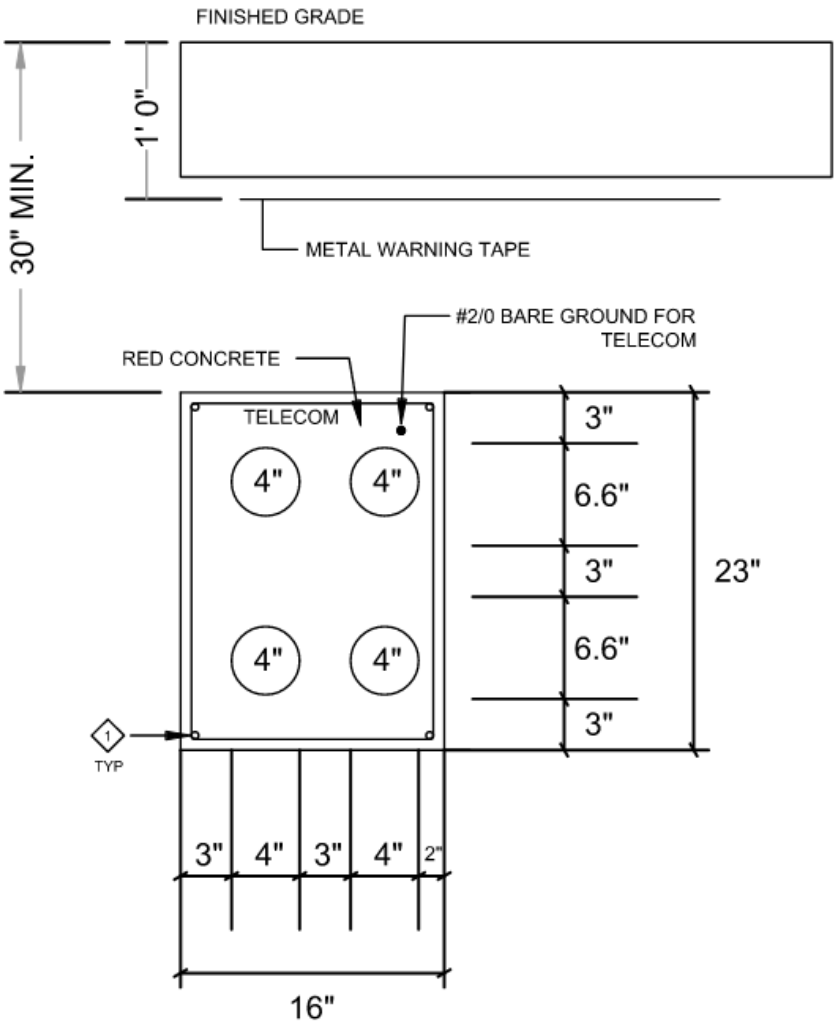


Figure 26A-4: RELLIS Campus Standard Duct Bank Details

Note: Details are for reference only and may vary based on specific project requirements.

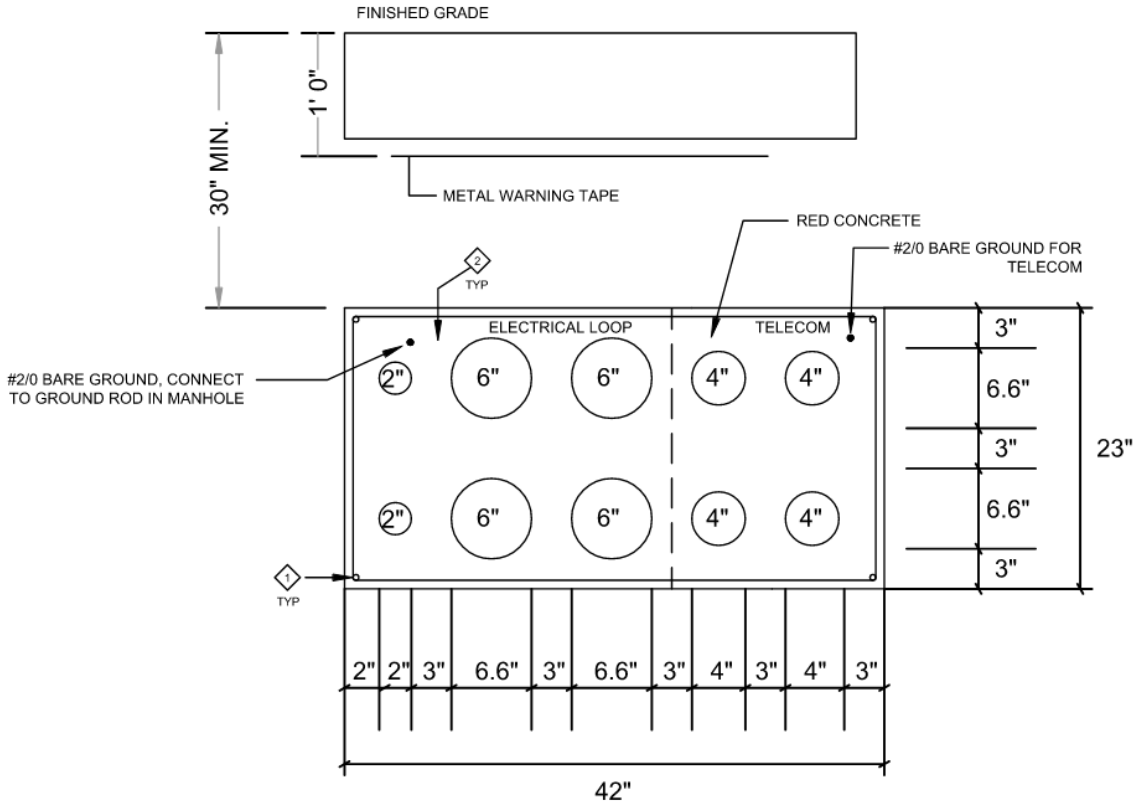




2 TELECOM DUCTBANK DETAIL

NOT TO SCALE

1. PROVIDE 4# REBAR LONGITUDINALLY IN EACH CORNER OF DUCTBANK FOR ENTIRE LENGTH.
2. RED CONCRETE.



3 ELECTRICAL/TELECOM DUCTBANK DETAIL
NOT TO SCALE

1. PROVIDE 4# REBAR LONGITUDINALLY IN EACH CORNER OF DUCTBANK FOR ENTIRE LENGTH.
2. RED CONCRETE.

DIVISION 27 - COMMUNICATIONS

GENERAL REQUIREMENTS

These guidelines shall be referred to during the design and construction of telecommunication systems for all RELLIS Campus buildings. These guidelines are minimum standards; the system member and/or user group for the building may specify additional requirements subject to review and approval by RELLIS IT.

In accordance with the TIA Engineering Manual and the American National Standards Institute (ANSI), two categories of criteria are specified: mandatory and advisory. The mandatory requirements are designated by the word “shall”; advisory requirements are designated with the words “should”, “may”, or “desirable”, when used.

All communications design drawings, details, and specifications must be reviewed by RELLIS IT for compliance with these guidelines prior to implementation.

A. All data contractor installation personnel must be BICSI Certified Installer Level I or higher. The onsite supervisor of the data contractor must be a BICSI Certified Technician for the term of the project construction period. The data contractor must have on staff a BICSI Certified RCDD who shall affix their stamp to shop drawings, submittals and as-built documentation. All certifications must be current. Proof of certification must be presented for supervisors and all installation personnel at or before the pre-installation meeting.

B. The A/E design team for all capital projects shall include a specialty consultant with specific expertise in the design of low voltage systems including data/telecom, audio/video, and/or physical security as applicable to the project scope. This design consultant shall be a certified BICSI RCDD with credentials and with extensive previous experience in higher education building design environments. The consultant should also provide support during the construction process to ensure all submittals, test procedures, and installations meet the requirements as specified for the project.

C. Warranty - It is the intent that the complete cabling system be installed to satisfy 20-year minimum warranty requirements of the cabling infrastructure manufacturers. Warranty documentation shall be provided at the time of substantial completion. Test results are required prior to turnover of Telecom Rooms (MDF/IDF) And must be submitted in electronic format to the RELLIS Campus CIO.

D. There shall be a pre-installation meeting with the general contractor, data contractor, FP&C Project Inspector, A/E technology consultant and RELLIS Networking representative to review the installation requirements and planned installation.

E. There shall be a pre-testing meeting with the general contractor, data contractor, FP&C Project Inspector, and RELLIS Networking representative to review the test requirements and plan for all fiber and copper installed.

F. Provide BICSI credentials for data contractor’s installation crew. Lead Technician shall hold at least BICSI Technician, remainder of crew shall hold a minimum BICSI Installer I certification.

COMMUNICATIONS GROUNDING AND BONDING

A. All conductor wire, busbars and conduit shall be UL listed.

B. The communications ground system shall be independent from all power grounding except for the connection to the building's electrical service main grounding electrode system.

C. Power grounding and/or bonding shall not be allowed to interfere or provide any back feed or be a conductor to the separate communications ground system source or to any communications bonded materials or equipment.

D. Primary Bonding Busbar (PBB) and Telecommunications Bonding Conductor (TBC):

1. The main ground source feed for the PBB in the equipment room (MDF) shall be an independent feed from the building's electrical service main grounding electrode system (TBC).

2. The TBC shall be stranded copper ground wire from the building ground system to the PBB in the MDF sized at a minimum #4/0 unless otherwise sized by the Electrical Engineer of Record.

3. The TBC connections shall be low emission exothermic welds at the connecting ends.

4. All grounding busbars must be pure copper, **not** copper plated.

E. Telecommunication Bonding Backbone (TBB) and Secondary Bonding Busbar (SBB):

1. The TBB originates at the PBB and shall be extended from the PBB within the MDF throughout the building along the same route as the telecommunications backbone pathways, to the SBBs in each IDF.

2. The minimum TBB conductor size between busbars shall be stranded copper ground wire one (1) AWG size smaller than the TBC.

F. Backbone Bonding Conductor (BBC): Whenever two or more TBBs are used in a multistory building, the TBBs shall be bonded together with a BBC (by low emission exothermic welds) at the top floor and at a minimum of every third floor in between with a copper conductor equal to the gauge of the TBB.

G. Telecommunications Equipment Bonding Conductor (TEBC) and Rack Bonding Conductor (RBC): All cabinets and racks shall be connected by the TEBC. The TEBC is a stranded copper #4 conductor from the PBB/SBB extending along each row of racks within the room. Bond each rack with an RBC. The RBC is a stranded copper #6 conductor connected to the vertical rack bonding terminal. All connections shall be irreversible crimp connections. Route conductor to minimize the quantity of sweeping bends.

CAMPUS TELECOM INFRASTRUCTURE AND ENTRANCE INTO FACILITIES

Currently, the primary fiber circuit enters the campus from the south via Goodson Bend Road. The main Remote Switching Unit (RSU) building for campus is located near the campus water tower northeast of the intersection of Avenue A and 4th Street. A second RSU Building is located in the southern portion of campus near the intersection of Avenue D and 7th Street. The CMP anticipates additional fiber service being added to campus in the future in conjunction with completion of a new onsite data center.

The current campus fiber distribution system consists of some existing pole mounted aerial service and some new concrete encased underground duct bank. New telecommunications duct bank is run in parallel with the medium voltage electrical duct bank supplying power to campus buildings. Existing facilities, which are currently served overhead, will be converted to underground service as they are renovated, and as new telecommunications infrastructure is extended through the campus. New facilities are required to connect to and/or extend concrete encased underground telecommunications duct bank as required.

All customer-owned cabling shall utilize the underground pathway system identified in this document and referred to in ANSI/TIA. Entrance point diversity is highly desirable.

A. RELLIS Campus Communications Infrastructure (RCCI):

1. The RCCI is the portion of the RELLIS communication system that connects all RELLIS Facilities. The point at which the RCCI ends and the Facilities communication system begins shall be known as the Communications Demarcation Point. This Point will be the MDF except under the following conditions:

    a. Facilities that are classified as “Group U” of the International Building Code.
    b. Pre-manufactured buildings that are of a temporary nature.
    c. Special permission by RELLIS Campus Administration.

2. Communications Demarcation Points not located inside a building shall be brought into an approved above ground patch panel dedicated for this purpose. Exterior patch panel location shall be reviewed and approved by RELLIS IT.

3. The RCCI duct bank shall contain a minimum of four (4) 4-inch Schedule 40 PVC conduits.

4. The RCCI duct bank shall be encased in red concrete per related design guidelines in Division 26. The RCCI duct bank shall run parallel and adjacent to the medium voltage electrical duct bank where possible with separate manholes and handholes as indicated below.

5. The RCCI shall provide precast, concrete manholes and handholes for underground telecommunication outside the building which meet the following requirements:

    a. Minimum inside dimensions of manholes shall be 4-feet wide, 6-feet long, and 6-foot high for cable splicing purposes. Manholes shall be used for all portions of the primary RCCI duct bank.

b. Minimum inside dimensions of handholes shall be 3-feet wide, 5-feet long, and 3-feet high for pulling purposes. Handholes shall be used only for distribution within a localized project site or at the last box prior to cabling entry into the building.
c. Handholes shall be placed not to exceed cable manufacturer's pulling tension by a safety factor of two and shall limit horizontal and vertical bends to no more than 180-degree between pull points.

6. Where RCCI duct bank extends into a building, Conduits shall be in minimum 3 inches of concrete or 2-hour fire rated construction.

B. Building Primary Terminal Room Facilities (MDF):

1. The MDF shall be the first communications room where fiber enters the building and shall be sized in accordance with the standards noted in this document.

a. The room shall house fiber and copper service entrance equipment for telecommunications, data, and all required wide area network equipment. This may not include Distributed Antenna System (DAS) equipment; all DAS equipment will have a separate dedicated room and shall be coordinated with RELLIS IT.
b. A minimum of 12-strands of single mode fiber optic cable shall be installed from the MDF to the telecommunications manhole, tunnel or other service point designated by RELLIS IT. (Note: Final strand count shall be coordinated with RELLIS IT.)
c. In the event a diverse pathway is provided into the building there can be consideration to have a 12-strand single mode fiber optic cable installed through each pathway for a total of 24-strands. (primary path = 12-strands; secondary/diverse path = 12-strands).
d. Provide twelve (12) 4-pair Category 6A cables from the MDF to each IDF. These cables will provide backup in the event the fiber backbone is damaged, or the fiber network cards fail. Install this cabling only to IDF's within the 270' maximum distance from the MDF.

C. Additional Building Communication Connection Points:

1. Install a minimum of four (4) 4-inch conduits stubbed out of the building for future Smart Campus Initiatives. One conduit shall be stubbed out of the building in each cardinal direction and terminated into a handhole. Distance from building and final location to be coordinated with civil and landscape.

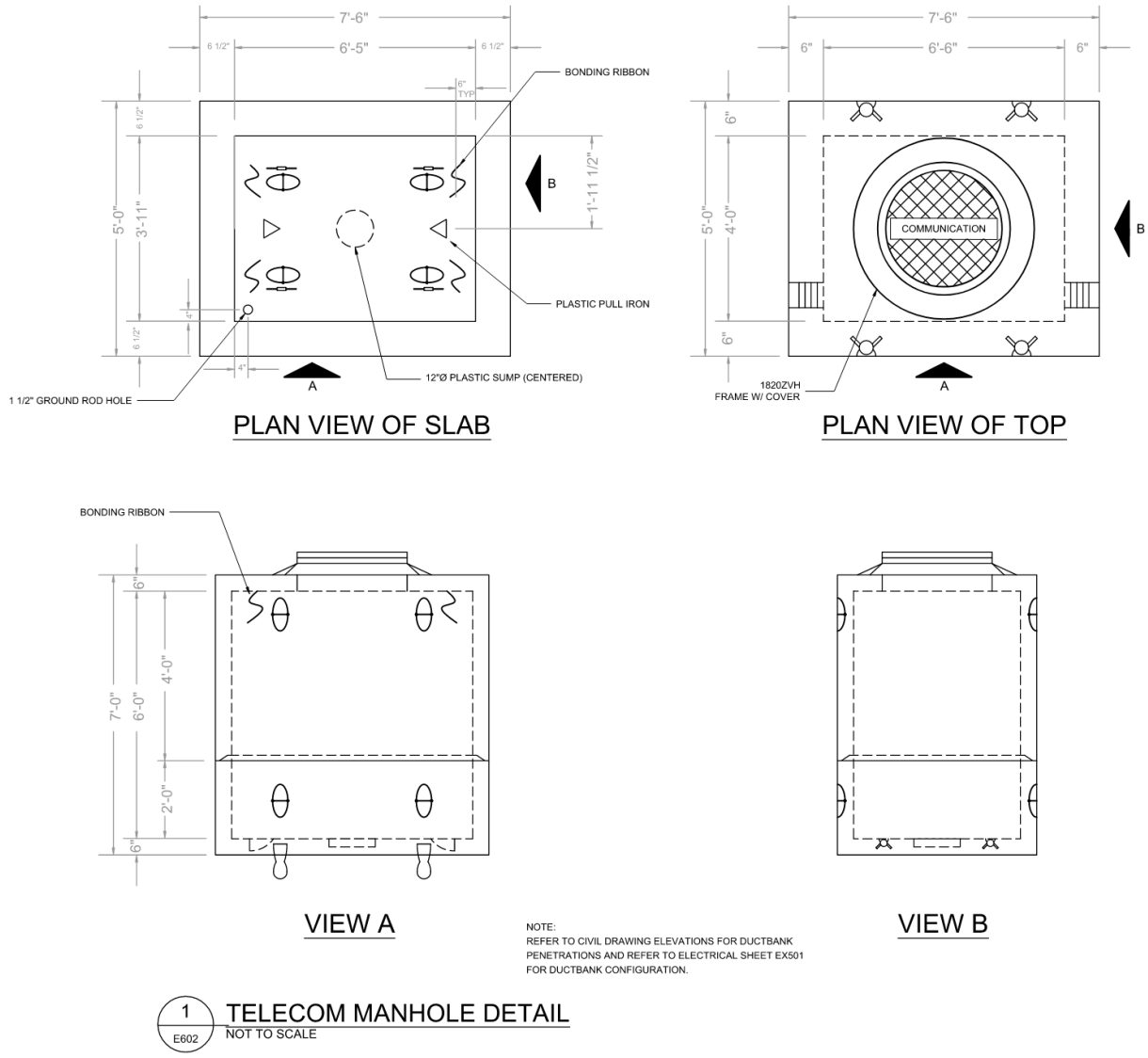
2. Provide two (2) 2-inch conduits from the MDF to a hand hole adjacent to the building and site parking lot. Provide a 2-inch conduit from the hand hole and extend in a path between parking lot light poles.

a. Provide a small (18"x18") hand hole at every other light pole and connect to the 2-inch conduit pathway.
b. Extend a 1-inch conduit from the hand hole into the light pole and up to minimum15-feet.
c. Provide knockout on pole to support wireless or surveillance cameras. Depending on the system deployed it may require 110-power.

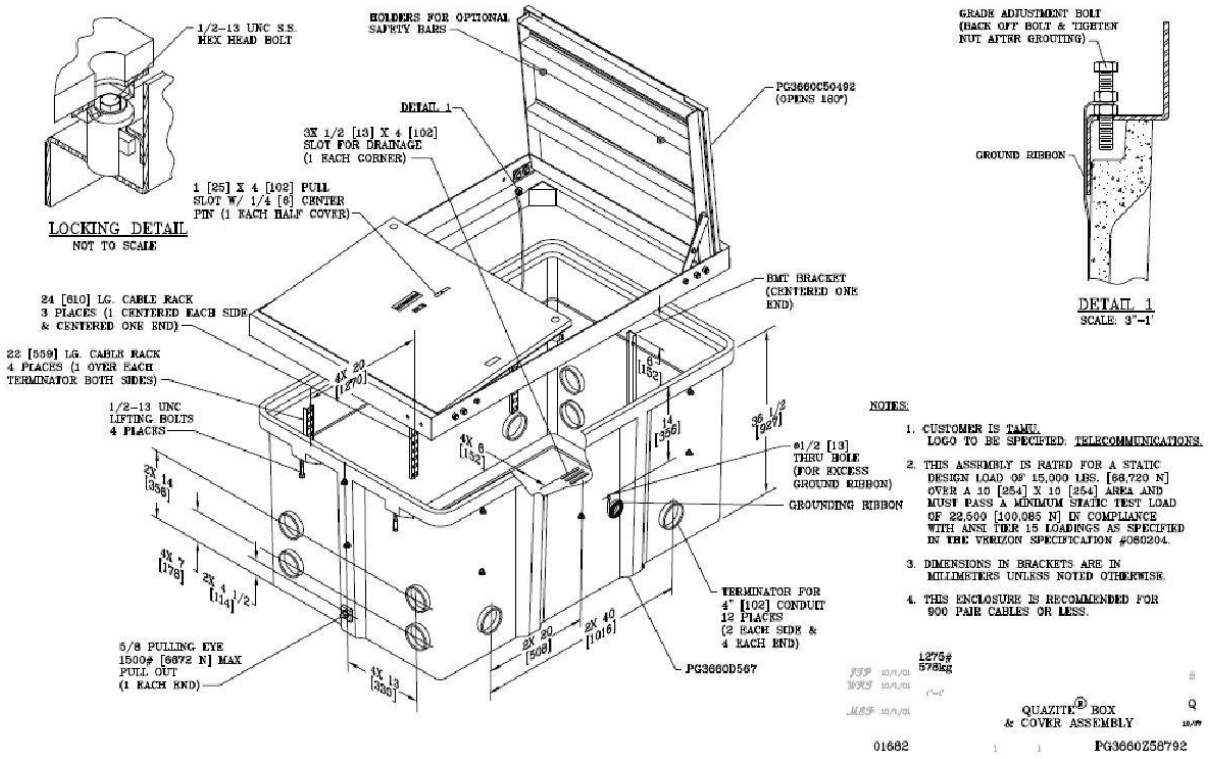
3. Conduits shall be installed to a minimum of six (6) locations for WiFi/Surveillance cameras to support vehicle activity. Location shall be determined and the quantity possibly adjusted during design with RELLIS IT and RELLIS Operations.

MANHOLES AND HANDHOLES

Precast manholes shall be manufactured by Oldcastle, Locke Solutions or equal approved by RELLIS IT.



Handholes shall be manufactured by Oldcastle, Locke Solutions or equal approved by RELLIS IT.



CABLE DISTRIBUTION FACILITIES

A. Overhead basket tray shall be provided from each telecom room as the distribution conveyance system for all station outlets being served. Provide a 1” EMT conduit (not to exceed 100 feet length) from accessible ceiling near the installed tray to each station outlet box. Utility/power poles, if used, shall be connected to the serving raceway in a similar manner. Cables shall lay loose in the trays installed above the ceiling, dressing of cables in basket tray is not required. Basket tray is for the exclusive use of the structured cabling system. Power cabling should not access the same tray. Consideration for security, audio visual and other low voltage cables shall be made, basket tray section dividers or the use of J-hooks attached to the exterior of the tray may be reviewed as options. Screened or shielded cables from other trades shall be considered on a case-by-case basis.

B. Trays shall be mounted 6" above accessible ceiling, have a minimum 6" clear above the tray, and have 3' of unencumbered space to the side of the tray for every 10' segment of tray.

C. J-hooks suspended by threaded rod shall be utilized to span distances between conduits and tray. Space J-hooks on 4’-5’ centers. J-hooks shall only be utilized where shown on the plans or when identified and approved through project submittals. Contractors shall verify the use of J-hooks as a method for cable support.

D. Install a pull cord in all empty conduits.

E. Maintain all clearances from electrical elements (lights, conduits, motors, generators, etc.).

F. In general, install cable runs in conduit (EMT) back to the cable tray. Leave approximately 18" of cable slack at the cable tray end of the conduit. Coil and secure the slack cable to the end of the conduit. Do not leave cable slack in the cable tray.

G. Tray shall be sized to accommodate the designed structured cabling system plus 25% growth.

COMMUNICATION ROOM STANDARDS

A. Communication rooms general information and guidelines:

1. The minimum Main Distribution Facility (MDF) room size shall be 12-foot by 14-foot. Size may increase based on building size and quantity of data ports being supported.

    a. Floor mounted racks and weight loads shall be reviewed for floor loading. The typical 7’x19” 2-post Communications Rack has a load capacity of 1000 lb. are required unless specified differently by Building Owner and approved by RELLIS Campus CIO.
    b. All flooring allocated for the installation of racks in the MDF and secondary IDF’s shall support a fully loaded 2-post or 4-post communication racks.

2. When required the room shall be divided for security purposes to establish two service areas in the same room. Mesh fence with a sliding locking gate/door will assist with maintaining usable floor space.

3. Intermediate Distribution Facility (IDF) minimum room size shall be 12-foot by 9-foot. Size may be increased based on the quantity of data ports being supported.

4. The quantity of communication rooms shall be based on usable square footage, quantity of floors and horizontal cable length.

5. MDF/IDF rooms must be keyed separately from the building master similar to a mechanical room and access to the keys will need RELLIS IT or building owner IT signoff. A dual-factor (pin and proximity) card reader shall be installed at each MDF; a proximity reader only will be installed at the entry of each IDF.

6. No means of water conveyance shall pass through IDF / MDF / Server rooms, except for one sprinkler head unless multiple are required per fire code. No main water lines or ductwork shall pass through the data rooms. Any water conveyance in these rooms must be approved by the RELLIS Campus CIO prior to construction.

7. **Important:** For turn over to RELLIS IT, all IDF and MDF rooms must be clean and dust free. These rooms must be as clean as any other room in the building to pass Final Completion.

8. Turnover of MDF/IDFs should be on the critical path of any construction project; these rooms should be turned over before substantial completion in proportion to the number of MDF/IDF rooms within the building. A good estimate for determining the turnover

date would be (Number of MDF/IDF rooms * 2 weeks) before substantial completion with a minimum of one month before substantial completion.

9. The following items are required to be achieved before RELLIS IT/Building Owner IT will populate these rooms for permanent switch installation:

    a. Room must be clean and interior environment dust free; Room shall be finished to the degree of any other room in the building upon take over.
    b. Floors shall be covered in antistatic tiles and grounded.
    c. Rooms must have permanent power, and boxes should be mounted at normal outlet height or in basket tray depending on building owner preference.
    d. A NEMA L6-30R receptacle shall be provided at the top of each rack in the room positioned so as not to interfere with door operation on the back side of the rack mounted at the basket tray.
    e. An additional NEMA L6-30R receptacle shall be provided in the same location as item d.) above at the rack housing the fiber enclosure.
    f. Include two (2) NEMA 5-20R convenience duplex receptacles on opposite sides of the room.
    g. A NEMA 5-20R receptacle shall be mounted at 4' AFF on the designated security wall field close to the location identified for access control equipment.
    h. The room shall have sufficient permanent lighting installed and functional with a minimum of 30 footcandles at floor level. Light fixtures shall be mounted parallel to the rack row, one on the front side and one on the back side of the row of racks. Lights must be on permanent power.
    i. All electrical outlets throughout the rooms shall be on dedicated circuits and connected to emergency generator power (if the project scope includes a backup generator).
    j. MDF/IDF/Server room air conditioning units shall be on permanent power; there must be a working thermostat in the room. If basket trays are mounted on the same wall as an A/C unit, tray shall be mounted 6" to 8" away from wall so cables will not be directly under the A/C unit.
    k. A/C equipment shall be sized to support a fully built out MDF or IDF. Heat loads to be estimated based on previous projects and customer anticipated equipment installation, plus the available space in the room to support future equipment. A/C system shall be expandable to support more increased future density of networking equipment.
    l. Rooms shall have permanent doors with TAMU RELLIS IT cores, **not** construction doors and locks.
    m. All MDF/IDFs will utilize basket tray, **not** ladder tray for routing of cable.

H. Communication rooms shall comply with the following requirements:

1. Comply with Telecom Industry Association (TIA) Building Wiring Standards.

2. There shall be a minimum of one communications room per floor. Provide additional rooms as needed to support the maximum cable distance of 270 feet.

3. MDF and IDF rooms should be designed to accommodate a minimum of 50% increase in rack space beyond the final building requirements.

4. MDF/IDF rooms shall be lined with ¾" AC plywood with the smooth side facing out. Plywood must be marine grade and have 2 coats of fire-retardant paint on both sides and all edges. **Do not cover fire-rated stamps with paint**. The plywood shall be 8' tall and start at outlet height of 12" AFF.

5. Floors shall be covered in anti-static tile and bonded to the communications grounding system.

6. Firestop in high density wiring locations shall utilize a mechanical firestop system equal to Specified Technologies, Inc. - EZ Path.

7. All electrical circuits serving communications racks shall be mounted at the basket tray level, typically at 6" above floor mounted racks. All thread support of basket tray shall be spaced no more than 4' to 5' on center.

8. Provide the ground bus required by TIA/EIA-607.

9. Provide 19" 2-post racks (PREFERRED). Rack height shall be 7', 8', or 9' as appropriate to serve the building and available space in the Telecom Room.

10. Typical Rack arrangement per Telecom Room:

    a. Rack #1 - Closest to the wall - Fiber panel
    b. Rack #2 - Data Patch Panels
    c. Rack #3 - Network Switches and UPS
    d. Rack #4 - Spare (if required)

11. Vertical management shall be double sided with doors, (not snap on panels) in appropriate lengths to match cable racks; either 7', 8', or 9' in height. 10" wide vertical cable managers shall be placed between racks and 6" wide managers shall be placed at the ends of the rack row.

12. Horizontal management shall be 2U one sided with doors; there shall be 1 manager provided for every patch panel installed (minimum of 3 managers).

13. All telecom room walls must be stacked exactly with the telecom room located on the floor above and below it.

14. Telecom rooms shall not serve outlets on other floors except as necessary for in-floor outlets that are not practical to run to the same floor telecom room. No open through-hole penetrations are allowed to be made from conditioned space to unconditioned space (Example: outlets in the floor or in the wall where the cable drops down from a conduit stub into a cable tray in a basement crawl space.

15. Cabling Contractor shall provide detailed shop drawings indicating routing, length, and labeling of all elements of the structured cabling system. Shop drawings shall be reviewed both by the Owner and technology consultant prior to the installation of the structured cabling plant. Provide a spreadsheet with every port/jack number along with the corresponding room number.

16. No ceiling is permitted in any MDF or IDF room.

17. The longest routing in wiring closets should be used to provide additional cable for an equivalent service loop of at least 2 meters.

18. To allow for future growth inside of wiring closets, racks should be placed to maximize the number of racks that can fit into the available space.

19. Finish color for racks and associated patch panels, vertical and horizontal managers should be black.

20. Basket cable tray shall start from the data room cable entry point and circumference the room and across the row of racks. Basket tray shall be hung with acceptable triangular cable tray wall mounts or trapeze style with 1/2'" all thread rods and uni-strut. Basket tray runs should be mounted 6" above rack height and connected to racks with a 6" stand up bracket and waterfall rack drops used to transfer from basket tray into Vertical managers. Acceptable manufacturers:

    a. B-line
    b. GSMetals / Flextray
    c. Cablofil
    d. WBT

21. All racks and basket tray shall be properly grounded to the grounding busbar in each IDF; all grounding busbars shall also be terminated to the main grounding busbar in the MDF. All grounding busbars must be pure copper, **not** copper plated.

22. Sprinklers may be installed in telecom rooms as required by NFPA Code, but **MAY NOT** pass through the room to access an adjacent room.

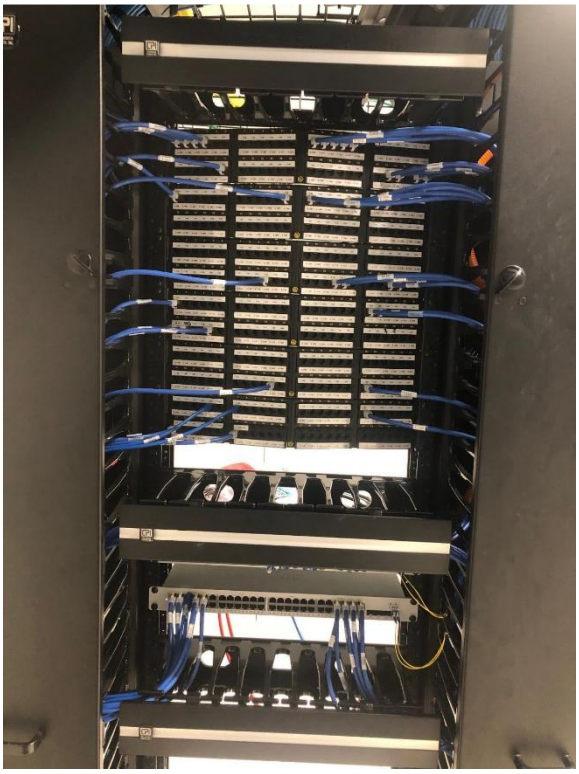
23. Do not locate ductwork or plumbing cleanouts in any telecom rooms.

24. Do not locate crawl space access in any telecom rooms.

25. Surveillance cameras shall be installed in the MDF, Server Rooms and each IDF. Refer to Video Surveillance Design Guidelines in other sections of this document for additional information.

26. Provide one (1) 4" conduit from the top floor IDF in a multistory building or the MDF from a single-story building to the roof to support connectivity for roof mounted equipment. Provide data and convenience power at the roof level. All devices shall be outdoor rated. Quantity of devices and location to be reviewed and confirmed with RELLIS IT during design.

SAMPLE PHOTOS – TELECOM ROOM BUILDOUT



COMMUNICATIONS BACKBONE CABLING

A. Single mode fiber optic cable is required between the MDF and each IDF of the building. 24-strand is minimum between MDF and each IDF.

B. All fiber terminations shall be accomplished with fusion splice to fiber optic assemblies with LC UPC connectors. All fiber splices must be fusion spliced; no mechanical splices accepted on campus. Fiber blocks shall be LC – LC connections. All fiber strands must be terminated, no loose strands, and tested with level IV fiber OTDR tester.

C. All fiber terminations will house in a rack mounted fiber optic enclosure.

D. Fiber riser cables from the MDF to the IDFs shall be armored plenum or riser rated; cables shall be rated for the environment.

E. Provide fiber patch cables equal to the number of fiber strands terminated times two. Single mode patch cables should be yellow, UPC polish, factory made, with test results provided, in the following lengths:

   1. 50% in 3 meter LC – LC

   2. 50% in 5 meter LC – LC

F. Fiber patch cords shall be individually packaged with test result summary on or in package.

G. Test all installed fiber cables using a Power/Light Meter and/or OTDR. Submit full test results to the General Contractor and the RELLIS Campus CIO.

H. All fiber terminations shall be labeled within the enclosure of their termination point including room number, rack number and enclosure id (i.e. A1-A6 to Room 2134 Rack 1 Fiber Panel 1 B1-B6). If the fiber terminates in a building outside of the existing building, a building number or common name should be included as well (i.e. A1-A6 to Building 8535 Room 1231 Rack 1 Fiber Panel 1 B1-B6). If the destination building is a single room the Room number can be omitted.

WORKSTATION TELECOMMUNICATIONS OUTLETS

A. Unless noted otherwise, furnish telecommunications workstation outlets with the following items:

   1. Provide a minimum of two (2) Category 6A cables at each workstation. Grounding of box and conduit shall be in accordance with NEC. The quantity of cables may increase based on the needs of the stakeholders.

   2. Data outlets shall be installed near the power outlets that are not associated with timer deactivation.

   3. As stated in TIA 568A Section 4.3, the maximum horizontal run for Category 6A cable shall be 295-feet as measured from the patch panel in the telecom room to the most distant outlet in the work area. Utilizing 270-feet will assist in maintaining the maximum

distance of 295-feet. Contractor's shop drawings shall show that the horizontal cabling elements (inclusive of service loops and vertical transitions) permanent link complies with the TAMU RELLIS standard of 270'. The use of “game changer” or other equivalent extended distance cable products must be approved by RELLIS IT prior to construction. When these extended distance cables are used proper termination and patch cables shall be provided. A different color keystone jack should be utilized (orange preferred) to indicate that it is a special type of cabling necessary.

4. All outlet jacks, patch panels, racks, cables, shall meet the requirements of TIA 568-A Category 6A. Termination pinout shall be 568B.

5. Each station outlet shall have a deep (3-1/2 inch) dual gang box with a single gang mud ring and single gang faceplate.

6. One 1” inch conduit shall run from the outlet box to the nearest cable tray.

7. Outlet box should be located a minimum of 12 inches from the nearest power outlet.

8. Outlet quantities and locations shall be reviewed with RELLIS IT during design for concurrence with anticipated capacity to support future increased cabling density.

B. Cable: Communications cabling shall be of a fire-retardant "open air plenum" type; meeting all federal and state fire codes. The cable shall be four pair, Category 6A cable. Cable shall have cable length markers minimum every two feet and relevant UL markings. Cable type to be above the base level Category 6A cable.

C. Approved cable manufacturer is: **Panduit**.

D. There shall be no proprietary connectivity parts, cable manufacturer shall use connectivity parts associated with their respective “partner”.

E. Cable jacket color shall be blue.

F. Provide **Blue** copper patch cords (Unless for “game changer” type of exception noted above. These should be orange or other RELLIS IT approved color to match jack color) to match cable type in these lengths and percentages - provide two (2) patch cables for each horizontal cable installed;

1. 50% -- 7ft. in length for MDF and IDFs.

2. 40% -- 10ft in length for users

3. 5% -- 20ft in length for users

4. 5% -- 3ft. in length for WAP’s (wireless access points); see drawing for details.

G. Category 6A Wiring Installation:

1. Do not strip cable sheath back more than is necessary to complete the termination.

2. No wire pairs untwisted more than 1/2".

3. Install cabling without kinks.

4. Bend radius should **not** be greater than 4 times the cable diameter.

5. No damage allowed to the sheath. If damaged, cable should be replaced.

6. Install cabling runs at least 6 inches away from fluorescent lights in suspended ceilings and 1 ft from power outlets.

7. Use Velcro cable ties; do not compress wire bundles.

8. Support cable bundles as appropriate using only industry-standard fittings.

9. Separate cable runs from power cabling by a minimum of 12 inches parallel and 3 inches crossing.

H. Wireless Access Points (WAPs):

1. Install two Category 6A cables to each location designated for a wireless access point.

2. As a general rule, interior wireless access point locations should be planned on a 60 ft. grid, modified as necessary to make allowance for the building structure and for the areas intended purposes. For above ceiling locations, install each cable with a 20 ft. service loop at the access point end. Terminate the cables with an RJ45 plug or RJ45 outlet in a two-port surface-mounted plenum-grade mount. Wireless access points should generally not be located in ceilings above 14 ft. In those locations, strong consideration should be given to a wall-mounted outlet. Locate wall-mounted outlets for access points no more than 14 ft. above the finished floor. Raceway requirements for interior wireless access points shall match workstation outlets as indicated in section A above (dual gang box and 1” conduit to nearest cable tray) when located in walls or hard ceilings. Boxes are not required for ceiling mounted wireless access points located in accessible ceilings.

3. Exterior wireless access point locations shall be reviewed with RELLIS IT during design for concurrence. Each exterior wireless access point location shall have a deep (3-1/2 inch) dual gang box with stainless steel faceplate and one 2-inch conduit routed to the nearest accessible ceiling space inside the building. Category 6A cabling shall be terminated with jacks and coiled with service loop inside the building at the terminus of the conduit from the exterior box. (Note: this requirement is unique to RELLIS due to specialized antenna arrays utilized for exterior WIFI coverage.)

I. Category 6A patch panels should be 48-port. Modular patch panels shall be populated with jacks. Horizontal managers should be 5”-6” deep 2U with attached covers.

CABLE TESTING

A. Horizontal cable: Data contractor must provide test results in Linkware, (Fluke’s proprietary software) in digital form and a copy **on USB flash drive** to RELLIS IT and Building Owner IT. Test results shall be 100% PASS; no marginal results accepted. In Linkware each cable must also show room number of the outlet location.

B. Test all installed Category 6A cable according to the complete Category 6A test standards for permanent link using a Level IV test unit such as a Fluke DSX model. The unit must have been calibrated within the last year.

C. Required information:

1. Outlet number and room number on the test result for each station cable.

2. **A list of outlet numbers and the corresponding room numbers and cable lengths in Excel spreadsheet format.**

3. Laminated half-size as-built drawings indicating each outlet location and outlet number. These will be permanently maintained in each MDF/IDF for future reference.

4. Provide all documentation in soft copy/flash drive. Flash drive to include all close out documents.

D. Warranty: It is the intent that the complete cabling system be installed to satisfy 20-year minimum warranty requirements of the cabling infrastructure manufacturers.

LABELING

A. Label all patch panels, cables, and outlets according to the campus labeling standard. Verify labeling scheme with the RELLIS Campus CIO.

B. Cables shall be marked with machine printed labels at each end of horizontal run, on faceplates in rooms and on front of patch panels in the IDF / MDF rooms. Patch panels shall also depict cable number and room number on front of patch panels. Cable numbers should be in the format of MDF/IDF number plus three-digit cable number i.e. 1001-1999 for IDF number 1. If the building has more than 9 IT rooms, then the format should use a dot notation. For example, 1.001-1.999 for IDF number 1 and 10.001-10.999 for IDF 10. Cable numbers in a multiple building complex should never start over if they are served from a single MDF.

TWO-WAY COMMUNICATION DEVICES AT ELEVATOR LOBBIES

A. Provide wall box, conduit and required cabling from the master unit, remote master units, switches and call stations.

B. A power supply is required to supply DC power to the master unit and any remote master unit or switches. Power supply shall have battery backup included.

C. Maintain all distance requirements for power and network connections.

D. Maintain survivability rating per NFPA 72 for Two-way in-building wired emergency communications.

E. Conduit should be full, end to end with pull points no further than 150’ apart and with no more than 180 degrees of bends between pull points.

F. Provide two ethernet jacks between the elevator control box (or location of elevator telephone connection) and the closest MDF/IDF.

G. Devices:

1. Master Unit - located near the fire alarm annunciator panel.

2. Remote Master - this device is required when the cable distance is exceeded from the master to the Call Station.

3. Remote Call Station - located at elevator landings or designated Areas of Refuge. Connected to the Master Unit with Category 6A cabling, distance requirements to be maintained.

4. Power Supply - located in Mech, Electrical or Telecom space, wall mounted, 110-power required, battery backup integrated. Power supply and power monitoring cables are typically required.

5. Provide brand/model for usage via what has been used in the past.

DISTRIBUTED ANTENNA SYSTEM (DAS)

A. Coordinate the DAS requirements with the campus DAS communications service carrier prior to installation, requirements may change depending on the carrier's equipment specifications.

B. RELLIS Campus DAS is managed and operated by RELLIS IT with a "Hub and Spoke" model.

C. Provisions shall be made for new buildings constructed on campus to accommodate a distributed antenna system (DAS) to enhance wireless communications (e.g., cell phones, first responder radio) within the building area.

D. The following equipment, wiring, and raceways at selected location(s) on the roof of the building to support the future equipment:

1. One spare 2" empty conduit with pull string from nearest electrical closet to designated roof location.

2. One 1 ½" empty conduit with pull string from the nearest IDF room to the designated roof location.

E. DAS shall support 5G technologies.

METERING & BUILDING AUTOMATION COMMUNICATIONS

A. All buildings will have meters installed that record consumption. Refer to related guidelines in Division 23 and UES requirements for additional information on metering. These meters will utilize the campus Ethernet and the Category 6A communication cabling within the building. The PowerLogic electric meters and the WAGES PLC will utilize a Category 6A

Ethernet cable to an EGX-400 Ethernet gateway. The DDC systems will communicate with a Category 6A communication cable to a designated DDC panel, a separate additional communications network, specifically for the DDC system, shall be wired and installed by the Division 23 or Division 25 contractor in accordance with current UES guidelines. Any switches, terminations, set-up, and integration will be provided by the installing contractor for the DDC system. This separate network will be managed and maintained by TAMU Utilities and Energy Services.

B. All building automation systems broadcasting wireless signals (if any) must be approved by RELLIS IT during design.

AUDIO VISUAL SYSTEMS

General Requirements

A. Coordinate all requirements for audio visual systems and equipment with RELLIS IT and the User Coordinator. Provide power outlets, conduit, wire and grounding as required. At a minimum, provide a complete sound system including ADA/TAS hearing assistance system and all reasonable infrastructure for audio-visual equipment and appurtenances for all classrooms, meeting rooms, and auditoriums whose seating capacity exceeds 50 seats.

B. Consideration shall be given to include professional grade sound systems for all spaces with 50 seats or more. Coordination with the building Owner and RELLIS IT is required during design.

C. Documentation: Laminated half-size as-built drawings shall be included within all Audio Visual rooms, as well as electronic copies provided to RELLIS IT at close out.

A/V Systems Overview

A. This document covers general learning, meeting and public spaces and does not intend to cover all types of spaces or scenarios in higher education. What it offers are contemporary, systems-oriented, guidelines that are grounded in industry best practices in AV systems design and installation.

B. It does not specifically address purpose-designed spaces that require specialized hands-on instructional activities (e.g., lecture halls, medical simulation, academic recording studios, physical science labs, vocational training labs, maker spaces, or kinesthetic learning spaces etc.).

C. Active Equipment: Equipment refers to particular A/V devices which have specific costs and capabilities associated with them. Equipment can be thought of as speakers, projectors, racks, switching gear, amplifiers, flat panel displays, etc. Cable is also considered part of the active equipment package because selection of specific A/V system elements will govern which type of cable will be used (i.e. coaxial, twisted pair, speaker, HDMI etc.).

D. Standards & Guidelines:

1. ANSI/AVIXA 3M-2011, “Projected Image System Contrast Ratio”
2. ANSI/AVIXA 2M-2010, “Standard Guide for Audiovisual Systems Design and Coordination Processes”
3. ANSI/AVIXA 1M-2009, “Audio Coverage Uniformity in Enclosed Listener Areas”
4. ANSI/AVIXA 4:2012, “Audiovisual Systems Energy Management”
5. AVIXA, 2003, “Basics of Audio and Visual Systems Design”
6. AVIXA, 2008, “AV Installation Handbook – The Best Practices for Quality Audiovisual Systems”
7. AVIXA 10:2016 DS1, “Audiovisual Systems Performance Verification”
8. AQAV, 2014, “AQAV Standard AV-9000-2014 Quality Management System for the Audiovisual Technology Industry” Revision 7/1/14”
9. The National Electrical Code (NFPA 70), Article 800
10. Commercial Building Standard for Telecommunications Pathways and Spaces (TIA-569-B)

Typical Room/Scenario Descriptions:

A. Digital Signage/Wayfinding Displays:

1. Provide a medium/large recessed in-wall back box, allowing for the termination of power, telecom and audiovisual cabling at all digital signage display locations.
2. Provide in-wall blocking at all digital signage display locations.
3. Provide a minimum of two (2) category 6A network cables at all digital signage display locations.
4. Displays and mounts overall depth to not exceed 4” in depth from finished surface to comply with ADA & TAS requirements.
5. Dedicated digital signage players or displays with onboard graphics processing (H.264) will be utilized determined by the signage software platform approved by RELLIS IT.

B. Huddle Rooms (2-5 people):

1. Displays: Provide a medium/large recessed in-wall back box, allowing for the termination of power, telecom and audiovisual cabling at all display locations. Provide in-wall blocking at all display locations. Displays and mounts overall depth to not exceed 4” in depth from finished surface to comply with ADA & TAS requirements.

2. Audio Reinforcement: Most commonly the displays onboard speakers will suffice for audio reinforcement for these smaller square footage spaces. Recessed, flush mounted in-ceiling speakers can be installed within hard lid or drop ceiling if the project determines it to be appropriate.

3. System Control: Most commonly the display manufacturer's remote will suffice for simple control of the display. A tabletop mounted touch panel, button controller may also be used for a more robust and fixed control interface.

4. Headend Equipment: Based on the limited number of inputs and system functionality there is no headend equipment required for these space types.

C. Small Conference Rooms (6-10 people):

1. Displays: Provide a medium/large recessed in-wall back box, allowing for the termination of power, telecom and audiovisual cabling at all display locations. Provide in-wall blocking at all display locations. Displays and mounts overall depth to not exceed 4" in depth from finished surface to comply with ADA & TAS requirements.

2. Audio Reinforcement: Recessed, flush mounted in-ceiling speakers will be installed within hard lid or drop ceiling. In an exposed ceiling environment pendant speakers will be installed. 70v enabled speakers are the preferred solution for simplified cabling needs. Preference for ceiling mounted microphones to be used for speech reinforcement. Note: Determining if the system must integrate with VOIP can change the entire microphone design.

3. System Control: Touch control panels are preferred to be touch enabled and installed at the table surface. This allows the end-users to easily access the system controls without having to leave the near proximity to the installed PC or source devices being used. These touch panels must be sized appropriately for various features and most often POE powered.

4. Headend Equipment: Due to the undesirable aesthetic impact of a floor rack within the conference room space, it is preferred to locate this rack outside of the room. This can be done by coordinating with RELLIS IT and the A/E team to house the AV equipment within a telecom IDF or provide a dedicated space for AV equipment (storage room, closet etc.). If a dedicated space for AV equipment is selected, the project must ensure that the space is adequately cooled.

D. Large Conference Rooms (10-18 people):

1. Displays: Provide two (2) medium/large recessed in-wall back boxes, allowing for the termination of power, telecom and audiovisual cabling at all display locations. Provide in-wall blocking at all display locations. Displays and mounts overall depth to not exceed 4" in depth from finished surface to comply with ADA & TAS requirements.

2. Audio Reinforcement: Recessed, flush mounted in-ceiling speakers will be installed within hard lid or drop ceiling, in an exposed ceiling environment pendant speakers will be installed. 70v enabled speakers are the preferred solution for simplified cabling needs. Preference for ceiling mounted microphones to be used for speech

reinforcement. Determining if the system must integrate with VOIP can change the entire microphone design.

3. System Control: Touch control panels are preferred to be touch enabled and installed at the table surface. This allows the end-users to easily access the system controls without having to leave the near proximity to the installed PC or source devices being used. These touch panels must be sized appropriately for various features and most often POE powered.

4. Headend Equipment: Due to the undesirable aesthetic impact of a floor rack within the conference room space, it is preferred to locate this rack outside of the room. This can be done by coordinating with RELLIS IT and the A/E team to house the AV equipment within a telecom IDF or a dedicated space for AV equipment (storage room, closet etc.). If a dedicated space for AV equipment is selected, the project must ensure that the space is adequately cooled.

E. Divisible/Combinable Multi-Purpose Room:

1. Video Wall (Preferred): Provide recessed in-wall back box(s), allowing for the termination of power, telecom and audiovisual cabling will be installed at all video wall locations. Provide in-wall blocking at the video wall location. Opening size may require supplemental structural framing. Coordinate video wall frame with final architectural finishes. Provide adequate ventilation and access to all components.

2. Projection Screens (with approval from RELLIS Campus CIO): Provide multiple ceiling mounted (appropriately sized) recessed motorized projection screens with projector. During the design coordination meetings, the image aspect ratio will be determined with the end users to ensure the source signal is 16x10 or 16x9. Regardless of the selected aspect ratio, the design team will utilize twisted pair receivers with scaling functionality to ensure that any signal resolution is displayed properly on the screens.

3. Projectors (With approval from RELLIS Campus CIO): The projector's brightness (lumens) must be appropriately calculated for a .7-.9 screen material.

4. Audio Reinforcement: Provide recessed, flush mounted in-ceiling speakers within hard lid or drop ceiling. Provide pendant speakers at exposed ceilings. 70v enabled speakers are the preferred solution for simplified cabling needs. Surface mounted speakers are also an acceptable audio reinforcement method for retrofit application or when a more robust front soundstage stereo image is determined to be appropriate. Wireless lavalier style microphones are preferred for instructors. Ensure that the lectern/teaching station has storage drawers for housing the bodypack when not in use.

5. System Control: If applicable, provide operable partition sensors at the ceiling to provide a trigger to the AV system processor to automatically configure the AV system into a combined or variety of divisible modes. Touch control panels are preferred to be touch enabled and installed at the table surface. This allows the end-users to easily access the system controls without having to leave the near proximity to the installed PC or source devices being used. These touch panels must be sized appropriately for various features and most often POE powered. These devices may also be mounted to the wall closest to the door or podium depending on occupant's preference.

6. Headend equipment: Due to the increased quantity of inputs and outputs for divisible spaces, it is often required to provide a larger rack to house the headend equipment (switcher, DSP, PC, control processor, etc.). Due to the undesirable aesthetic impact of a floor rack within the room, it is preferred to locate this rack outside of the room. This can be done by coordinating with RELLIS IT and the A/E team to house the AV equipment within a telecom IDF or a dedicated space for AV equipment (storage room, closet etc.). If a dedicated space for AV equipment is selected, the project must ensure that the space is adequately cooled.

F. Classroom (Lecture Style - Didactic):

1. Video Wall (Preferred): Provide recessed in-wall back box(s), allowing for the termination of power, telecom and audiovisual cabling will be installed at all video wall locations. Provide in-wall blocking at the video wall location. Opening size may require supplemental structural framing. Coordinate video wall frame with final architectural finishes. Provide adequate ventilation and access to all components.

2. Projection Screen (With approval from RELLIS Campus CIO): To support this lecture-based teaching method, a single ceiling mounted appropriately sized recessed motorized projection screen with projector is most often utilized. During the design coordination meetings, the image aspect ratio will be determined with the end users to ensure the source signal is 16x10 or 16x9. Regardless of the selected aspect ratio, the design team will utilize twisted pair receivers with scaling functionality to ensure that any signal resolution is displayed properly on the screens.

3. Projectors (With approval from RELLIS Campus CIO): The projector's brightness (lumens) must be appropriately calculated for a .7-.9 screen material.

4. Audio Reinforcement: Provide recessed, flush mounted in-ceiling speakers within hard lid or drop ceiling. Provide pendant speakers at exposed ceilings. 70v enabled speakers are the preferred solution for simplified cabling needs. Surface mounted speakers are also an acceptable audio reinforcement method for retrofit application or when a more robust front soundstage stereo image is determined to be appropriate. Wireless lavalier style microphones are preferred for instructors. Ensure that the lectern/teaching station has storage drawers for housing the bodypack when not in use.

5. System Control: Touch panels are preferred and will be installed at the lectern/teaching station desk surface. This allows the instructor to easily access the system controls without having to leave the near proximity to the installed PC or source devices being used. These touch-enabled control panels must be sized appropriately for the various features to be controlled. These touch panels are most often POE powered. These can also be mounted to the wall closest to the door or podium depending on occupants preference.

6. Headend Equipment: Based on the limited amount of inputs and outputs generally found in these system types, it is common for the headend equipment (switcher, DSP, PC, control processor, etc.) to be housed within the lectern or teaching station. These pieces of furniture are recommended to be within the AV scope of work, and at minimum be specifically designed to house AV equipment (rack rails, integrated cooling features, cable management features, etc.).

G. Collaborative Learning Classroom (Active Learning): Collaborative Learning Classrooms (CLC) are teaching and learning spaces that allow faculty to move their course design beyond the lecture. The room design, flexible furniture, writing surfaces, and technology all combine to support faculty in engaging with their students through collaborative learning activities and more participatory use of media. CLC's facilitate diverse sizes and groupings of students, creating a flexible and supportive environment for a class to transition seamlessly between a professor's presentation and facilitated student group work. Such rooms enable options for supporting a myriad of teaching and learning arrangements.

1. Furniture: For larger CLC's seven (7) foot circular tables are preferred, in smaller classrooms of this type it is preferred to use D-shaped tables effectively by lining the walls with the tables. Arrange the tables so that students anywhere in the room can see anywhere else in the room. There should be at least 5 feet between table edges (12' center to center table separation). If possible, supply power via a floor box, poke-thru, raised floor, or other system that keeps the cords hidden.

2. Displays: The minimum display configuration would consist of two optimally sized ceiling-mounted motorized, retractable projection screens with ceiling mounted projectors showing the central system sources of content. A video wall arrangement is preferred. Many newer CLC's have a wall-mounted screen for each table that can be used by the students to work together on assignments, or by the instructor to project slides or other content. These student displays signal can be routed back to the central system for presentation on the projection screens.

3. Headend Equipment: Due to the increased quantity of inputs and outputs for CLC's, it is often required to provide a larger rack to house the headend equipment (switcher, DSP, PC, control processor, etc.). Due to the undesirable aesthetic impact of a floor rack within the CLC, it is preferred to locate this rack outside of the room. This can be done by coordinating with RELLIS IT and the A/E team to house the AV equipment within a telecom IDF or a dedicated space for AV equipment (storage room, closet etc.). If a dedicated space for AV equipment is selected, the project must ensure that the space is adequately cooled.

4. Audio Reinforcement: Provide recessed, flush mounted in-ceiling speakers within hard lid or drop ceiling. Provide pendant speakers at exposed ceilings. 70v enabled speakers are the preferred solution for simplified cabling needs. The speakers will provide program (content) and speech reinforcement for the system. In larger CLCs a wireless lavalier microphone will be provided for the instructor. During the programming phase for these space types, the AV consultant and RELLIS IT will determine if microphones are required at the student tables.

5. System Control Panels: Touch panels are preferred to be installed at the lectern/teaching station desk surface. This allows the instructor to easily access the system controls without having to leave the near proximity to the installed PC or source devices being used. Due to CLC's often having a reduced size for the lectern/teaching station it is acceptable for these control panels to be wall mounted near the instructor station. These can also be mounted to the wall closest to the door or podium depending on occupants' preference.

Any AV equipment that will have a connection to the building IT network will need to be approved by RELLIS IT prior during design.

AV Closet Requirements

Buildings with an Audio/Video closet should have a 45-space rack unit such as the Middle Atlantic BGR-45SA-27 or equivalent per room. For example, if one closet corresponds to three (3) rooms, then the closet should contain three (3) rack units.

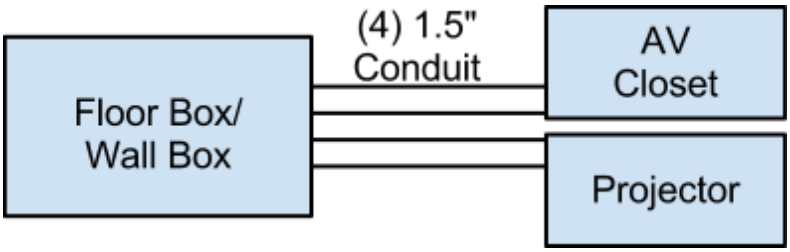
A. Must include a 24"x36" laminated drawing of a line diagram with rack elevations that is mounted to the wall.

B. Four (4) 120V 20A outlets should be located at the base of each rack unit.

C. Two (2) data lines shall be dropped to each rack unit.

D. Two (1.5 “) conduits should run from the lectern floor box (if present) or wall to the AV closet per room. Two additional (1.5 “) conduits should run from the lectern floor box (if present) or wall to the projector’s location or main displays. Note: The use of displays or video wall is preferred over projectors.

Please see the graphic below for one (1) room example:



Room Requirements

Room shall be controlled via AMX controller, video switcher, digital video transmitter/receiver pairs, and a touch panel interface. Controller and switcher will be an all-in-one unit or equivalent. Video switcher should have capabilities for scaling, digital inputs/outputs, analog inputs/outputs, and should be HDCP compliant. Switcher should have additional audio/video ports for expandability. A Smart Podium/LCD is required. Assistive Listening FM ADA standard system is required for all classrooms. Lecterns shall be reviewed and approved by the RELLIS CIO.

Programming Requirements

Programming shall include AMX Resource Management Suite software links/hooks.

Mounted Equipment Requirements

Note: If a projector is required then the following equipment is required:

A. Chief CMA 440 Lightweight Above Tile Suspended Ceiling Kit.

B. Electric non-tab tensioned Projection Screen with built- in Low Voltage Controller of adequate size for the room in a 16:10 Aspect Ratio.

Audio Requirements

In smaller rooms, where small speakers will suffice, four (4) ceiling mount JBL 16Ω speakers should be installed. For larger applications, a more specific speaker JBL AC 18/26 speakers or equivalent shall be specified. Large auditoriums will be wired with front mounted speakers in stereo format with ceiling speakers to fill audio voids in the room.

Small/ceiling speakers will require a 14 gauge plenum-rated cable from Liberty cable (14-2C-P-WHT) or equivalent. Larger/front mounted speakers will require a 12 gauge plenum-rated cable (12-2C-P-WHT) from Liberty cable or equivalent.

An audio presentation mixer should be present. Preferably a Nexia PM.

Video Requirements

Video signals in the room should be in digital format. Video to projector will be transmitted via four (4) Category 6 cables from Liberty cable (24-4P-L6SH-WHT) or equivalent. Wires will not be terminated or hooked up to a network switch. These cable runs go from lectern floor box/wall to projector.

Conduit Needs (No AV Closet Present)

If a floor box is present, two (2) 1.5” inch conduit runs shall connect to the floor box. One conduit run will terminate in the ceiling to an empty double-gang electrical junction box. One conduit run will terminate at the projector ceiling plate to allow Video cabling to be run inside.

If a floor box is not present, two (2) 1.5” inch conduit runs shall connect to the wall closest to the podium location and terminate into a double-gang electrical wall junction box. One conduit run will terminate in the ceiling to an empty double-gang electrical junction box. One conduit run will terminate at the projector ceiling plate to allow Video cabling to be run inside.

Power Receptacles Requirements

All receptacles should be 120V 20A. Where wall mounted displays are required, provide a duplex receptacle mounted inside the wall backbox. Where a ceiling mounted projector is required, provide a duplex receptacle flush mounted on the projector ceiling plate.

Where lecterns are required, provide a quadplex receptacle in the associated floor box. If floor box is not present, receptacles should be located as close as possible to the lectern podium location to limit the length of umbilical cabling.

Power receptacles for cameras (if required) shall be installed flush with ceiling located at back of room within 6 inches of camera network ports.

Network Connections for A/V Equipment

All network connections for A/V equipment shall utilize category 6A cabling as specified elsewhere in these guidelines.

Provide three (3) network connections at each Lectern Location. If located in the floor box, network cable shall be terminated at floor box. One (1) of the connections will have a network switch installed on it to split the connection for the Lectern Equipment. The remaining two (2) connections will be used for other specified equipment.

Provide one (1) network connection/drop located at the back of the room for security camera. The camera location will vary depending on the entrance to the classroom, equipment location, as well as structural limitations such as support posts, etc. Ideal location should have a clear view of projector, lectern, projection screen and entry door. If a room has two entrances, the location of the camera should be centered in the back of the room.

DIVISION 28 – ELECTRONIC SAFETY & SECURITY

These guidelines shall be referred to during the design and construction of the electronic security systems and subsystems for the Texas A&M RELLIS Campus buildings.

GENERAL REQUIREMENTS

A. All security contractor (integrator) personnel must be manufacturer certified and capable of an installation that falls under the manufacturer's guidelines necessary to obtain a manufacturer warranty.

B. The security contractor (integrator) shall maintain a valid Type B license from the Texas Private Security Bureau and an operating facility in the local area (100-mile radius) of the RELLIS Campus to provide service to the Owner for the warranty period. All certifications must be current. Proof of certification must be presented for supervisors and all installation personnel at or before the pre-installation meeting.

C. The A/E design team of consultants shall include a security design consultant with extensive previous experience in higher education building design environments. The consultant should also provide support during the construction process to ensure all submittals, test procedures, and actual installation meets the requirements as specified for the project.

D. The security contractor (integrator) shall warrant all completed work, including all materials and labor, to be free from defects in design, workmanship, and/or materials for a period of two (2) years from final acceptance date. The acceptance is defined as the completion of all functional performance testing and the resolution of all punch list items.

E. A pre-installation meeting with the general contractor, security contractor, FP&C Project Inspector, and RELLIS IT Security Representative is required to review the installation requirements and planned installation.

F. A pre-testing meeting with the general contractor, security contractor, FP&C Project Inspector, and RELLIS IT Security Representative is required to review the test requirements and plan for all systems and subsystems installed.

G. In addition to Electronic Security, the building design shall include Crime Prevention Through Environmental Design (CPTED) strategies that include adequate site and exterior building lighting, landscaping techniques, and proper signage.

BUILDING ACCESS CONTROL SYSTEM (BACS)

A. All buildings on the RELLIS campus shall be equipped with a building access control system (BACS), which is an extension of the existing Avigilon BACS monitored and maintained by RELLIS IT/Facilities.

B. This system replaces the typical mechanical key-controlled door lock with a door locking system that uses a proximity card reader as the access credential.

C. The BACS shall consist of card readers, biometric readers, door position switches, and request-to-exit sensors operating in conjunction with associated electric door hardware that grant access and monitor BACS controlled openings.

D. Typical BACS configuration is card reader or scheduled controlled entry with free exiting that allows for system wide lock down during security events.

E. Typical BACS controlled openings (doors, hatches, etc.) include:

1. BACS monitoring at all accessible exterior openings (doors, hatches, etc.) with Card Reader control at designated primary entry points.

2. BACS vertical card reader control at elevators and stairwells to allow for system segregation of designated building levels.

3. BACS card reader control at designated suite entrances to allow for system segregation of designated building sections.

4. BACS dual authentication card reader control (card read + keypad) at the telecom MDF

F. All wire and cable for BACS components shall be U.L. approved for its intended application and shall meet or exceed manufacturer's recommendations for the components connected. Increase conductor sizes on cables as required to be consistent with circuit current ratings, length of wire runs, and manufacturers' recommendations.

G. Current required reader manufacturer/model is Schlage MT15 and MTK15. Validate current specification with RELLIS IT during design.

VIDEO SURVEILLANCE MANAGEMENT SYSTEM (VMS)

General Requirements

Video surveillance technology includes all types of cameras placed internally or externally throughout campus and the related equipment to operate the cameras or view, listen, and record images and/or audio. All uses/placement of equipment must be reviewed and approved by the RELLIS Campus CIO. Equipment used for surveillance may be monitored or non-monitored.

All buildings on the RELLIS campus shall be equipped with high megapixel, multiple sensor video surveillance cameras. The video footage of these cameras shall be managed by an existing Avigilon VMS monitored and maintained by RELLIS IT/Facilities.

The VMS system will consist of surveillance cameras, Power over Ethernet (PoE) switches, and head-end Network Video Recorders (NVR) that record and store surveillance camera footage/images.

Unshielded Twisted Pair (UTP) cable for surveillance cameras shall be provided by the telecom contractor (Div 27)

Cameras intended for monitoring or displaying general access to public events must be approved in advance and privacy concerns must be specifically addressed by the department requesting

approval. Surveillance cameras must not be located in or monitor a campus housing resident's room or restroom/shower area, or any other restroom/shower area where there is a reasonable expectation of privacy.

Minimum Required Camera Locations

A. All exterior public entrances to the building shall deploy exterior video surveillance cameras in such a manner to provide comprehensive remote situational awareness of the building approach and overall site.

B. All interior public entrances to the building shall deploy interior video surveillance cameras in such a manner to capture fully identifiable characteristics of each individual entering and exiting.

C. All elevator lobbies and stairwell entrances shall deploy interior video surveillance cameras in such a manner to capture fully identifiable characteristics of each individual entering and exiting the floor.

D. The design team shall perform a video surveillance assessment in consultation with RELLIS IT and RELLIS Operations for any new buildings with significant student presence or priority research projects.

Signage For AVST Equipment

Conspicuous, public signage must be displayed at all main entrances of buildings and facilities with video surveillance equipment or in the immediate area of the equipment. Surveillance cameras in some locations may be actively monitored in real time by authorized personnel, whether sporadic or continuously, while other camera locations may not be monitored at all. Departments must clearly indicate in their posted signage if their AVST equipment is not monitored.

Signage language is as follows: "This area is subject to surveillance for security purposes and may or may not be monitored."

Requests for Installation of Equipment

Approval of installation and relocation requests will be guided by the need for security of state property, facilities and people, with attention given to the privacy of members of the campus community. All modifications and systems shall be approved by the RELLIS Campus CIO to comply with standard requirements.

FIRE ALARM SYSTEMS

Texas A&M University Department of Environmental Health and Safety (TAMU EHS) serves as the local Authority Having Jurisdiction (AHJ) for all System owned property and any buildings or structures on the RELLIS Campus, including any public private partnership (P3) entities. All proposed construction, structural changes, changes in use, any change affecting egress from a building or space, or any modification or work involving life safety systems or equipment, regardless of building occupant, must be reviewed and approved by EHS as well as the appropriate construction design, management, or review team in order to address fire and life safety issues in accordance with TAMUS policy.

TAMU EHS provides plan review, in-wall inspections, above ceiling inspections, final inspections and acceptance testing of all fire alarm systems for both new construction and facility renovation projects.

Requirements for fire alarm systems are governed by the most current version of the TAMU EHS fire and life safety design guidelines. This document is maintained and updated by TAMU EHS and can be found on their website here:

Texas A&M University Supplemental Guide for the Design, Installation, and Acceptance of Fire and Life Safety Systems

For broken hyperlinks or confirmation of most current version, contact TAMU EHS for additional information.

DIVISION 31 - EARTHWORK

GENERAL INFORMATION

Earthwork must be reviewed by RELLIS Administration and SSC Services Landscape Maintenance for landscape material type and soil preparation.

All projects that utilize RELLIS Campus property that is not contained within the assigned construction area boundary (i.e. field office, material storage/laydown, related offsite improvements, etc.), must first gain written permission from RELLIS Administration prior to use. Once usage is approved, maintenance and upkeep of the affected land areas will be held to the standards of current contractual agreements with SSC for use until final turnover back to RELLIS Administration. Upon turnover, any changes made during the time of possession must be evaluated for current and future impacts to the area. Changes made that do not benefit TAMUS must be removed and brought back to original, like new, and/or better condition unless an agreement is made with RELLIS Administration to leave specified upgrades in place. Furthermore, all property bordering the construction boundaries must be turned over to the RELLIS Campus in a like new or better condition, subject to approval by RELLIS Administration on its final condition.

SITE CLEARING

Clear/grub/strip of trees, roots and vegetation that portion of the site to receive landscaping and improvements. Remove roots to a minimum depth of 24". Onsite burning is only allowed with prior approval by RELLIS Environmental Health and Safety Department. Contact RELLIS EHS for current burn permit forms/procedures and approval requirements. Onsite burning may not take place if a burn ban is in place in Brazos County. Burying of trees/vegetation is not acceptable. Trees/vegetation to remain shall be adequately fenced and otherwise protected from damage by construction operations.

If good friable topsoil exists on site, strip this material to a depth of 6" and stockpile for reuse in areas to receive grass and other landscaping. Topsoil shall be free of significant vegetation, rocks or other deleterious materials.

All areas disturbed during construction shall have erosion and sediment control, to be maintained by the contractor, until landscaped and turf areas have been established.

The RELLIS Campus has a number of areas within RTA4 (the former Knife River Quarry) at the southern end of campus for stockpiling excess topsoil, clean general fill, or other usable spoil materials. Projects are encouraged to coordinate with RELLIS Administration to identify areas where excess materials can be stockpiled for use on future projects or to eliminate costly offsite haul and disposal operations. Note that this applies only to quality reusable material that is free of vegetation, rocks, concrete spoils, and/or other deleterious materials.

TOPSOIL

Topsoil shall be a natural, fertile, friable soil, possessing characteristics of representative productive soils in the vicinity. It shall be obtained from approved naturally well-drained areas. Only the top 12” (inches) of earth shall be removed and used. It shall not be excessively acid or

alkaline or contain toxic substances, which may be harmful to the plant growth. Topsoil shall be without admixture of subsoil and shall contain a minimum of lumps, stones, stumps, roots, or similar substances 1” (inch) or more in diameter. Topsoil shall not be collected from sites that are infected with a growth of, or the reproductive parts of, noxious weeds (i.e. Nut Sedge, Johnson grass, etc.). Topsoil shall not be stripped, collected, or deposited while wet. It is the responsibility of the Contractor to furnish the location where the topsoil is to be obtained to the FP&C Project Manager or its representative in writing, as well as samples of such soil.

Quality assurance and approval of topsoil samples shall be performed by FP&C or SSC Project Manager in consultation with the Landscape Architect, RELLIS Administration, and SSC Grounds Maintenance. Refer to more specific requirements in the *Division 32 – Landscaping* section of these guidelines for information on soil requirements at landscaping and turf installation areas.

GRADING AND COMPACTION

Slopes of planted areas should allow easy maintenance. Turf areas shall have a slope of no more than 4:1. A 2 percent minimum slope is desirable; however, site specific grading may require swales with shallow slopes that shall be designed by the Engineer for proper capacity. Areas with slopes greater than 4:1 must be planted with ground cover and constructed to control erosion.

Existing trees and other plant material to be preserved shall be indicated on the grading plan. Where trees are to be preserved, no grading or paving of the existing grade within the drip line is allowed.

Slopes for walkways shall comply with Texas Accessibility Standards.

Unless otherwise determined by applicable geotechnical report, non-structural areas (outside of paved or improved areas) backfill or embankment shall be compacted in lifts no greater than 8” loose thickness to a minimum of 90% maximum density as per ASTM D-698 with a moisture content of +/- 2% of optimum. Open area embankment may be compacted in lifts no greater than 12" loose thickness to a minimum of 90% maximum density as per ASTM D-698 with a moisture content of +/- 2% of optimum.

Paving area shall be proof rolled with a 20-ton pneumatic tire roller. Unless otherwise determined by applicable geotechnical report, structural area (extending 2 feet beyond edge of pavement or back of curb) backfill or embankment adjacent to paving and structural areas shall be compacted in lifts no greater than 8” loose thickness to a minimum of 98% maximum density as per ASTM D-698 with a moisture content of +/- 2% of optimum. Backfill around structures shall be placed uniformly and only after the elements of the structure have attained the required strength to resist the soil pressure.

Select fill where required shall be a material available in the general area of the project (if possible) having a plasticity index (PI) ranging from 7 to 15, a liquid limit of 35 or less and being free from organic matter, large rocks or other deleterious materials.

All existing utility appurtenances (valve boxes, fire hydrants, manhole ring and cover, etc...) shall be adjusted to final grades.

EXCAVATION, TRENCHING, AND BACKFILL FOR UTILITIES

Excavation/trenching and backfilling operations shall be coordinated such that a minimum amount of trench is open at any one time. Backfilling is to be scheduled so there is a minimum amount of open excavation left during hours of no work. All open excavations shall be properly lit and barricaded during hours that the contractor is not on site. The open ends of all utility lines shall be temporarily sealed at the end of the working day.

Adequate measures shall be taken to prevent runoff water from entering the trench without damage to surrounding facilities/properties.

De-watering systems shall be provided as required for excavation/backfill activities and to allow installation of utility lines and embedment envelope on dry stable trench bottom. Discharge from the de-watering system shall be directed to drainage facilities of adequate capacity in a manner that will not damage or interfere with the use of adjoining facilities/properties. De-watering systems shall be provided at no additional cost to the Owner.

The embedment zone for a utility line extends from 6" below the bottom of a utility line to 12" above its top. Embedment material for water and sanitary sewer HDPE lines shall be clean bank run sand. Embedment material for storm sewer RCP lines shall be gravel with a maximum diameter of 3/4". Embedment material for pre-insulated thermal utility piping is sharp sand. Electrical duct bank is typically encased in red concrete and installed on the undisturbed trench bottom. High water table elevations may necessitate the use of alternate embedment material and different embedment zone dimensions.

Backfill above the embedment zone for trenches in non-structural areas, unless otherwise determined by applicable geotechnical report, shall be compacted in lifts no greater than 8” loose thickness to a minimum of 90% maximum density as per ASTM D-698 with a moisture content of +/- 2% of optimum. Backfill above the embedment zone for trenches in structural areas under existing or proposed pavement or ground supported structures shall be cement stabilized sand (2 ½ sacks of cement per cubic yard of sand) compacted in maximum 8" lifts to 95% of ASTM D558 with a moisture content between +/- 2% of optimum. Consolidation of trench backfill by flooding/jetting is not allowed.

An excavation/trench safety program shall be implemented which complies with OSHA trench safety standards, Subpart P. A trench safety plan shall be prepared and sealed by a Texas Professional Engineer and submitted to the Owner prior to the start of construction.

TERMITE TREATMENT

All buildings on the RELLIS Campus must have foundation soil treatment for termites, regardless of construction type. All products used for the treatment of termites shall display labels bearing Environmental Protection Agency approvals and shall be mixed and applied in accordance with directions on the label.

VOID SPACE BELOW GRADE BEAMS

Refer to Division 03 of these guidelines for information on void form requirements.

DIVISION 32 – EXTERIOR IMPROVEMENTS

SITE PAVING

Site paving shall be provided to facilitate pedestrian and vehicular access along with emergency and service vehicle access to the site and facility being designed.

Materials, parameters and methods shall be in basic conformance with the TxDOT “Standard Specifications for Construction of Highways, Streets and Bridges,” latest edition, applicable Bryan/College Station Unified Design Standards, and applicable ASTM standards.

Unless otherwise determined by applicable geotechnical report, stabilization shall be required. Subgrade material to receive pavement sections other than pedestrian sidewalks which have a plasticity index (PI) greater than 20 shall be stabilized in place with lime prior to placing the pavement. Lime shall be placed in slurry form. Lime shall be thoroughly mixed per TxDOT Specification Item 260. Subgrade material to receive pavement sections other than pedestrian sidewalks which have a PI equal to or less than 15 shall be stabilized in place with Type I Portland cement. Cement shall be dry mixed into the subgrade using a rotary pulverizing mixer, appropriate water added, and then thoroughly mixed with the cement and soil per TxDOT Specification Item 275. Prior to the application of lime or cement to the subgrade, the optimum percentage of material to be added shall be determined based on TEX-121-E (Lime) and TEX-120-E (Cement) Laboratory tests conducted on mixtures of the subgrade soils with varying percentages. The amount of lime required for stabilization should be the percent required by weight to produce a PI less than 18 and a pH not less than 12.4. The amount of cement required for stabilization should be the percent required by weight to produce a minimum compressive strength of 300 PSI in 5 days. No traffic allowed for the first 3 days or until 150 PSI strength is reached.

Compaction shall be required, refer to Division 31, Grading and Compaction section.

Appropriate design vehicles shall be selected and modeled to design paving structure, radius, and required widths. Design vehicles may include 73 foot tractor trailer (53 foot trailer), front loading trash trucks, delivery vehicles, aerial fire apparatus, and TAMU bus. A/E team shall coordinate design vehicle selection with owner and user groups.

Pavement sections subject to vehicular traffic shall be either a rigid section of jointed reinforced concrete pavement (JRCP) or a flexible section consisting of hot mix asphaltic concrete (HMAC) surface over an approved flexible base material or HMAC Base Type A or B (Black Base) (coordinate pavement type selection with Owner). JRCP pavement sections shall be a minimum of 6" thick. Finish shall be broom or burlap drag. The thickness of the pavement section elements shall be recommended by the geotechnical engineer based on soil conditions and anticipated traffic loadings. Pavement at trash dumpsters, loading docks, etc. subject to heavy vehicular maneuvering and turning shall be JRCP.

HMAC Paving

HMAC shall be Type D and the flexible base material shall be Type A, Grade 1 as defined in the TxDOT Specification Item 247, 2004 Edition. A rolling pattern for HMAC shall be established in the field by a testing laboratory using a Troxler Nuclear Density Gauge. The flexible base shall be compacted in maximum 8" lifts to a minimum density of 95% of the maximum density as per ASTM D-1557 with a moisture content between +/-2% of optimum. The base shall be primed with approved asphaltic material at a rate established by the team and shown on the plans prior to

HMAC placement. Between successive HMAC courses, an approved asphaltic tack coat at a rate established by the team and shown on the plans shall be placed as needed to properly bind layers.

Required HMAC Tests:

A. Mix Verification.

B. Laboratory Density - The HMAC surface course shall be compacted to contain 3 to 8 percent air voids when tested in accordance with Tex-207-F and Tex-227-F.

C. Thickness Verification.

D. Laboratory Stability.

HMAC flexible pavement sections shall typically be edged by reinforced concrete curb and gutter to receive storm drainage from the pavement and to stabilize the pavement edge. Place doweled expansion joints in curb and gutter as a minimum at end of radius returns, at curb inlets and at maximum 40' centers in straight runs. Expansion joints in curbs with adjoining sidewalks shall match the joint location and spacing in the sidewalk. Contraction joints a minimum depth of 1/4 slab depth and shall be placed at 10' intervals. Curb and gutter section shall be placed on 6” stabilized and compacted subgrade.

HMAC Paving may be utilized for onsite parking areas or for repairs of existing HMAC roadways. All new campus roadways or significant replacements shall be concrete pavement. Asphalt is not acceptable for new roadway pavement unless approved in writing by RELLIS Administration.

Concrete Paving

Concrete paving shall consist of Type I or II Portland Cement conforming to ASTM C150, Type C or F fly ash conforming to ASTM C618 (up to 25% percent by weight of cementitious materials), aggregate meeting ASTM C33, and water conforming to ASTM 1602. Additional admixtures may be used meeting appropriate ASTM standards. Concrete pavement shall have a minimum compressive strength of 3,000 psi at 28 days. A concrete mix design with current (within 365 days of submittal) 28-day break data shall be submitted by the contractor and reviewed by the A/E team.

Required Concrete Tests:

A. Test Cylinders at 7 and 28 days per ASTM C39 (Additional test cylinders requested beyond minimum requirements shall be at the cost of the Contractor.)

B. Air Content

A jointing plan shall be prepared as part of the design plans showing the type and location of joints in all JRCP pavements including sidewalks and curbs/valley gutters. The expansion joints in sidewalks shall be placed at walk intersections and at maximum 20' centers in straight runs. Expansion joints, contraction joints, construction joints, and isolation joints shall be placed in accordance with good engineering practice as required to control cracking and other distress in

the concrete pavement and to facilitate construction with a maximum spacing equal to 2 times the thickness of the pavement in feet (2*t') with a maximum spacing of 15 foot. Concrete sawn joints shall be cut "green" using the "soft saw cut technique" as soon as the concrete hardens to support the weight of an early entry type concrete saw and operator to avoid raveling.

Concrete pavement shall typically be edged with a 6" concrete curb. Preferably the curb shall be poured monolithically with the pavement but doweled curb sections are allowed. If poured separately the curb section shall be recessed 1" into the pavement and attached with dowels of sufficient spacing and length to hold the curb firmly to the pavement.

All pavement/surfaces and gutters shall be crowned and/or sloped sufficiently to positively direct storm runoff to points of discharge or collection as to eliminate 'birdbaths". Minimum cross slopes for open pavement areas shall be 1%; minimum crown for streets shall be 6" above the gutter line; minimum slopes for curb and gutter shall be 0.5%.

Concrete for all site paving/curbs/gutters shall have a minimum compressive strength of 3,000 psi at 28 days. Reinforcement shall be new deformed steel bars conforming to ASTM A615, Grade 60 minimum No. 4 bar in size. No welded wire fabric shall be used as reinforcement except in unique situations as approved by Owner. All concrete shall be adequately cured by protecting it against moisture loss for a period of not less than 72 hours beginning immediately upon completion of finishing operations and initial set of concrete. The use of water as a finishing agent is prohibited, the use of evaporation retarders may be used to aid in finishing

Expansion joints shall consist of smooth bar dowel assemblies conforming to ASTM A615, grade 60 with a PVC sheath over the free end, asphalt impregnated fiberboard filler, and cold applied self-leveling polyurethane sealant with closed cell polyethylene backer rod. A PVC cap seal may be specified in lieu of a joint sealant if approved by the Owner.

Parking

The basic configuration of parking lots shall be as follows:

A. Parking Angle: 90 degrees

B. Stall Width: 9'-0"

C. Module Width: 64'-0" (stripe to stripe), 63' - 0" (back of curb to stripe), 62' - 0" (back of curb to back of curb)

D. Drive Aisle: 24'-0"

E. Stripe Width: 4"

F. Stripe Length: 20'-0"

G. Stripe Colors: White for general parking. Yellow for no parking and loading.

Landscaped medians and/or islands shall be planted with low profile vegetation, irrigated, and spaced appropriately for the design. Concrete mow strips a minimum of 2'-0" wide shall be provided at the back of curb for head-in parking when no wheel stops are provided. Lighting

shall be provided in accordance with UES exterior lighting guidelines (RELLIS specific). Refer to Division 26 – Electrical guidelines for additional information.

Concrete Walks

Pedestrian sidewalks shall be JRCP with a minimum thickness of 4" and a minimum width of 6' or sized to handle pedestrian and bicycle flow. Pedestrian sidewalks that may also be service and/or emergency vehicle pathways shall be a minimum of 6” thick and appropriate width.

Concrete sidewalks including pedestrian plazas and other general architectural concrete flatwork shall be light broom finish typical. Decorative and/or non-standard concrete finishes (i.e. rock salt, colored admixtures, exposed aggregate, etc.) are prohibited without express written approval from RELLIS Administration. Concrete, brick, or stone pavers may also be utilized for visual interest or to define structured pedestrian pathways subject to review and approval by RELLIS Administration. Refer to additional information in the paver section below.

Sidewalks shall be designed per Texas Accessibility Standards with a cross-slope (max. 2%) in the direction of site drainage patterns. Do not dowel sidewalks into adjoining foundations or entrances/exits to structures. A structural stoop outside of entrances/exits shall be designed as part of the foundation and graded by the site civil. Avoid surface drainage of stormwater across sidewalks.

Mow Strips

Planter areas that are adjacent to turf areas shall have a 12” wide x 4” thick, reinforced concrete mow strip with minimum No. 3 rebar and medium broom finish. Concrete shall be 5 sack mix, 3000 PSI at 28 days, minimum.

At the perimeter of all buildings not directly adjacent to paving or landscape beds, provide a continuous concrete mow strip minimum 24” wide x 4” thick to protect exterior building finishes from landscape maintenance equipment. Mow strip shall be separated from the building by an expansion joint and not doweled to the building foundation or slab.

Unit Pavers

Concrete, brick, or stone pavers may be utilized as a decorative element to define crosswalks, highlight building entrances, or identify major pedestrian pathways or connectors. When utilized, all pavers shall be placed on a sand leveling bed over cast-in-place concrete flatwork minimum 4” thick. Pavers placed directly over prepared subgrade (without concrete base) are prohibited.

Material continuity plays a significant role in connectivity and structure of a broader campus environment. That said, RELLIS does not currently dictate specific paver manufacturers and/or colors to be utilized due to the expansive size of the campus, the relatively low development density, and lack of a continuously connected pedestrian route throughout. All chosen paver products, materials, and colors require review and approval by RELLIS Administration during design and prior to purchase and installation.

SOLID WASTE

Bulk solid waste removal at RELLIS is provided via contracted service with Texas A&M University Utilities and Energy Services Solid Waste Department. Coordinate with RELLIS Administration

and UES regarding size and location of dumpsters for new construction projects. Based on facility size and projected waste stream, a trash compactor may be required. Dumpster or compactor location should be at grade level and should be placed so that it can be loaded from the top as well as the side.

Per RELLIS Campus Master Plan guidelines, all dumpsters and waste collection service areas shall be screened from public view with opaque walls or fencing as dictated by architectural guidelines for the associated development district. Waste collection areas should be adequately lit for nighttime access. At dumpster locations, provide a concrete pad of sufficient size and strength to accommodate the dumpster and truck. Provide concrete-filled steel pipe bollards as required to protect screen walls and/or fencing from both dumpsters and waste collection service vehicles.

SITE FURNISHINGS

Standard site furnishings are an integral part of the development of campus streets, open spaces, and pedestrian zones for a consistent campus character. These items should be consistently applied throughout the campus to the greatest extent possible. Guidelines for RELLIS site furnishings are intentionally flexible to allow creative design solutions and adapt to future growth of the campus.

Except for several key items below, RELLIS does not prescribe specific site furniture (i.e. benches, tables, chairs, etc.). However, all exterior furnishing selections shall be reviewed by RELLIS Administration during design and prior to purchase and installation. All site furnishings shall be selected utilizing the following guiding principles:

A. Fitness with Site and Context

B. Functionality

C. Economy

D. Quality

Bicycle Racks

Dedicated bicycle lanes and/or pathways are currently limited on the RELLIS Campus due to its expansive geographic area and low development density. All new construction projects should at a minimum plan an area for future bicycle parking as the campus continues to develop and non-vehicular mobility pathways are added. The number, type, and quantity of racks required will be determined during the schematic design phase in consultation with RELLIS Administration. Bicycle racks are not required for facilities located within the secure Proving Grounds.

RELLIS preferred bicycle rack selection is:

Loop Bike Rack – 35 Collection by Landscape Forms; color: gloss black

	Style	Depth	Length	Height	Product Weight
	Bike Rack	14"	36"	31"	25 lbs

Trash Receptacles

Provide trash receptacles to support pedestrian plazas, gathering spaces, or exterior building areas appropriate for incidental waste and to support a clean and well-maintained campus environment.

RELLIS preferred trash receptacle selection is:

Scarborough Litter Receptacle by Landscape Forms – side opening, vertical strap, single use; color: gloss black

	Side-Opening	25"	41"	Bar: 75 lb Strap: 81 lb

Decorative Bollards

Decorative bollards may be utilized in any area that has a need to restrict vehicular traffic but maintain a pedestrian connection. Decorative bollards may be provided in either lighted or unlighted versions. When lighted, provide hardwired connections only. Solar and/or battery powered bollard lights are expressly prohibited on the RELLIS Campus. Decorative bollards may be provided in either fixed or removable versions. When removable, they must be designed to be locked in place.

RELLIS preferred decorative bollard selection is:

Annapolis Bollard by Landscape Forms – 6” diameter, lit (hard-wired) or unlit, fixed or removable; color: gloss black

	Style	Diameter	Height	Product Weight
	6"	6"	33"	Surface Mount: 47lbs Embedded: 80lbs Removable: 107lbs

Note: standard 6” concrete-filled steel pipe bollards may be utilized at service yards, mechanical areas, etc. for protection of equipment, walls, overhead door jambs, etc. as required. When utilized for this purpose, steel bollards shall be painted safety yellow.

FENCING AND GATES

The RELLIS Proving Grounds utilize both ornamental metal and chain link fencing to define and separate secure areas depending on the campus location and bounding edges. Additionally, ornamental metal fencing may be utilized with prior review and approval by RELLIS Administration for screening of mechanical equipment and/or service areas depending on location within applicable development districts outlined in the Campus Master Plan. When utilized, fencing and gates on the RELLIS campus shall comply with the applicable guidelines below.

Ornamental Metal Fencing

RELLIS preferred product for Proving Ground Ornamental Fencing is:

Montage Commercial Ornamental Steel Fence by Ameristar Fence Products
www.ameristarperimeter.com

Pickets: 0.75” Sq. x 14 ga.
Rails: 1.5” x 14 ga.
Posts: 2.5” or 3” Sq. x 14ga.
Height: 8’ panels
Color: powder coated black

RELLIS preferred product for opaque metal panel fencing (screening yards/dumpster gates) is:

Cambridge Architectural Fence by Basteel Perimeter Systems; height: as required, color: Patrician Bronze.

Chain Link Fencing

Chain link fencing may be utilized in either galvanized or black vinyl coated applications subject to review and approval by RELLIS Administration. Secure Proving Grounds fencing, when not ornamental, is typically 8' tall galvanized chain link with tan privacy slats. Detailed fencing specifications shall be provided by the Architect or Engineer in consultation with RELLIS Administration. Minimum chain link fencing guidelines are indicated below:

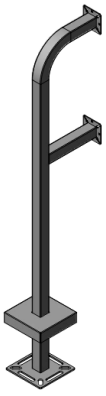
Terminal Posts: 3" Schedule 40
Line Posts: 2-3/8" Schedule 40
Top & Bottom Rails: 1-5/8"
Maximum Line Post Spacing: 120" O.C.
Tension Wire: 9 ga.
Tie Wire Spacing: every 15" on line posts and 24" on rails

Motorized Access Controlled Gates

Motorized Access Controlled Gates are typically utilized for access to the secure RELLIS Proving Grounds or to secured exterior service areas of a facility. Different configurations may be employed based on the layout of the area and/or facility. Typically, dual leaf (one lane in, one lane out) cantilevered sliding gates are preferred. Detailed specifications shall be provided by the Architect or Engineer in consultation with RELLIS Administration.

Motorized sliding gate operators manufactured by HySecurity (www.hysecurity.com) are preferred. Model selected based on gate length, gate weight, power and duty cycle requirements.

Gate entry shall be controlled by either proximity card reader or TransCore RFID toll tag reader mounted on a PedestalPro dual mount steel arm (www.pedestalpro.com). Proximity reader shall be in accordance with Division 28 guidelines for Building Access Control Systems (BACS) specified elsewhere in this document. Exit shall be via metal loop vehicle detection. Video surveillance camera shall be provided at each gate location situated for clear view of entering and exiting vehicles. Cameras shall be in accordance with Division 28 guidelines for Video Surveillance Management System specified elsewhere in this document.



LANDSCAPING

All landscape plantings shall be planned and designed to be compatible with the overall campus landscaping scheme and the current version of the RELLIS Campus Master Plan. Emphasis shall be placed on durability and low maintenance characteristics. Landscaping plans for all projects, regardless of size or complexity, shall be reviewed by RELLIS Administration and the SSC Grounds Maintenance Department during design and prior to installation.

Planting Design and Selection

Planting selection shall be in accordance with the approved plant list provided below. Plant spacing shall be determined by the plant species and shall be designed to accommodate height and spread at full maturity. Too often, landscape architects design a planting layout to achieve an immediate appearance of a mature landscape at substantial completion. RELLIS Campus' intent is for long term sustainable landscape designs that reflect appropriate spacing and coverage of plants, provide for reduced cost of maintenance, and minimize water usage.

Spacing shall be 100% of full mature crown size for all plants. The only exception to this requirement is for planting used for screening purposes. For screening, plant spacing should be reduced to 60% of mature growth size, and size at the time of planting should be increased.

All plant material shall be container nursery grown. Plants shall meet the American Standards for Nursery Stock. Plants shall be high quality, exhibit a growth habit that is normal for the species, and be sound, vigorous, healthy, and free from insects, weeds, disease and injury. Container, box, ball, height, and spread dimensions shall be measured according to specified standards and good practice.

Container plants shall have been in containers for sufficient length of time for root system to hold earth when taken from container but not long enough to become root-bound or cause "hardening-off." Heeled-in stock or stock from cold storage is not acceptable. Plants cut back from larger sizes to meet specifications will not be acceptable.

Plant names shall conform to those given in "Standardized Plant Names" latest edition, prepared by the American Committee on Horticultural Nomenclature, or be names generally accepted by the trade.

Plant Size

Plants will be measured when branches are in their normal position. Height and spread dimensions shown on the drawings refer to the main body of the plant and not branch tip to tip. Plants with a spreading or semi-spreading habit will be measured by the average diameter of the spread. Plant heights will be measured by the mean height from the ground line to the top of the canopy. Caliper measurements will be taken at a point on the trunk six (6) inches above natural ground for trees up to four (4) inches in caliper and at a point twelve (12) inches above natural ground for trees over four (4) inches in caliper. The caliper size for multi-trunked plants will be determined by adding the calipers of the largest cane and one-half (1/2) the caliper(s) of the second and third largest cane(s).

When a range of size is shown on the Drawings, no plant shall be less than the minimum size and at least 40% of the plants shall be as large as the maximum size shown on the Drawings.

The required measurements are the minimum sizes acceptable and are the measurements after pruning, when pruning is required. Sizes of plants or plant types such as vines, groundcovers, seedlings, young plants, understock, etc., will be measured in accordance with the plant standards or as indicated on the Drawings.

Mulch

Confirm current campus standard mulch type with RELLIS Administration and SSC Grounds Maintenance during project design. Mulch should be placed in minimum 3” thickness and trees and turf areas should have a mulch ring cut in with a beveled edge 3”-4” deep. Edge should be beveled toward the tree and flat against the turf edge to discourage mulch from migrating onto the turf.

Mulch material shall be free of large leaves and sticks that would prevent proper dressing of the mulched surface, free of harmful substances, and free of detrimental amounts of soil or other foreign matter that would promote early compaction, matting or deterioration of the mulch.

Planting Beds

Planting bed mix should be 40% sandy loam, 35% coarse sand, 25% well decomposed compost. This mix shall be used for the entire depth of the root zone for new annual flower beds and ornamental planting beds. Depth of the planter should be based on the plant material to be used. All planters should be irrigated. Crown surface for drainage.

If live perennial weeds exist on site at the beginning of work, spray with a non-selective systemic contact herbicide as recommended and applied by an approved licensed landscape pesticide applicator. Leave sprayed plants intact for at least fifteen (15) days to allow systemic kill. Apply herbicide in strict accordance with manufacturer’s instructions. Clear and remove these existing weeds by scraping or grubbing off all plant parts at least 1” below the surface of the soil over the entire area to be planted.

Remove existing soil to an overall depth equal to twelve inches (12”) below finish grade. Till exposed soil to a minimum depth of six (6) inches. Ensure that bed is adequately drained to prevent water retention in the landscape bed. Add 12 inches of prepared planting bed mixture accounting for settlement. Soil and compost can be pre-mixed or tilled in place. Mulch all planting areas when plant installation is complete with a minimum settled depth of three inches (3”) of composted shredded hardwood mulch.

At time of planting, all areas to be planted shall be free of concrete, bricks, stones, stumps, or other deleterious matter 1" in diameter or larger and shall be free from all wire, plaster or similar objects including construction debris that would be a hindrance to planting or maintenance. At final completion of any landscape project the landscape beds should be weed free.

Turf Areas

All areas disturbed by a project which are not replaced with new permanent structures, paving/hardscape, and/or planting beds shall be graded to properly drain and new full coverage permanent turf established prior to acceptance and turnover to the RELLIS Campus. NO

EXCEPTIONS. This includes drainage ditch and drainage channel side slopes and bottoms. No significant bare spots or areas of erosion shall exist at the time of substantial completion.

Permanent turf shall be accomplished either through the installation of sod, seeding (drill seed or hydroseed), or some combination of both. Determination of areas to receive sod vs. seed shall be reviewed with RELLIS Administration during design. Due to the expansive size of the RELLIS Campus and recognizing that project budgetary constraints exist, the general framework below should be utilized for project planning. The RELLIS Campus Master Plan defines three main types of landscape areas (indicated below). Guidelines for turf implementation follow each description:

A. Maintained Areas: Building perimeters, parks/public green space, and the perimeter of pedestrian activity. These areas should be established with sod and permanent full coverage turf irrigation. Sand cap mix specified below shall be provided at all areas receiving sod.

B. Natural Areas: Areas identified as part of tree preservation or open space but not directly within an identified park or campus green. These areas may be established primarily with seed, but selected areas including pavement edges and drainage channels may be sodded. Permanent irrigation is encouraged but temporary irrigation may be utilized to establish turf. Sand cap mix is encouraged but not required. The placement of locally available topsoil is required to a minimum depth of 3” in seeded areas to ensure adequate organic base material for germination of seed.

C. Undisturbed Areas: All other green areas, including those adjacent to stormwater management and those forming an undisturbed buffer area. These areas should be established with seed. Temporary irrigation should be provided only as necessary to re-establish turf and prevent erosion/sedimentation. Although some amount of organic topsoil is highly recommended to support germination of seed, native clay soils may be used provided they are backfilled and graded in accordance with other related provisions of these guidelines.

Sod

All turf areas to receive sod shall have a minimum 4” deep sand cap mix placed and fine graded before placement of turf; 6” is recommended. Soil depths are to be measured after settling by irrigation and/or light compaction from no more than 2 passes with a smooth drum 1-ton roller.

Sand cap mix shall contain the following:

≤10% clay
≤20% silt
≤20% total silt plus clay
≥80% sand
pH = 5.5-7.5 or have a plan to amend it to reach this range EC = <2 mmhos/cm
Sodium absorption ratio (SAR) = <3

Soil shall be free of sticks, stones and debris larger than 3/4". Soil shall be free of weeds, other undesirable vegetation, oil, or any other anthropogenic chemicals. Locally procured soil is preferred over imported soil. RELLIS has a number of locations in the RTA4 area (former Knife

River Quarry) where topsoil has been stockpiled or is available for use on campus projects. If a local source of native sand meeting these specifications cannot be located, commercially available masonry sand should be sampled and tested to see if it meets the above specifications.

Specify Bermuda grass cultivar 'Tif-Tuf'.

Sod shall be composed of certified, approved, or nursery grown grass and shall be true to name/variety. Sod shall be substantially free of noxious weeds, disease, insects, thatch and undesirable grasses. Sod shall have a sufficient density so that no surface soil is visible at a mowing height of 1-1/2 inches. Sod shall be neatly mowed and mature enough that when grasped at one end it can be lifted and handled without damage to the sod. Maximum mowing height shall be 2-1/2 inches.

Sod shall be cut to provide a sufficient root zone and stand of live grass. Sod shall be cut with a uniform soil portion of a ½" thickness, plus or minus ¼ inches. Sod shall be cut, delivered and installed within 24 hours of cutting. Sod shall be cut by mechanical means such as sod cutters. Sod shall be cut when the moisture content (either excessively wet or dry) will affect the lifespan of the sod.

Area to be designated for sod, shall be fine graded, smoothed, with Sand Cap Mix placed before final grading. If soil is dry, lightly moisten before placement of sod. First row of sod shall be placed in a straight line with additional placement of rows shall be parallel and tightly placed against each row. Staggered lateral joints butted tightly shall be used. Sod shall not be stretched or overlapped.

Sod should not be laid on top of existing grass or weeds. For new construction or for landscape repairs it should be cut in to match the surrounding grade.

Sod on slopes greater than 3:1 shall be placed perpendicular to slope. Sod on slopes shall be temporally fastened to ground by stakes, staples, pegs or other approved methods. After sod has become established, contractor shall remove fasteners.

Sod shall be lightly rolled after the section is placed. Once sod has been placed, immediately water sod to prevent excessive drying. Thoroughly water sod so that underside of sod and soil are completely wet.

At final completion of any landscape project the sod should be weed free.

Seed (Hydroseed or Drill Seed)

Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseeding applications. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

Seed content in the slurry mixture shall be as follows:

A. Sahara Bermuda Grass – 4 lbs. per 1,000 square feet.

B. Common Bermuda Grass – 4 lbs. per 1,000 square feet.

C. Annual Rye Grass – 8 lbs. per 1,000 square feet. Annual rye grass shall be included only if the construction schedule dictates that seed be installed between October 1st and March 15th. If annual rye is installed the contractor must return in February and scalp the rye grass tight to the soil. The clippings shall be raked up and removed from the site. This must be done as many times as necessary to eradicate the rye grass and prior to re-seeding with Bermuda grass.

It is the responsibility of the contractors to schedule the installation of the seed at the optimum growing season. No additional compensation shall be provided for the scope of work associated with the installation of rye grass.

Hydroseed shall be applied in a uniform cover. Immediately remove and clean all overspray from trees, shrubs, curbs, pavement, fire hydrants, light poles and other site improvements.

If drill seeding is utilized, perform the following two-step process:

A. Apply broadcast fertilizer.

B. Uniformly distribute seed with a turfgrass drill seeder. The area shall be drilled from two directions with at least 45-degree difference in angle of approach. After seeding, all areas shall be culti-packed until a minimum of 85% of the seed is covered or otherwise accepted by the Landscape Architect and/or Owner's Representative.

Required Contractor Maintenance Period (90 days)

Following substantial completion and prior to final acceptance, the Contractor shall provide a comprehensive landscape maintenance program for a minimum of ninety (90) calendar days. No sooner than 2 weeks prior to the expiration of the 90-day period, the Contractor shall request a turnover inspection by RELLIS Administration and the SSC Grounds Maintenance Representative. If it is determined that the landscape is not ready for turnover, the maintenance period will continue until all requirements are met.

Contractor maintenance shall include the following:

A. Watering of trees, plantings and turf.

B. Monitoring, adjustment, and minor repairs of the irrigation system.

C. Mowing, edging, and trimming of all turf areas.

D. Monitoring, fertilizing, weeding and cultivating all turf areas.

E. Pruning and trimming of plant material.

F. Weeding, cultivating, and cleaning planting beds.

G. Application of fertilizers, insecticides, and herbicides.

H. General site clean-up and removal of trash.

I. Replacement of dead or diseased trees, shrubs, groundcovers, sod and seed as necessary.

J. Other miscellaneous services as needed to ensure the landscape is maintained to the standards of these guidelines and the Campus Master Plan.

TREES

RELLIS Administration recognizes and values the importance of campus trees as an essential and valuable resource and as a major component of the campus identity. These guidelines provide procedures regarding tree design, selection, maintenance, preservation, protection, and replacement.

Definitions:

A. Caliper *Inch:* is the diameter of a young tree. It is measured 6” above ground for trees up to and including 4” caliper size. If caliper at 6” above ground exceeds 4” caliper, the tree will then be measured at 12” above the ground. Newly planted (nursery stock) trees on the RELLIS Campus are measured in caliper inches.

B. *Critical Root Zone (CRZ):* an area from the base of the tree that extends beyond the drip line. It is equal to 1 foot radius for every inch of stem diameter. This minimum area is needed for tree and root health and stability.

C. *Diameter at Breast Height (DBH):* a standard method of measuring stem diameter 4.5 feet above the ground. Established trees on RELLIS campus are measured in DBH inches.

D. *Drip Line:* Considered the outer edge of the tree canopy. An imaginary vertical point that extends from the canopy edge to the ground.

E. *Pruning:* The removal of dead, dying, diseased, or live, interfering objectionable and weak branches in a scientific manner.

F. *Replacement Tree*: A self-supporting tree on the RELLIS Campus Master Plan Species list that meets caliper inch requirements.

Reference Standards

A. National Arborist Association (NAA)

B. American Association of Nurserymen (AAN)

C. American National Standards Institute (ANSI)

D. International Society of Arboriculture (ISA)

E. Tree Care Industry Association (TCIA)

F. US Forest Service Urban and Community Forest

G. Arbor Day Foundation

H. Texas A&M Forest Service

Preconstruction Requirements

A. Preconstruction Meeting: At least 7 days prior to the start of work, a pre-construction meeting with the Owner's Representative shall be set to review any questions the contractor may have regarding the work, administrative procedures during construction, and project work schedule as the questions relate to trees. This meeting should be held on the construction site when applicable and possible. This meeting shall include:

1. RELLIS Administration Representative
2. General Contractor
3. SSC Grounds Maintenance
4. ISA Certified Arborist (If outside arborist is overseeing work)
5. Subcontractor assigned to install trees and tree protection
6. Earthwork Contractor
7. All Site Utility Contractors that may be required to dig or trench into the soil
8. Landscape Subcontractor
9. Irrigation Subcontractor

B. Construction Site Tree Assessment: Prior to any construction, the General Contractor shall provide an evaluation of all existing trees on site. The Assessment shall include all potential root pruning, branch pruning, tree removals, transplanting, and/or the current health of the trees and an ongoing care plan. This assessment must be approved by SSC Grounds Maintenance and a RELLIS Administration Representative.

Critical Root Zone (CRZ)

The General Contractor or Construction Manager shall coordinate specific requirements regarding tree protection fencing, construction storage, construction parking, construction traffic through site, scaffolding, forms, foundation or any other issues as they relate to CRZ. This shall be the minimum amount of preservation required with any additional requirements determined in coordination between the SSC Grounds Maintenance Representative and the Owner's Representative.

One foot of radial protection per diameter inch of tree shall determine the CRZ (i.e., a 25" tree would have a 50-foot diameter CRZ).

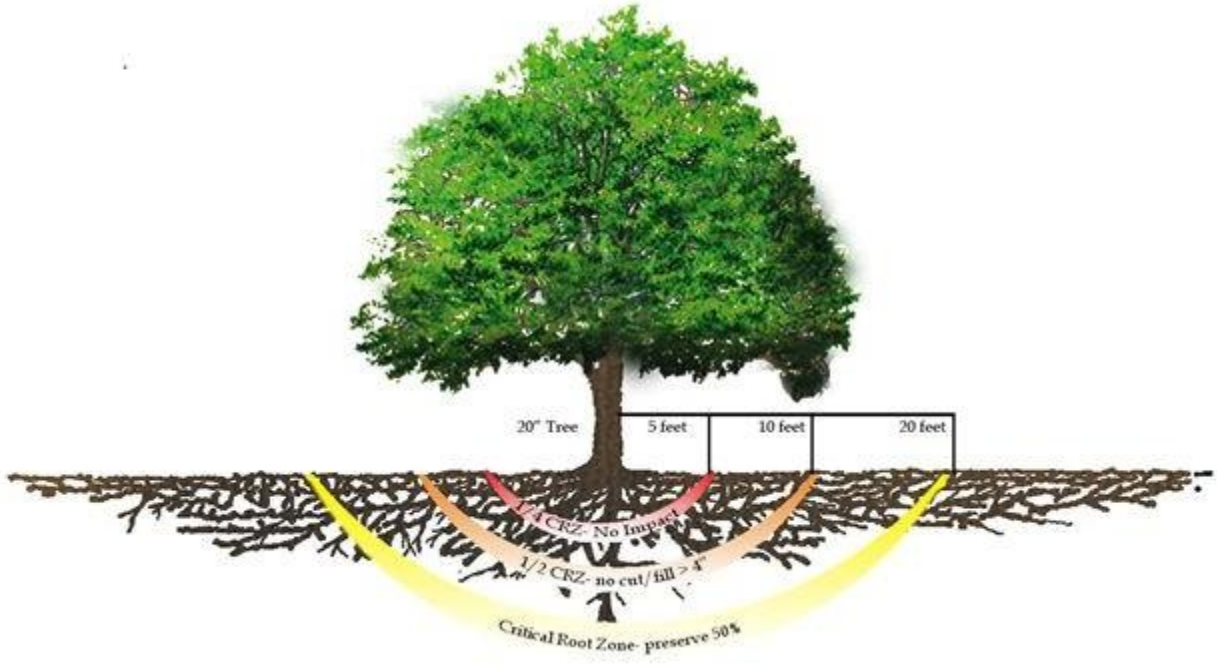
Identified Protection Areas:

A. A quarter (25%) of the CRZ means no impact is allowed in this area.

B. Half of CRZ (50%) means no cut or fill greater than 4" is allowed in this area (i.e., for a 25" tree it would be 25 ft in diameter).

C. Total CRZ needs to be preserved by at least 50%.

The Critical Root Zone – Development Impact Example: 20” diameter tree



Tree Protection

All trees shown on the construction plans to be preserved shall be protected with temporary chain-link fencing. In areas where installation of chain-link fencing would be detrimental to a tree or a tree’s root system, other methods of fencing may be acceptable per approval from RELLIS Administration.

Protection fencing shall be installed prior to the start of any site preparation work (clearing or grading) and shall be maintained throughout all phases of the construction project until substantial completion and the approval to remove the fencing from RELLIS Administration.

Tree protection fencing that is damaged or found to be non-compliant shall be repaired/replaced within 24 hours of notice or a stop work order shall be given.

Erosion and sedimentation control barriers shall be installed or maintained in a manner that does not result in damage to the tree or Critical Root Zone (CRZ) and in a manner that does not result in soil buildup.

Protective fences shall surround the trees or groups of trees and will remain at the location specified in the approved site plan. For natural areas, protective areas shall follow the limit of construction in order to prevent the following:

A. Soil compaction in the root zone area as a result from vehicular traffic, parking or storage of equipment and materials.

B. Root zone disturbances due to grade changes (greater than 4 inches of cut or fill). No removal of soil or piling of soil is permitted with the CRZ of protected trees.

C. Compaction from construction activities, including personnel or equipment resting under protected trees.

D. Welding or any other heat sources under or near trees.

E. Other activities detrimental to trees such as chemical storage, concrete wash out and other construction spoils.

F. Portable toilets should not be placed within any CRZ of a protected tree.

G. Exceptions to installing fences at CRZ shall be permitted in the following cases:

1. Where there is to be an approved grade change, impermeable paving surface, tree well, or other such site development, erect the fence 2 to 4 feet beyond the area disturbed.
2. Where permeable paving is to be installed within a tree's CRZ, erect the fence at the outer limits of the permeable paving area (prior to site grading so that the area is graded separately prior to paving installation to minimize root damage).
3. Where construction activities come within 6 feet of any tree, Permission must be obtained from RELLIS Administration prior to any work. If approved, protection of the trunk with strapped on planking to the height of 8 feet (or the limits of lower branching) may be required in addition to the reduced fencing provided.
4. Where trees are close to proposed buildings, erect the fence so there is 6 to 10 feet of workspace between the fence and the building.

Projects on the RELLIS campus shall adhere to specifications based on the most current editions of the following:

A. American National Standards Institute (ANSI) A300– 05 Management of Trees and Shrubs during Site Planning, Site Development, and Construction (latest edition).

B. ANSI Z133.1 Safety Standards

C. Related ISA Best Management Practices (BMP's)

Trees within limits of construction are ultimately the property of RELLIS Campus. All attempts shall be made to ensure survivability of trees including:

A. Continuous inspection of tree protection fencing installed per Campus specifications and approved site plan.

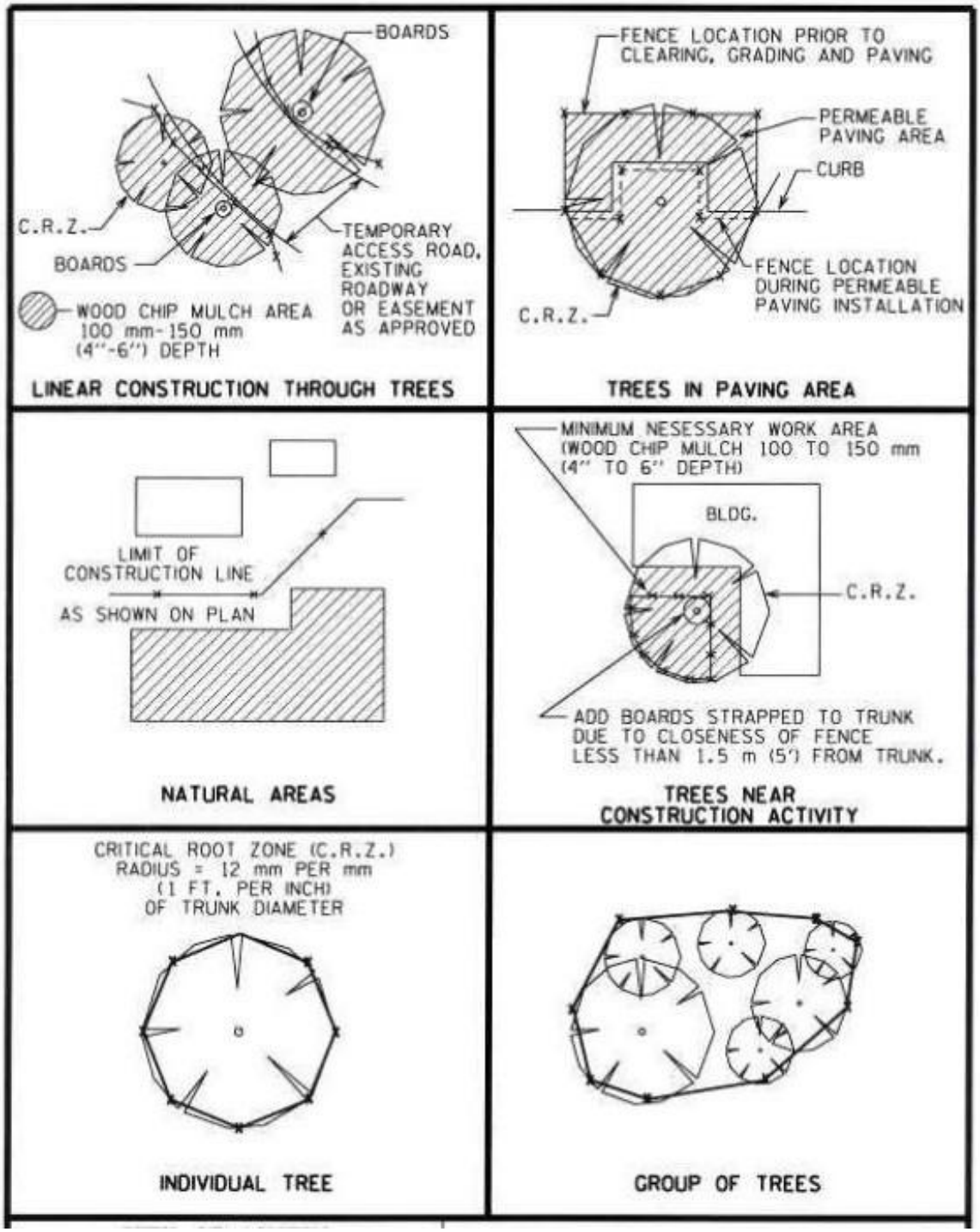
B. Any encroachments into tree protection fencing and CRZs shall be brought to the attention of the Owner's Representative, Construction Inspector, and/or SSC Grounds Maintenance Representative.

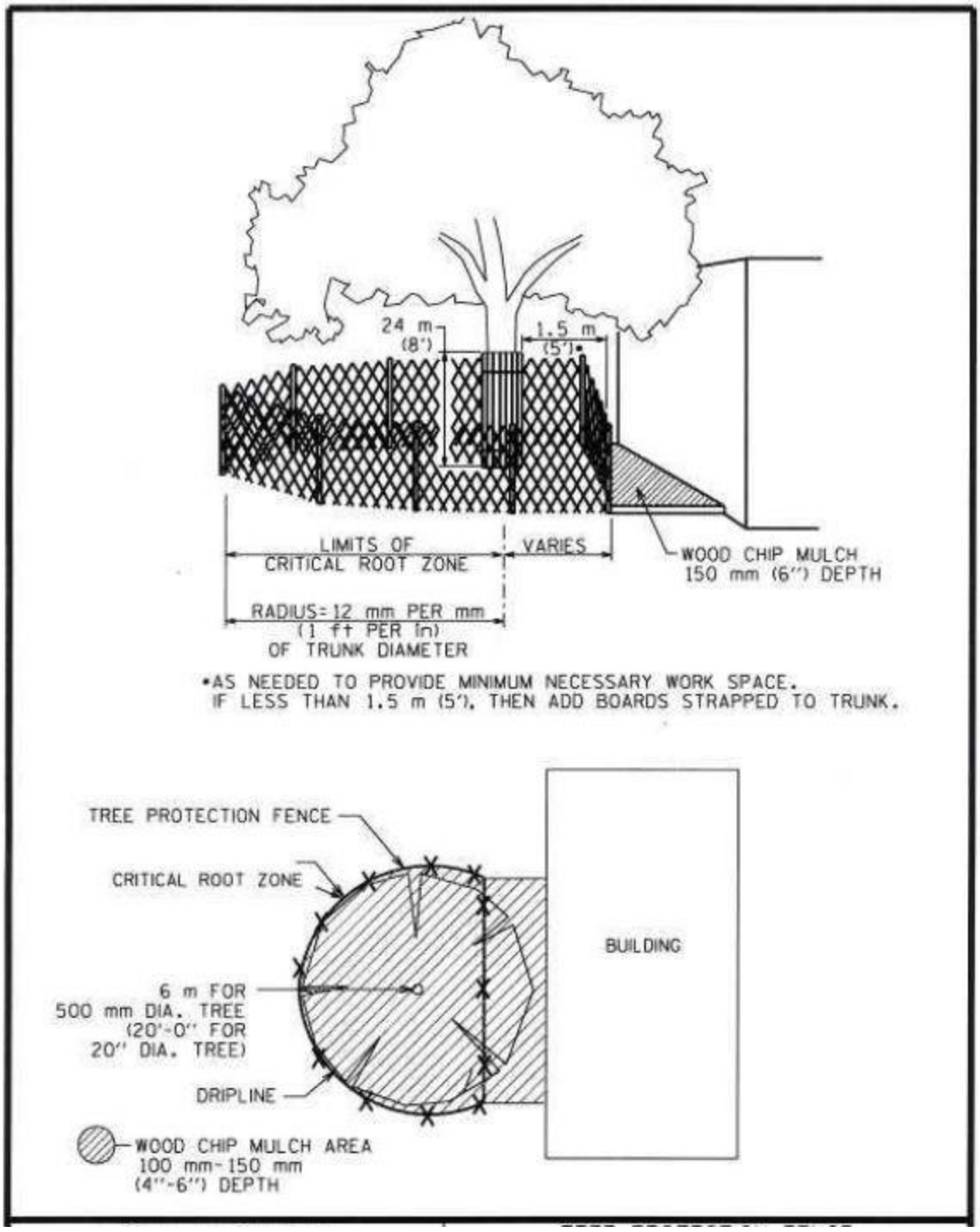
C. Deviations from approved tree preservation plans will occur only with written authority from RELLIS Administration.

Any roots two inches (2") or greater severed by construction activities shall be pruned flush with the soil. Roots severed shall be backfilled with quality soil or compost as soon as possible. Cuts

to oak roots shall be made using disinfected tools and painted when finished. If exposed roots are not backfilled within 48 hours, cover them with organic material in a manner that reduces soil temperature and minimizes water loss due to evaporation.

Sample Tree Protection Details




24 m
(8')
1.5 m
(5')*
LIMITS OF
CRITICAL ROOT ZONE
VARIES
WOOD CHIP MULCH
150 mm (6") DEPTH
RADIUS=12 mm PER mm
(1 ft PER in)
OF TRUNK DIAMETER
*AS NEEDED TO PROVIDE MINIMUM NECESSARY WORK SPACE.
IF LESS THAN 1.5 m (5'), THEN ADD BOARDS STRAPPED TO TRUNK.
TREE PROTECTION FENCE
CRITICAL ROOT ZONE
BUILDING
6 m FOR
500 mm DIA. TREE
(20'-0" FOR
20" DIA. TREE)
DRIPLINE
WOOD CHIP MULCH AREA
100 mm-150 mm
(4"-6") DEPTH

Tree Removal

Trees approved for removal shall be removed in a manner that does not impact trees to be preserved. Contractor performing tree removal shall coordinate with SSC Grounds Maintenance and RELLIS Administration to remove selected trees in a manner that will enable them to be processed into usable materials.

Campus Heritage Trees (24" DBH and above) shall not be removed without approval by RELLIS Administration. Review will take into account the following:

A. Current health of the tree (tree is dead, tree is a risk, or tree is diseased).

B. The tree is a danger to the public.

C. The tree is infected with insects or disease, and its removal is recommended practice to prevent transmission.

D. The tree is creating an extreme nuisance because of its species, size, location, or condition. The nuisance could be caused by fruit or seed drop, root conflicts and excessive twig or limb breakage.

E. The tree severely interferes with growth and development of a more desirable tree.

F. The tree's aesthetic value is so low that the site would be enhanced visually by the removal of the tree.

G. Any construction, improvements or maintenance to be made around the tree would substantially interfere with the tree's natural growth and size or would damage or destroy it.

H. The tree has been topped or disfigured thus producing an unsound branching structure conducive to severe storm damage, wind throw and accelerated death.

I. Final approval will be determined by RELLIS Administration.

Tree Planting

Projects on RELLIS Campus shall adhere to specifications based on the most recent editions of the following for tree planting:

A. American National Standards Institute (ANSI) A300–06, Planting and Transplanting Standards (latest edition)

B. American National Standards Institute (ANSI) Z60.1, Standards for Nursery Stock

C. ANSI Z133.1 Safety Standards

D. Related ISA Best Management Practices (BMP's)

General Design Guidelines:

A. RELLIS Administration will not approve designs proposing additional tree plantings within existing tree canopies and CRZ.

B. There shall be no site improvements located within the CRZ of existing trees. Site improvements include light fixtures, signage, paving that requires excavating, tables/benches/walls that require footings.

C. There shall be no plant materials located within CRZ, including turf and groundcovers. Mulch only.

D. Refer to RELLIS Campus Irrigation Guidelines. Every newly planted tree shall have a minimum of one irrigation bubbler installed, with the goal of watering as much of the root ball surface area as possible.

E. Place three (3) T-posts around each newly planted tree, and drive into existing soils. Preferred attachment method incorporates Arbortie-green by Deeproot Products or equivalent in lieu of wire or rope. Stakes should be removed after the first growing season. Posts must be marked for safety (painted, safety caps, etc.). Six-foot T-posts are the typical means of staking. Thirty-gallon trees and below should have untreated 1" x 1" wooden stakes driven through the root ball into undisturbed soil.

Planting of Containerized Trees:

A. Roots of bare root trees should be moist and protected at all times prior to planting. Prepare planting hole for each plant before removing it from their protected area.

B. The prepared hole shall be large enough to spread the roots without crowding. The sides of the hole shall be roughed to ensure glazing of hole does not occur.

C. Inspect roots and prune any that appear broken or damaged.

D. Any tree that does not obviously have the root flare planted above grade will be rejected.

E. Backfill with existing soil from the excavated hole and add the soil into the hole a few inches at a time, firming the soil after each addition. While backfilling, be sure the plant remains vertical and be careful not to damage roots. Use water to settle the soil around the roots while backfilling. Do not compact wet soil.

F. After backfilling is complete, do not form a ridge (berm) around the edge of the hole to hold water.

G. The edge of the tree ring should be cleanly cut with a 3" deep beveled shovel cut edge which holds mulch in place and prevents surrounding turf from growing into the tree ring.

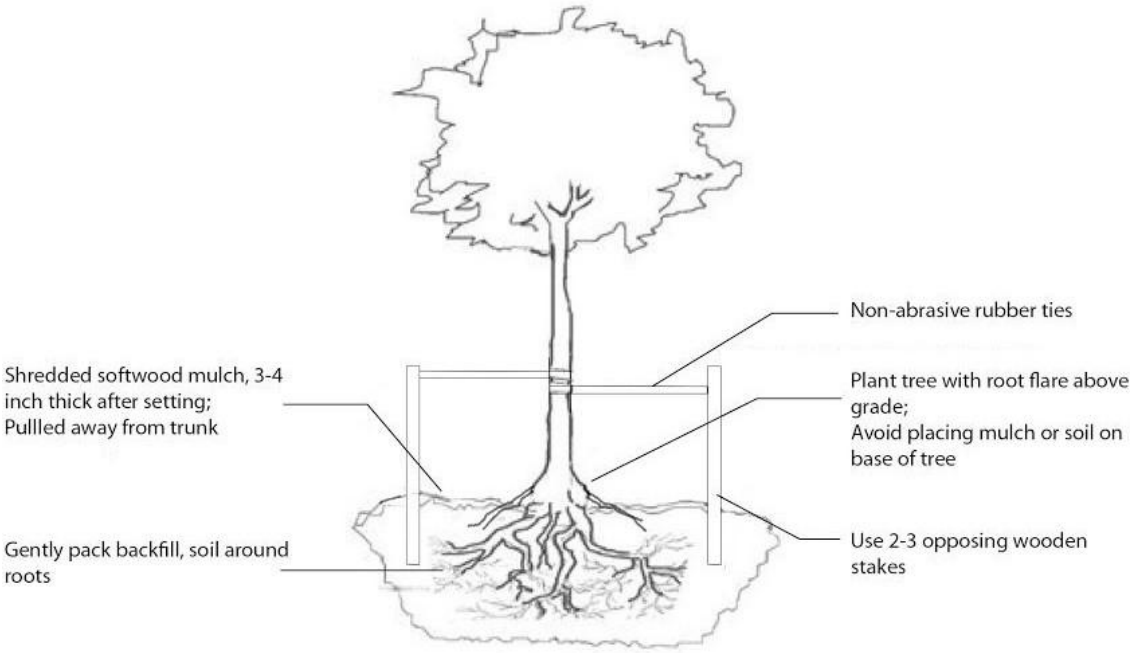
H. There should be no weeds, sod or debris in the tree ring.

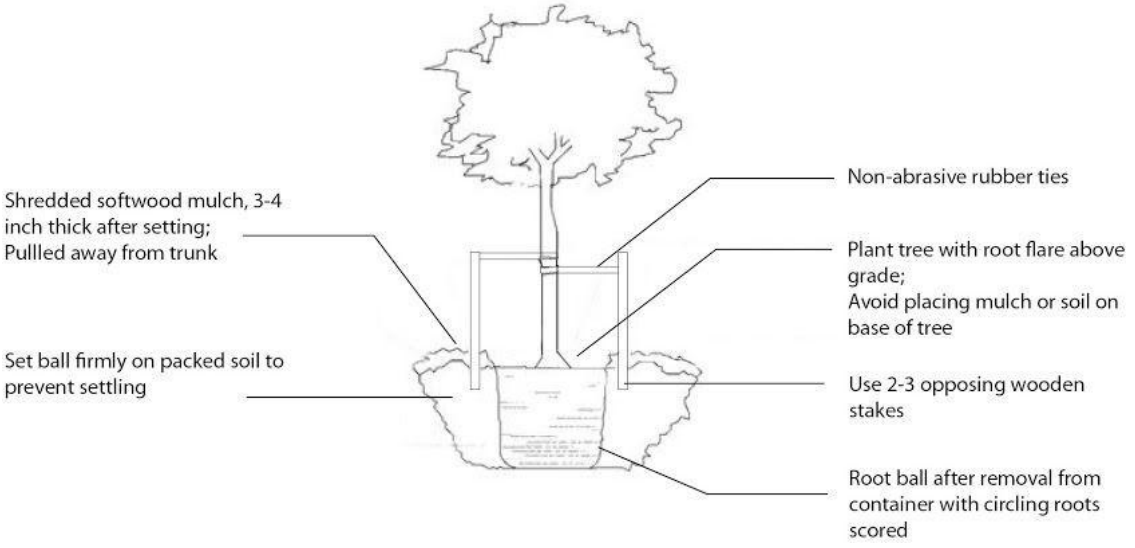
I. Tape, plant tags and bamboo support poles should be removed at planting.

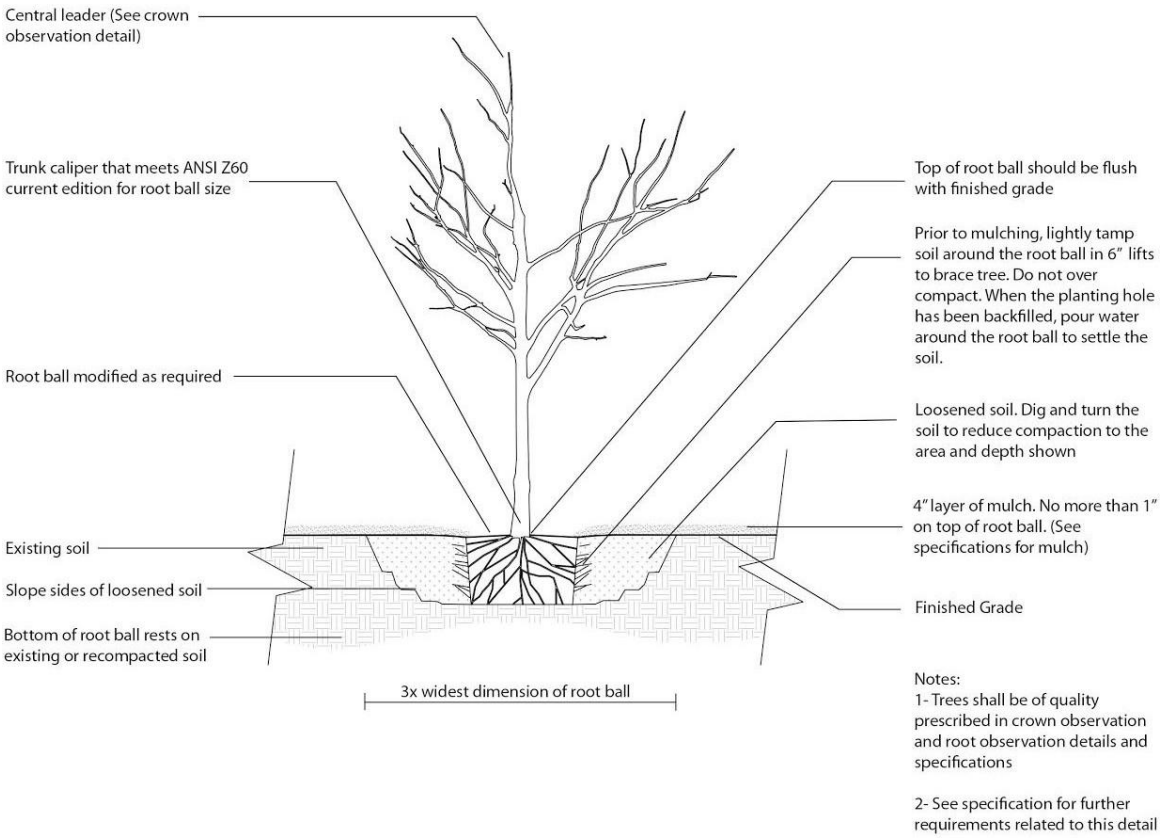
J. Ground pine bark mulch should be applied at 3" depth and should be pulled away from the trunk of the tree.

K. Thoroughly water the tree at installation.

Sample Tree Planting Details







Tree Pruning

Projects on RELLIS campus shall adhere to specifications based on the most current editions of the following for tree pruning:

A. American National Standards Institute (ANSI) A300 - 01 Pruning Standards (Latest)

B. ANSI Z133.1 Safety Standards

C. Related ISA Best Management Practices (BMP's)

Contractors will apply the standards and guidelines when engaged in pruning operations on campus. To ensure that pruning is appropriate for the species and tree/site conditions, it is important to have a clear understanding of the specific needs of the tree and the objectives for pruning.

Requirements for Pruning Trees:

A. No more than 25% of the tree may be pruned. Anything above 25% must be discussed and approved by SSC designated Arborist.

B. No tree shall be cut back in such a manner that its health will be impaired. An exception to this may occur in tree removal or emergency storm damage situations in which protecting people or property is urgent. Any emergency procedures shall be brought to the attention of the SSC designated Arborist.

C. When pruning cuts are made to a lateral branch, the remaining branch must possess a basal thickness of at least half the diameter of the wound affected. Such cuts shall be considered correctly done when the branch collar is left intact and the cut is not “flush” with the stem.

D. Tree branches shall be removed and controlled in such a manner as not to cause damage to other parts of the tree or to other plants and property.

E. All cutting tools and saws used in pruning shall be kept adequately sharpened so as to retain smooth surfaces and secure bark on all cuts.

F. Precautions for the inadvertent transmittal of oak wilt will be recognized. This includes the disinfecting of cutting tools between trees and cuts to be treated with tree wound dressing.

G. Pruning Objectives:

1. Maintenance Pruning: Recommended when the primary objective is to maintain or improve tree health and structure and includes risk reduction pruning.
2. Risk Reduction Pruning: Recommended when the primary objective is to reduce overall tree risk and chance of limb or tree failure.

H. Pruning Types:

1. Crown Cleaning: The selective removal of one or more of the following items: dead, dying or diseased branches, weak branches and water sprouts.
2. Crown Thinning: The selective removal of branches to increase light penetration, air movement and to reduce weight.
3. Crown Raising: The removal of lower branches to provide clearance.
4. Crown Reduction or Shaping: Decrease the height and/or spread of a tree. Consideration should be given to the ability of the species to sustain this type of pruning.
5. Vista Pruning: The selective thinning of framework limbs or specific areas of the crown to allow a view of an object from a predetermined spot.
6. Crown Restoration: Should improve the structure, form and appearance of trees that have been severely headed, vandalized or storm damaged.

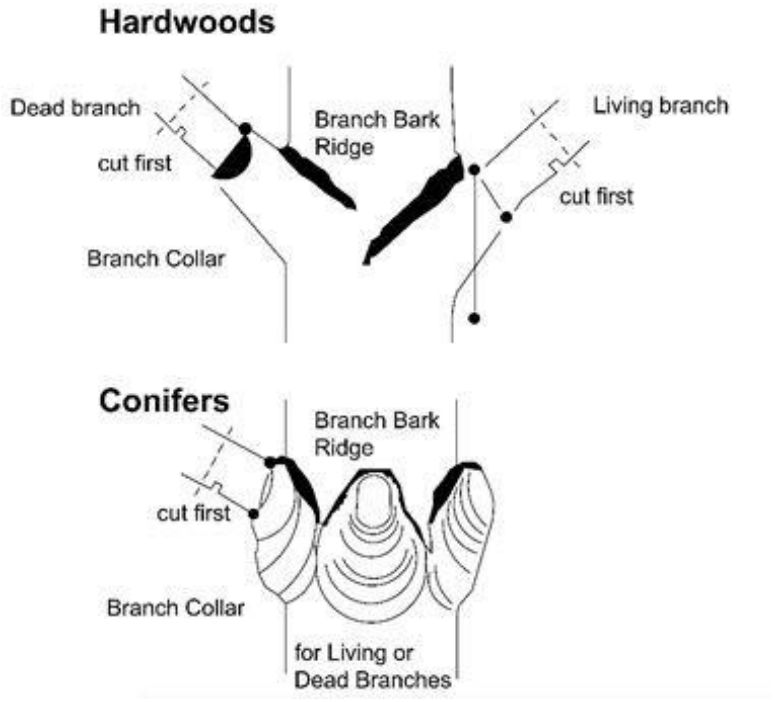
I. Campus Clearance Recommendations:

1. All trees and/or branches in or around infrastructure shall be shortened or removed when necessary to prevent damage to infrastructure or tree.
2. Growth on the tree should be directed away from infrastructure such as buildings, light poles, power lines and signs by reducing and/or removing limbs on that area of the tree.
3. Vertical clearance for roads shall provide a minimum clearance of 14’ above street level. An 8’ vertical clearance shall be provided for pedestrian walkways.
4. Clear all branches and foliage in contact with or within 2’ of roofs, walls, stairways, decks or other building appendages to the extent feasible while maintaining aesthetics and canopy structure. Prune to direct growth parallel to or away from the building.

Exceptions will be made in instances that operations will eventually hinder the structural integrity of the tree or clearly cannot conform to ANSI A300 standards.

J. Prohibited Pruning Acts:

1. Excessive Pruning: Except for clearance of utility lines, traffic or abating a public nuisance, excessive pruning will not be tolerated.
2. Topping: Topping is the indiscriminate cutting of tree branches to stubs or lateral branches that are not large enough to assume the terminal role. Other names for topping include “heading”, “tipping”, “hat-racking”, and “rounding over”.
3. “Lion Tailing”: Excessive removal of branches from the lower two-thirds of a stem or branch.
4. No pruning of a tree’s canopy shall take place to compensate for removal or damage to its root system.
5. No cavities shall be filled with any substance (except in instances of beehive relocations)



APPROVED PLANT LIST

The plant list below is intended to be used as a guide. Plants included in this list should be selected with care to ensure the appropriate microclimate. Any additions or substitutions to this list must be requested and approved in writing by RELLIS Administration. Failure to gain approval will result in replacement of unapproved plant material at no cost to the Owner.

Type	Common Name	Scientific Name
Shade Trees	Bur Oak	*Quercus macrocarpa*
	Cedar Elm	*Ulmus crassifolia*
	Chinkapin Oak	*Quercus muehlenbergil*
	Common Bald Cypress	*Taxodium distichum*
	Live Oak	*Quercus virginiana*
	Mexican Sycamore	*Quercus polymorpha*
	Montezuma Cypress	*Taxodium distichum var. mexicanum*
	Willow Oak	*Quercus phellos*
***Note: Monterrey Oaks (Quercus polymorpha) are not permitted for new installations at RELLIS as they do not tolerate the salinity of the campus irrigation water.*		
Medium Trees	Cherry Laurel	*Prunus caroliniana*
	Eagleston Holly	*Ilex x attenuata "Eagleston"*
	Japanese Blueberry Tree	*Elaeocarpus decipiens*
	Lacebark Elm	*Ulmus parvifolia*
	Mesquite	*Prosopis glandulosa*
	River Birch "Duraheat"	*Betula nigra "Duraheat"*
Ornamental Trees	Common Crapemyrtle	*Lagerstroemia indica*
	Evergreen Sumac	*Rhus virens*
	Forest Pansy Redbud	*Cercis canadensis*
	Mexican Plum	*Prunus mexicana*
	Possomhaw Holly	*Ilex decidua*
	Prairie Flameleaf Sumac	*Rhus lanceolata*
	Purple Leaf Plum	*Prunus cerasifera*
	Southern Waxmyrtle	*Myrica cerifera*
	Tree Yaupon	*Ilex vomitoria*
	Vitex	*Vitex agnus-castus*
Evergreen Shrubs	Boxwood	*Buxus microphylla*
	Chinese Fringe Flower	*Loropetalum chinense*
	Dwarf Burford Holly	*Ilex cornuta "Dwarf Burford"*
	Dwarf Palmetto Palm	*Sabal minor*
	Dwarf Waxmyrtle	*Myrica cerifera*
	Dwarf Yaupon	*Ilex vomitoria*
	Glossy Abelia	*Abelia x grandiflora*
	Gray Cotoneaster	*Cotoneaster glaucophyllus*
	Indian Hawthorn	*Raphiolepis spp.*
	Japanese Pittosporum	*Pittosporum tobira*
	Japanese Yew	*Podocarpus macrophyllus*
	Mahonia	*Mahonia bealei*
	Nandina	*Nandina domestica*
	Nellie R. Stevens Holly	*Ilex cornuta*
	Primrose Jasmine	*Jasminum mesnyi*
	Rosemary	*Rosmarinus officinalis*
Perennials & Other Shrubs	American Beautyberry	*Callicarpa americana*
	Artemisia	*Artemisia x "Powis Castle"*
	Blue Plumbago	*Plumbago auriculata*

	Bulbine	*Bulbine frutescens*
	Daylily	*Hemerocallis spp.*
	Dwarf Pomegranite	*Punica granatum*
	Firebush	*Hamelia patens*
	Firecracker Fern	*Russelia equisetiformis*
	Flame Acanthus	*Anisacanthus quadrifidus*
	Fragrant Sumac	*Rhus aromatica*
	Gaura	*Gaura lindheimeri*
	Giant Hesperaloe	*Hesperaloe funifera*
	Giant Turk's Cap	*Malvaviscus arboreus var. drummondii*
	Inland Sea Oats	*Chasmanthium latifolium*
	Jerusalem Sage	*Phlomis fruticose*
	Knock-out Rose	*Rosa x "Knock-out"*
	Lily-of-the-Nile	*Agapanthus africanus*
	Louisiana Hybrid Iris	*Iris x "Lousiana Hybrids"*
	Mexican Heather	*Cuphea hyssopifolia*
	Mexican Mint Marigold	*Tagetes lucida*
	Oakleaf Hydrangea	*Hydrangea quercifolia*
	Pride-of-Barbados	*Caesalpinia pulcherrima*
	Red Yucca	*Hesperaloe parviflora*
	Russian Sage	*Perovskia atriplicifolia*
	Rusty Blackhaw Viburnum	*Viburnum rufidulum*
	Texas Lantana	*Lantana urticoides*
	Texas Sage	*Leucophyllum frutescens "varieties"*
	Texas Sotol	*Dasylirion texanum*
	Trailing Lantana	*Lantana montevidensis*
	Turk's Cap	*Malvaviscus arboreus var. mexicanus*
	Variegated Ginger	*Alinia zerumbet*
	Walking Iris	*Neomarica gracilis*
	White Butterfly Iris	*Dietes iridioides*
	Yellow Bells	*Tecoma stans var. angustata*
	Yellow Bicolor Iris	*Dietes bicolor*
	Yellow Yucca	*Hesperaloe parviflora*
Ornamental Grasses	Bamboo Muhly	*Muhlenbergia dumosa*
	Deergrass	*Muhlenbergia rigens*
	Gulf Muhly	*Muhlenbergia capillaris "Regal Mist"*
	Lindheimer Muhly	*Muhlenbergia lindheimeri*

IRRIGATION

The guidelines below are intended to cover a complete irrigation system from design to installation for the RELLIS campus. All plans for new or renovated irrigation systems are to be reviewed and approved by RELLIS Administration in consultation with SSC Grounds Maintenance and the assigned project manager (TAMUS FP&C or SSC EDCS).

General Requirements

Ensure all irrigation designs and installations comply with relevant codes and regulations. The design and installation of the irrigation system must meet the requirements of TCEQ (Texas Commission on Environmental Quality). The irrigation system must be installed under the supervision of a licensed irrigator.

Supply and install the components required for an automatic irrigation system to provide supplemental water to the intended landscape efficiently and uniformly. All materials shall be installed in strict accordance with the manufacturer's installation specifications, which shall be considered a supplement to these specifications.

The Landscape Architect and/or Project Irrigation Designer shall prepare scaled design drawings of the proposed irrigation system which meets Irrigation Association Design Standards and standards set by this document herein. All construction drawings shall have a licensing seal affixed to the document by a licensed irrigator. Provide a digital version for the Owner at no additional expense. A suitably scaled as-built drawing shall be provided prior to substantial completion. All components of the irrigation system shall be shown as installed, with clear measurements from an identifiable reference point to the location of the controller and its circuit breaker, master valve, zone control valves, main water connection, blow off connection, pump and its electrical connections, and any other similar features. Provide two hard copies of as-built drawings as well as electronic files in AutoCAD (.dwg) and PDF (.pdf) format.

It is understood that piping layout is diagrammatic only and piping shall be routed to avoid plants and structures where applicable. No machine trenching, unless approved by RELLIS Administration or the SSC Arborist, is to be done within drip line of trees. Trenching in these areas must be performed by hand digging, tunneling, or boring.

All irrigation work shall be performed by a suitably experienced and qualified licensed Irrigation Contractor, having trained and competent personnel adequate for the scope of work utilizing staff certified by the IA in such disciplines as Certified Irrigation Technician (level 1 or 2) and Certified Designer. The contractor shall be a member in good standing of the Irrigation Industry Association and/or TCEQ Texas Commission on Environmental Quality and have met the qualification standards currently applied to licensed contractors by that organization.

The irrigation system should have head-to-head coverage and should be designed for matched precipitation rates. The contractor shall follow all the manufacturer's operating and performance specifications. All irrigation heads shall be flush with the final grade of the soil. Irrigation valve boxes must also be set flush with the final grade of the soil and properly supported to prevent settlement. No gravel shall be placed in the valve boxes.

Provide clear instructions for operating the irrigation system "in season", showing the relative timing differences between zones of different precipitation rates, and a schedule of run times

suggested for various weather conditions. Division of the system into “hydro-zones”, or areas with different water requirements, whether based on gardens/grass, sun exposure, drainage patterns, or distinct areas is encouraged. Also consider slopes in the design of the system so that runoff water from higher elevations can be beneficial to middle and lower elevations.

Preconstruction Irrigation Audit

A mandatory preconstruction audit will be performed for all projects involving an existing irrigation system or systems to be impacted by construction projects in the vicinity. This audit shall be performed by the Irrigation Contractor in consultation with SSC Grounds Maintenance and will identify and document any portions of the existing system having deficiencies prior to work commencing. The Irrigation Contractor will be responsible for maintaining fully functioning irrigation systems to adjacent properties which are affected by the construction project. It is the duty of all contractors to complete the irrigation audit prior to work commencing or it is assumed that the system is 100% functional and operational, and any damage found or incurred after this date will be repaired to the Owner’s satisfaction at the Contractor’s expense.

Site Conditions

Contractors working on campus shall at their expense preserve and protect existing turf, trees, plants, monuments, structures, paved areas, and any other site amenities that may not be identified here from damage during the installation. Repair all damages to the original condition immediately and notify Owner’s Representative of the repair complete with photo documentation of before and after.

The job site shall be kept in a neat, clean, and orderly condition at all times during the installation process as determined by the Owner’s Representative. All scrap and excess materials are to be regularly removed from the site and not buried in trenches. Trenching, laying pipe, and backfilling shall be continuous so that the amount of open trench at the end of each workday is minimized. Any open trench or other excavations shall be barricaded and marked with high visibility flagging tape.

Trenching and excavations within the drip lines of existing trees are to be performed by hand or other non-invasive methods described above. Exercise extreme care to ensure clean cuts through all roots encountered. Backfill trenches showing exposed roots within 24 hours. All excavations within the critical root zone and drip line shall follow the tree protection procedures specified elsewhere in this document.

Coordinate staking and identification of utilities with all agencies prior to excavations. Take the necessary precautions to protect underground utilities during construction. Repair any damage immediately at no additional cost to Owner and provide photo documentation of the repair. Any existing irrigation components (i.e. heads, valves, controllers, backflow devices, etc.), removed or demolished are the property of the Owner and shall be returned to Owner’s Representative or disposed of at their discretion.

Installation Requirements

Install main lines in six inch (6”) wide trenches with a minimum of eighteen inches (18”) of soil cover. Install lateral lines in four inch (4”) wide trenches with a minimum of twelve inches (12”) of

soil cover. For all gasketed pipe install concrete thrust blocks in areas where the rubber gasketed main changes direction (i.e. ells and tees) where the rubber gasketed main terminates. Backfill in trenches shall be properly compacted to prevent future settling and to match the adjacent finish grade.

Perform a hydrostatic test of the irrigation main line at not less than operating pressure for minimum of twenty-four (24) hours prior to backfilling trenches. Piping may be tested in sections to expedite work. All testing to be witnessed by the Owner's Representative and SSC irrigation personnel. Provide notification a minimum of forty-eight (48) hours prior to testing. Any leaks or component failures to be corrected within 72 hours and retested immediately thereafter.

Stake the locations of sprinklers for approval by the Landscape Architect and/or Owner's Representative before proceeding with installation of irrigation components. All sprinklers are to be checked for proper operation and spray arc. Adjust or change nozzles as necessary to obtain the optimum desired spray patterns.

Any existing turf grass damaged or destroyed during the installation process should be replaced to the Owner's satisfaction with solid sod laid flat on a 1" inch cushion of screened bank sand or enriched topsoil and rolled smooth to remove lumps and seams. Sod shall have a seamless transition with existing adjacent turf and/or paved surfaces.

Completion and Acceptance

Prior to requesting a substantial completion inspection, the Irrigation Contractor shall provide completed as-built/record drawings and all operations and maintenance manuals to the Landscape Architect and Owner's Representative for review. Affix irrigator license seal to the as-built drawings.

Operation and maintenance manuals should include a table of contents, diagram of controller, specification/product sheets on all parts of the system, and as-built drawings/diagrams of all stations complete with zone locations and descriptions. Manuals shall be provided electronically in .pdf format uploaded to the appropriate folder location in eBuilder and on a USB flash drive.

Before a Certificate of Substantial Completion is granted, the Irrigation Contractor must provide a demonstration and training session for the Owner's Representative and SSC Grounds Maintenance staff.

The complete system shall be guaranteed against defects in materials and installation for a period of one year from the date of substantial completion. All projects shall specify and require the irrigation contractor to provide maintenance of the system for a minimum period of 90 days following substantial completion.

Materials and Equipment

All materials and equipment for the irrigation system shall be in accordance with the guidelines below. No substitutions shall be made unless approved by the Owner's representative in accordance with substitution procedures in the contract general conditions. Where conflicts, errors, or newer model/part numbers exist, confirm with RELLIS Administration and SSC Grounds Maintenance prior to specification, submittal, and/or installation.

A. PVC Pipe and Fittings:

1. All main lines 4” inches and larger shall be Class 200 gasketed pipe. Main lines 3” and smaller and all lateral lines shall be Schedule 40 PVC solvent-welded pipe and fittings. Threaded fittings, if used, shall be Schedule 80.
2. Use solvent and procedures recommended by manufacturer to make solvent-welded joints. Thoroughly clean pipe and fittings before applying PVC pipe primer and solvent.
3. All valves and/or fittings must have at least eighteen inches (18’’) of spacing before or after any other valve or fitting to allow for future repairs.
4. At all PVC-to-metal connections, work metal connection first, use a non-hardening pipe dope such as Permatex No2. Use only light wrench pressure to tighten. The PVC component shall have male threads, and the metal component shall have female threads.

B. Sleeves/Conduit:

1. All sleeves in soil shall be installed and backfilled with the same considerations for protection of the material as if it were water pipe. Compaction shall be to the same standard as the adjoining undisturbed soil and the sleeves shall project at least 12" on either side of the hard surface being crossed.
2. Sleeves being installed beneath roads or driveways for later use shall have the necessary pipe installed at the same time with each end elbowing to at least 36" above grade. Sleeves shall not be installed deeper than 12” below the paving surface.
3. All new sleeves shall be schedule 80 PVC pipe, unless the circumstances of its installation require stronger material to ensure its survival during ongoing construction activity by other trades.
4. Sleeves shall be sized to be no less than twice the size of the pipe being protected if lateral line and three times the size if main line. Install at every 150’ L.F. of paving, driveway, roadway or any hard surface that may be encountered. Provide a minimum of two sleeves at each location.
5. Sleeves crossing any hard surface such as roadways, sidewalks, driveways, or other impenetrable surfaces will be identified by a ¼” Brass carriage bolt at each end of the crossing for future identification.

C. Controller, Air Card, and Weather Station:

1. All new irrigation controllers shall be Weathermatic SmartLine SL1600 or SL4800. Model selection based on number of zones required for the project.
2. Each irrigation controller shall have a weather station to manage microclimates. The controller shall utilize real time ET data to determine plant water requirements. Evapotranspiration deficits shall be calculated daily and transferred to the controller.
3. Weather station shall be Weathermatic SLW5 or most current wireless model and suitable for outdoor mounting. Weather station shall be capable of two-way communications with controller(s) and have independent power supply, self-diagnostic circuit and microprocessor. Weather station shall be installed in the open as much as possible along the eaves of nearby structures identified as the most suitable location by Owner’s Representative.

4. Controller must not require software to be installed locally. Connection to controller through the web shall be through a web-enabled appliance such as a PC, Smart Phone, Tablet, etc.
5. Each new irrigation controller shall be provided with a Weathermatic SmartLink Aircard model SL-AIRCARDFLOW.
6. Controller shall be provided with Weathermatic enclosure suitable for either wall mount or pedestal mount depending on application. Enclosure shall be Weathermatic model SLWM (wall-mount) or SLPED-ENC (pedestal).
7. Controllers must be able to receive data from multiple flow sensors. Multiple controllers must be able to receive data individually from a single flow sensor. This shall be achieved using Isoflow and Combiflow Weathermatic components.
8. Controller shall have self-diagnostic capabilities to detect “short” or “open” zones and the ability to display lists of faults on an LCD display for the user. Diagnostics shall also include LCD display of volt/amp readings by zone and for transformer output as well as backup battery reading. A chatter function shall also be provided to assist in locating buried valves. The controller shall automatically prevent master valve opening when the valve locator diagnostic is used.
9. Controller shall be capable of standard timed watering or auto adjust watering times. Auto adjust watering shall be based on real time, on-site weather data and system audit data entered by the user. Auto adjust timing shall be based on real time ET data. Controller shall provide reviewable watering deficits, scheduled run times by zone and a total run time recap for each zone which is resettable by the user. A timer shall be provided to allow run time adjustment by zone for shade/sunlight, system efficiency and other local factors. Auto adjust mode shall also include automatic calculation of run/soak times based on both soil type and zone elevation.
10. Manual operation shall be provided by program, by station, or on a programmable test program with durations from ten (10) seconds to ten (10) minutes. The programmable test program shall also check for short and open conditions on each zone each time it is run.
11. Non-volatile memory shall retain all programming and real-time clock shall be provided to maintain date and time.
12. Controller shall accommodate either traditional valve wiring systems or TWO Wire valve systems.
13. Controller shall be provided with a three-year warranty on all hardware and one-year warranty on labor. The manufacturer is solely responsible for all warranty issues and will be the only point of contact with TAMU.
14. Controller must be EPA Water Sense approved and have Center for Irrigation Technology (CIT) Smart Water Application Technology (SWAT) Protocol.
15. Affix a non-fading copy of the site-specific irrigation diagram to the inside cabinet door of the controller. Irrigation diagram shall be sealed between two (2) plastic sheets, 20 mil minimum thickness. Irrigation diagram shall clearly show all valves operated by the controller, including station number, valve size, and type of planting irrigated.
16. Provide full grounding and lighting protection per system manufacturer’s recommendations. Grounding network shall measure 10 OHMS or less when measured with a vibra-ground instrument.

17. Location for the controller shall be determined during design in consultation with RELLIS Administration and SSC Grounds Maintenance. All controllers shall be installed on the exterior of the building to permit access by SSC Grounds Maintenance staff without the need to enter the building.
18. It is the responsibility of the project A/E to properly coordinate with the project Electrical Engineer to design and indicate a dedicated 120VAC power circuit to the irrigation controller on the electrical drawings. Controller power shall be installed by a licensed electrician in accordance with governing codes. Appropriate means of disconnect shall be provided directly adjacent to the controller.

D. Backflow Prevention/Reduced Pressure Zone Device (RPZ):

1. All new irrigation system backflow prevention device assemblies (RPZ) shall be FEBCO Model 860.
2. The RPZ device shall be in new condition, installed according to the local plumbing code, sized to accommodate the flow requirements present, and successfully tested by a licensed Certified Backflow Prevention Tester.
3. Before installing an RPZ device, flush the lines thoroughly to remove all debris and other foreign matter. If required a strainer should be placed upstream of the RPZ device.
4. All irrigation RPZ devices shall be installed on the exterior of the building to permit access by SSC Grounds Maintenance staff for annual certification, testing and maintenance. Locate the device in the same general vicinity as the irrigation controller.
5. RPZ devices shall be provided with a metal cage for protection and installed on a concrete slab-on-grade. Insulate all above ground piping and provide full aluminum jacketing in accordance with other related design guidelines.
6. The RPZ device must be installed in a horizontal only position with flow down to provide proper operation of the relief valve. Provide adequate space around the installed unit so that the test cocks will be accessible for testing and servicing facing straight up.
7. Prior to substantial completion, the Irrigation Contractor shall test and certify all RPZ devices and provide copy of written test certificate with the project closeout documents.

E. Point-of-Connection (POC), Master Valve, and Flow Sensor:

1. Each POC shall utilize a normally closed master valve with pressure regulating capabilities not to exceed 60 PSI and a real time flow sensor to communicate and respond to both high flow and low flow events.
2. There should be no more than two POCs per one controller. If there are multiple POCs for a single controller, a Weathermatic SmartLink Model SLF-COMBIFLOW device must be installed.
3. Provide one line-sized combination master valve and flow sensor on the main line near the POC and after the RPZ device. For Mainlines below 3” inches in diameter use a Weathermatic Master Valve and flow sensor, and for lines 3” inches and above utilize Rainbird or Hunter brass body master valves. Master valves and flow sensors to be installed per manufacturer’s specifications, including but not limited to straight pipe

length requirements. Wire rides are only to be used as a last resort and may only be used with explicit written permission from the Owner's Representative.

4. All new flow sensors shall be Weathermatic SmartLink Model SLFSI. The flow sensor shall be the same size as the main line. Flow sensor must have a flow range of 0.25 to 12 FPS and be a 4-blade impeller type (paddle wheel). Flow sensor wiring shall be CAT5ES or PE39 wiring.

F. Electric Control Valves:

1. All electric control valves 3" and smaller shall be Hunter ICV, model number to match size and features.
2. One (1) remote control valve tag shall be attached to the stem of each electric remote control valve. Tags shall be numbered sequentially. Numbers shall correspond to station numbers in the irrigation controller. Provide tags and corresponding numbers for wires pulled for future valves.

G. Ball Valves:

1. Ball valves shall be McDonald or approved equal.
2. Install a ball valve twelve inches (12'') upstream from the RPZ device.
3. Install a line-sized isolation ball valve twelve inches (12") before each zone. However, with prior approval from the Owner's Representative, it may be acceptable to install one isolation valve for two zones depending on system piping arrangement.
4. Gate valves are not permitted.

H. Quick Coupling Valves:

1. Quick coupling valve shall be 3/4'' Rainbird 33DRC or equal with 2-Piece Body, 3/4" double track key lug, rubber cover, brass body construction on double swing joints schedule 80 PVC.
2. All quick coupling valves shall have a ball valve installed no less than twelve inches (12'') and no further than twenty-four inches (24'') from the valve.
3. Install quick coupler valves along the main line. Provide one per control valve or every 150 LF along the main line, whichever is practical to be determined by the Owner's Representative.

I. Control Wire:

1. All irrigation control wiring shall be 14 AWG direct burial Weathermatic two wire system, or low-voltage, branch-circuit cables 14 AWG minimum, between controllers and automatic control valves. Wiring shall be color-coded different from feeder-circuit-cable jacket color, with jackets of different colors for multiple cable installation in same trench.
2. Grounding rods shall be placed in accordance with manufacturer's recommendations.
3. All wire splices shall be made with Wade, DBR/Y-6 (Direct Bury) Splice by 3M or approved equal. Use one (1) splice per connector sealing pack. All splices must use UL approved connector. All splices shall be installed in a 10'' valve box.

4. An expansion curl shall be provided within 3 feet of each wire connection. Expansion curl shall be of sufficient length at each splice connection and at each electric control valve, so that in case of repair, the valve bonnet may be brought to the surface without disconnecting the control wires. Control wires shall be laid loosely in the trench without stress or stretching of control wire conductors.
5. Where more than one (1) wire is placed in a trench, the wiring shall be taped together at intervals of 10'.

J. Spray Heads:

1. Spray heads shall be Hunter Pro-Spray (PROS-XX) with MP rotary nozzles 1000, 2000, 3000 series with check valve.
2. Spray heads at turf areas should be 6''. Spray heads at shrub areas shall be 6" or 12" depending on application.
3. Side inlets shall not be used on any heads.
4. Variable Arc Nozzles (VANs) are permitted only in areas where a fixed nozzle would spray on the hardscape or adjacent building.

K. Rotor Heads:

1. Rotor heads shall be Weathermatic Models T3, PGJ, and/or I-25.
2. Hunter PGJ will only be accepted in areas less than 20'.
3. Weathermatic T3 nozzles shall be low angle for flat surfaces. For berms, the nozzles shall be no smaller than a 7' radius.
4. All heads shall have a check valve installed before the head.
5. I-25 nozzles smaller than a 15' radius are not permitted.

L. Tree Bubblers:

1. Tree bubblers shall be Irritrol 533 adjustable flood bubblers.
2. Bubbler shall be installed on 12'' Hunter swing joints.
3. Tree Bubblers shall be the only acceptable method of irrigating trees. No other forms of drip will be accepted.

M. Drip Tubing:

1. Drip tubing should be installed on the uphill side of all plants.
2. At ground cover areas, drip shall be Hunter drip tube with 12'' spacing. Drip shall also have a 6'' pop-up indicator.
3. At other plantings of shrubs, ornamental grasses, etc., blank drip tubing should be used, and individual drip emitters installed so that only the root zone of the individual plants is irrigated.
4. An automatic line flushing valve shall be installed at the end of each independent zone. The valve shall be capable of flushing one (1) gallon of water at the beginning of each irrigation cycle.

5. Pressure regulating valve shall be capable of regulating pressure using interchangeable, color-coded regulating springs. The regulator shall have a built-in indicator that shows when the proper outlet pressure has been reached.
6. Drip lines shall consist of nominal sized 1/2” low density, linear polyethylene tubing, housing internal pressure compensating, continuously self-flushing, and integral drip emitters. The tubing shall have an outside diameter (O.D.) of 0.67”, and an inside diameter (I.D.) of 0.57”. The emitters shall have the ability to independently regulate discharge rates, with an output pressure of 7-70 psi, at a constant flow of 0.62 GPH. The drip line shall have factory installed emitters 12” on center.

N. Swing Joints:

1. Swing joints shall be installed at every sprinkler head.
2. Hunter SJ swing joints shall be used for sprinkler heads with 1/2” or 3/4’’ inlet.
3. Hunter HSJ swing joints shall be used for heads with 1” inlet.
4. Use of cut-off risers and/or flexible tubing (“funny pipe”) is prohibited.

DIVISION 33 – UTILITIES

GENERAL

All connections to campus utility distribution systems or public utilities shall be accurately located by dimensions or coordinates. Depth of piping shall be shown, and inverts must be shown at manholes and other critical points.

All site utilities shall be included as part of the BIM(s). They shall be shown accurately in terms of size, depth, and location.

The domestic water, sanitary sewer, and thermal distribution systems on the RELLIS Campus are managed and maintained by Texas A&M Utilities and Energy Services (TAMU UES) through an intra-system cooperation agreement. Medium voltage electrical service and distribution is also managed and maintained by TAMU UES on behalf of the RELLIS Campus, however, requirements for this utility are detailed separately in the Division 26 section of these guidelines. TAMU UES' published design standards apply to all construction and renovation projects on the RELLIS Campus. Refer to the most current version of these standards which are located here:

https://facilities.tamu.edu/departments/utilities-energy-services/design-standards.html

Specific TAMU UES design standards applicable to utility distribution systems include:

- Design Standard for Fire Hydrants
- Grease Traps and Interceptors
- Interconnection of Building Hydronic Systems to Campus Thermal Utility Infrastructure
- Procedures for Receiving and Disconnecting Temporary and Permanent Utility Services
- Storm Drainage Utilities
- Thermal Systems (Chilled Water & Hot Water)
- Underground Piping Installations
- Underground Piping System Insulations
- Utility Metering

For broken hyperlinks or confirmation of most current versions, contact TAMU UES for additional information. Additional campus specific requirements are detailed further below.

SANITARY SEWER

The current wastewater collection system at the RELLIS Campus consists of both original sections from the initial base construction and sections constructed during various infrastructure upgrade projects. The original sections are clay tile and PVC pipe with some portions of the system that have been in service for over 70 years. The recently installed sections consist of HDPE pipe and are 12" and 16" in diameter to meet slope requirements. A new private lift station with associated force main was constructed on the west campus adjacent to the Research Innovation Complex (RIC) in 2021.

The campus is currently served by a 100,000 gallon per day (GPD) permitted onsite lagoon wastewater treatment plant located in the southeast area of the campus. This plant discharges to a tributary of Thompson's Creek which eventually drains to the Brazos River. Through mid-2026, peak daily flows through this plant have reached as high as 63,000 GPD with average daily flows in the 40,000-50,000 GPD range. All projects should review projected wastewater flows with RELLIS Administration and TAMU UES during POR development and throughout project design to ensure sufficient plant capacity exists to support proposed development.

The conventional sanitary sewer collection system shall be designed, installed, and tested in accordance with TCEQ requirements. Gravity sanitary sewer mainlines shall be no less than 6" and services lines shall be no less than 4". Sanitary sewer piping and fittings shall meet UES design standards for High Density Polyethylene (HDPE) pipe with a DR 11 or heavier.

Manholes are required for all horizontal and vertical bends as well as changes in pipe size. Manholes on sanitary sewer mainlines shall be spaced per TCEQ rules and regulations 30 TAC 217. Sanitary sewer service lines shall have two-way cleanout spaced as required per accepted plumbing code and at the building. Appropriate wye fittings shall be used at service connections. Sanitary sewer manholes shall be pre-cast sections meeting ASTM C478 with a reinforced concrete base and resilient pipe connections meeting ASTM C923. Minimum 28-day concrete strength shall be 3,000 psi. Manholes shall be placed on 9" of 1-1/2 sack cement stabilized sand. A sealant shall be used between the ring/cover and throat adjustment rings and manhole chimney. The throat adjustment rings shall be 12" (minimum of 2 and a maximum of 4). Manhole construction, sizing (including manhole opening), invert slope, channel shape, and testing shall be in accordance with TCEQ requirements.

Sanitary sewer and storm sewer shall be shown on separate sheets along with profiles. Profiles on sewer lines shall be shown for all pipe sizes. The profiles shall show as a minimum, depth of cover, other utility crossings with verified elevations, slope, inverts, pipe material and class of pipe.

All pipes penetrating exterior walls or foundations of buildings below grade must be installed properly with sleeves to prevent breakage due to building settlement or expansive soil. All interior beads shall be milled from the PE pipe to allow for deflection tests. Deflection tests shall be by a mandrel pulled 30 days following trench backfill. All tests shall be witnessed by the Owner.

Lift Stations and Force Mains

Sanitary sewer lift stations shall consist of precast (ASTM C478) or cast-in place reinforced concrete wet well containing a heavy-duty duplex pumping system readily accessible and removable for replacement/maintenance. A lockable hatch system of adequate size for maintenance/access shall be provided. A reliable level control system shall be provided to start/stop the pumps including a high-level alarm. The basic control system shall consist of a remote disconnect, combination starter for each motor, H-O-A switches, visual and audible high-level alarm, run lights and seal failure sensors. All conduit connections to the wet well will be adequately sealed to sewer gases/moisture. Pump discharge piping for each pump shall be flanged ductile iron containing a check valve and plug valve located in a valve pit exterior to the wet well. Metal surfaces inside the wet well and the inside surfaces of the wet well shall be protected by appropriate coatings. Valve pit shall have a lockable hatch of adequate size for operation and maintenance of valves.

Sanitary sewer force mains shall be AWWA C906 DR 11 or heavier. Exposed piping shall be ductile iron with appropriate coating protection. PE material shall have a minimum designation number of PE4710, and the resin used in the extrusion of the polyethylene pipe shall conform to ASTM D3350 Cell Classification PE445574C. Fittings shall be butt-fusion or electrofusion type, with DR number, designation number, and cell classification matching pipe. Fittings and stock shall meet ASTM D3261, ASTM F1055, and AWWA C906 as appropriate. All angles, bends, tees, etc. shall be stabilized with concrete thrust blocks, sized by project A/E. All non-metallic force mains shall have aluminum detector tape 12” placed below final grade.

STORM DRAINAGE

The RELLIS Campus consists of multiple watersheds, and drainage is managed through a Regional Stormwater Management Plan (RSWMP). Due to the rapid and continued pace of development on the campus, this regional plan is routinely updated to ensure prudent management of campus drainage as new projects are brought online. In general, the plan utilizes regional ponds for detention and management of overall campus drainage to minimize the need for project specific onsite detention. However, size and scope of proposed projects may dictate improvements to existing or construction of new ponds and conveyance systems.

The design team and project Civil Engineer are responsible to coordinate with RELLIS Campus Administration at the project onset and throughout design to ensure that all headwater and tailwater conditions are properly evaluated and that proposed site development is consistent with both the RSWMP and the CMP.

RWSMP Overview

The regional stormwater management program provides for the administration, planning, design, construction, and operational management of regional stormwater facilities (RSWF). Regional stormwater management uses a watershed-wide approach to analyze potential flooding problems, identify appropriate mitigation measures and select site locations and design criteria for RSWF. These RSWF include, but are not limited to, regional detention and retention ponds, watershed protection, waterway enlargement, channelization, and improved conveyance structures.

RSWMP Participation

All projects shall participate in the RSWMP in one of the following ways:

A. Where existing regional detention capacity exists to support fully developed project conditions, the project may utilize these existing facilities. Depending on the specific drainage basin, fees may be assessed to the project on a per acre basis for cost recovery of shared improvements.

B. Where existing regional detention capacity does not exist to support fully developed project conditions, the project shall be responsible for designing and constructing either offsite facilities (preferred) or onsite facilities (typically storm water retention or detention) to mitigate increases in runoff resulting from the proposed development. Design and placement of offsite facilities may include improvement/enlargement of existing RSWF or construction of new RSWF subject to coordination with RELLIS Administration.

In every case where offsite or regional detention facilities are utilized, the project A/E shall be responsible for evaluating the offsite conveyance system downstream of the project site to determine if sufficient capacity exists to convey flows from the proposed development to the RSWF. Any improvements to offsite conveyance required by the proposed development are the responsibility of that project. Additionally, the project A/E shall be responsible for the proper design of all onsite stormwater facilities within the project area necessary to adequately convey onsite flows to the point of discharge to the campus system.

Adverse Impact Analysis

Three (3) development conditions shall be analyzed with each adverse impact analysis:

A. Existing Conditions: This refers to current development conditions in the watershed and on site. This shall be used as the baseline for determining the impact of the development of the site or the watershed to other properties or drainage systems.

B. Proposed Conditions: This refers to existing conditions with the proposed development added. This shall be used to determine if the increased runoff from the proposed development results in an adverse impact on other properties or drainage systems.

C. Ultimate Conditions: This refers to ultimate development conditions within the watershed. In addition to being used to design proposed drainage facilities this condition shall also be used to determine if the increased runoff from the ultimate development of the watershed results in an adverse impact to other properties or drainage systems.

The RELLIS Campus may reject a project's request to participate in the RSWMP by mitigation and require on-site detention. The campus' decision will be based on the knowledge of significant adverse impacts that would be created by ultimate development of the watershed regardless of the distance from the development to the area of concern. The Campus may also reject a request for participation when it is not in the best interests of the RSWMP. The design team is recommended to meet with RELLIS Administration to discuss participation options during project programming and prior to commencing design of a project. This preliminary meeting in no way relieves the project of its responsibility to prepare the necessary engineering documentation to support a request for participation.

Atlas 14 Hydrology

All RELLIS Campus hydrologic studies/analysis shall use rainfall data provided by NOAA Atlas 14 publication.

The storm drainage planning and design shall follow the current adopted Bryan/College Station Unified Stormwater Design Guidelines (B/CS USDG) and any adopted amendments and/or updates thereto. Note: This sets the requirement and expectation of storm water analysis to include:

A. Analysis of the 2-, 10-, 25-, 100- and sometimes 5-year storm events.

B. Regional Detention to be analyzed for the 2-, 10-, 25-, 50-, and 100-year storm events.

C. Hydraulic grade line calculated for the 10-year and 100-year frequency storm assuming ultimate development for storm sewers.

This Facility Design Guidelines manual directs all designers to utilize the Atlas 14 rainfall values stated herein in lieu of the values stated within the B/CS USDG. The current adopted version can be found at www.bcsunited.net; however, projects shall ensure that the most current adopted version is used regardless of the version located at the link above. In situations where the B/CS USDG and this document contradict one another, this document shall take precedence.

The following two items should be considered during the design process:

1. Diversion of stormwater away from the natural watercourse will not be allowed, except within the property boundaries controlled by the developer under the following conditions:

    a. The storm water is returned to its natural flowing watercourse prior to leaving the developer's property,

    b. For watersheds greater than twenty (20) acres, a timing analysis of the existing and diverted hydrograph must be performed to confirm that the peak flow rate has not been increased at the point that it reenters the watercourse, as a result of the diversion.

2. All developments shall provide adequate drainage outfall at the lower end of the site into an existing ditch, channel, drainage easement, or right-of-way, or to the centerline of an existing natural drain. Where a proposed street, storm drain, or open channel does not discharge into a natural low or into an existing adequate drainage easement, facilities and drainage easements of adequate width to contain the design discharge shall be constructed and dedicated to the centerline of an existing natural low within the same watershed.

Storm sewer conveyance system (pipes or open channels) sizes shall be determined by a licensed Texas Professional Engineer (PE) and are to be based on existing/future capacities determined by a drainage study following the parameters contained within these guidelines and the B/CS USDG. If the existing infrastructure cannot accommodate the increased capacity, then onsite detention/retention pond(s) shall be required or the development shall bear the cost to construct adequate infrastructure to a regional pond facility, if available and as approved by the RELLIS Administration.

Channels (General)

A fifteen (15) foot access road on one side of the extreme limits of the channels is required when channels do not parallel and adjoin an alley or roadway. Where utilities are installed in the access road of the channel, the access road will be widened to seventeen (17) feet. The access road will slope toward the channel with a maximum cross slope of one (1) inch per foot. Additionally, the top of utility manholes or any at-grade appurtenances within the access road shall match the finish ground surface elevation within zero (0) to plus (+) four (4) inches at the time of construction or as set forth in the B/CS USDG, whichever is most stringent.

The channel(s) shall be designed for the ultimate twenty-five (25) year storm with freeboard. If the drainage area to the channel is more than one hundred (100) acres, the channel shall be designed for the ultimate one hundred (100) year storm.

Modifications to existing watercourses or newly created open channels may be designed as earthen channels, concrete lined channels or a combination of both. Liners other than grass or concrete which enhance the aesthetics or habitat value of the watercourse and which reduce future maintenance requirements are encouraged. Preliminary planning for the applicability of other channel liners shall be reviewed with the RELLIS Administration prior to the submittal of construction plans for approval.

The constructed channel geometry may be triangular, rectangular or trapezoidal in shape. All earthen channel side slopes should be 4H:1V or flatter to provide ease of maintenance and vehicular protection.

Concrete Channels

From the top of the concrete lining to the top of the ditch, a side slope not steeper than four (4) horizontal to one (1) vertical shall be required; nor shall the slope be less than twelve to one (12:1). The minimum longitudinal slope shall be 0.4 percent, or 0.1 percent with a minimum "cleaning" velocity of three (3) feet per second (3 fps) during an existing conditions five (5) year storm event. The depth of all tie downs shall be thirty-six (36) inches upstream, twenty-four (24) inches downstream, and eighteen (18) inches for side slopes.

Concrete Reinforced Riprap side slopes shall not be steeper than one and one-half (1½) horizontal to one (1) vertical, unless soil tests made by a geotechnical engineer show that a greater slope, or a special design, will be stable. Where vehicular traffic may travel within a horizontal distance equal to one-half (½) the vertical rise of the slope, a two-foot surcharge load shall be included in the design.

Fencing, guardrails or handrails will be required adjacent to the channel where channel vertical wall heights exceed two (2) feet. Fencing will also be required adjacent to the channel where channel side slopes exceed two to one (2:1) and the channel depth is greater than two (2) feet. The fencing must not cause sight distance problems for motorists.

Vertical walls will not be permissible for depths greater than two (2) feet unless properly fenced or enclosed. Walls will have a minimum thickness of six (6) inches.

Backfill

When the plans indicate fill of a channel side slope, the fill material shall be placed in layers not to exceed 12 inches and shall be benched or notched into existing slopes. Each lift of fill shall be compacted to the required density and moisture contents shown below, unless otherwise shown on the plans:

Subgrade Material	Density	Moisture Content
PI ≤ 20	≥ 95% of Max Dry Density	-2% of Opt. or greater
PI > 20	≥ 95% of Max Dry Density	≥ Opt. Moisture

The maximum dry density and optimum moisture content shall be determined in accordance with TxDOT Test Method Tex-114-E. Tests for in place density shall be made in accordance with TxDOT Test Method Tex-115-E and within 24 hours after compacting operations are completed. If the material fails to meet the density specified, it shall be re-worked as necessary.

Backfill material shall be free from roots, trash, silt and objectionable debris and shall be approved by the Engineer. The channel side slopes and infill areas shall be cut to the finished dimensions after completion of the fill process.

Concrete Riprap

Concrete riprap shall be reinforced with No. 3 or No. 4 reinforcing bars spaced at a maximum of 18 in. in each direction unless otherwise shown. Provide a minimum 6-in. lap at all splices. Provide horizontal cover of at least 1 in. and no more than 3 in. at the edge of the riprap. Place the first parallel bar no more than 6 in. from the edge of concrete. Use approved supports to hold the reinforcement approximately equidistant from the top and bottom surface of the slab. Adjust reinforcement during concrete placement to maintain correct position.

Sprinkle and consolidate the subgrade before the concrete is placed as directed. All surfaces must be moist when concrete is placed.

Compact and shape the concrete once it has been placed to conform to the dimensions shown on the plans. Finish the surface with a wood float after it has set sufficiently to avoid slumping to secure a smooth surface or broom finish as approved. Cure the riprap immediately after the finishing operation.

Concrete Pilot Channels

Concrete Pilot Channels must be used within the flowline of all earthen, grass lined drainage channels when the minimum “cleaning” velocities within the channel are not met. The concrete pilot channels shall have a minimum width equal to one-third (1/3) of the channel's bottom width and be constructed of reinforced concrete, minimum 4” thick. The concrete shall be reinforced with No. 3 or No. 4 reinforcing bars spaced at a maximum of 12-in. in each direction. Provide a minimum 6-in. lap at all splices. Provide horizontal cover of at least 1 in. and no more than 3 in. at the edge of the pilot channel. Place the first parallel bar no more than 6 in. from the edge of concrete. Use approved supports to hold the reinforcement approximately equidistant from the top and bottom surface of the slab. Adjust reinforcement during concrete placement to maintain correct position.

Storm Sewer Pipe (General)

The minimum cleaning velocity for a storm sewer line is three (3) fps for a 5-year event. The maximum velocity for a storm sewer trunk line is 15 fps.

The minimum slope for the storm sewer line is 0.3% or as approved by the TAMUS FP&C Civil Engineer. The minimum pipe size for main lines shall be 24-inches in diameter unless the option for multiple smaller sized pipes is approved by the TAMUS FP&C Civil Engineer.

Storm sewer lines should not be placed below/underneath buildings or structures. If a proposed building or structure is over an existing storm drain, the storm drain should be relocated around the exterior of the building or structure at the expense of the project.

Storm roof drains shall be run separately from all other storm water sources to the outside of the building and collected by underground storm drain laterals connected to an associated storm drain collection system. Discharge of primary roof drains directly to grade is not permitted on new construction projects without prior approval by RELLIS Administration.

Campus storm sewer main lines shall be High Density Corrugated Polyethylene (HDPE) dual walled pipe unless located below vehicular paving (roadways or parking). Storm lines below vehicular paving shall be reinforced concrete pipe (RCP) Class III (ASTM C76). Campus storm sewer laterals or "yard lines" may be SDR 26 PVC (ASTM D3034) or heavier for less than 18-inches or as approved by the RELLIS Administration.

All storm sewer installations shall include watertight joints.

HDPE Pipe

HDPE pipe and fittings shall be manufactured in accordance with requirements of ASTM F 2306, latest edition. The pipe shall have a full circular cross section, with an outer corrugated pipe wall and a smooth inner wall.

Virgin material for pipe and fitting production shall be used and be high density polyethylene conforming with the minimum requirements of cell classification, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4%.

Minimum Pipe Stiffness (PS) at five percent deflection shall be as described in ASTM F 2306, Section 6.3 when tested in accordance with ASTM D 2412.

All HDPE Corrugated and Smooth Lined Pipe shall be certified through the Plastics Pipe Institute (PPI) Third Party Certification program. All HDPE pipe delivered and used shall bear the Third Party Administered PPI seal.

All pipe shall be clearly marked at intervals of not more than 10 ft, and fittings and couplings shall be clearly marked as follows:

A. Manufacturer's name, trade name, or trademark

B. Nominal size

C. Specification designation (e.g. ASTM F 2306)

D. Plant location

E. Date of manufacture

F. Legend polyethylene (PE)

Joints shall be installed such that the connection of pipe sections will form a continuous line free from irregularities in the flow line. Joints shall conform to one of the following:

A. Integral Bell and Spigot: The bell shall overlap a minimum of two corrugations of the spigot end when fully engaged. The spigot end shall have an O-ring gasket that meets ASTM F 477 “Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.”

B. Exterior Bell and Spigot: The bell shall be fully welded to the exterior of the pipe and overlap the spigot end so that the flow lines and ends match when fully engaged. The spigot end shall have an O-ring gasket that meets ASTM F 477 “Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.”

C. Watertight Joints: Watertight joints shall be in accordance with the requirements of ASTM 3212.

The pipe shall be bedded in accordance with the requirements of ASTM D 2321, and manufacturer’s recommendations. A minimum of 6 inches of bedding shall be provided prior to placement and shall be loosely compacted. Maximum material size limited to 1-1/2 inches.

The minimum cover for HDPE storm pipe shall be two and-a-half feet (2.5’) for all mains as measured from the outside top of pipe vertically to finished ground or pavement, provided that all HDPE pipe be encased with manufacturer recommended backfill filling the void between trench wall and pipe outer diameter up to a minimum 24-inches above crown of pipe or as approved by the RELLIS Campus Facilities and Construction Department Manager.

Manholes and Junction Boxes

Manholes and/or junction boxes with access openings shall be installed on the storm sewer system at all piping intersections, changes in slope and angle points except for small drain leads which may use appropriate wye fittings. Access manholes or junction boxes shall have a maximum spacing of 300-ft for 24-in diameter pipe and smaller, and 400-ft for larger than 24-in diameter.

Manholes shall be either pre-cast (ASTM C 478) or cast-in-place with a reinforced concrete foundation. Junction boxes shall be of reinforced precast or cast-in-place construction. In high visibility areas near buildings, at pedestrian drop off points or within driveways/aisles, manholes and junction Box tops may be cast-in-place to allow finished lines and grades of the design plans to match evenly with inlet tops. Minimum 28-day concrete strength shall be 3,000 psi. Foundation for manholes and/or junction boxes shall be on 1-1/2 sack cement stabilized sand.

At the spring line of the pipe, the inside wall of the junction box must be a minimum of the outside diameter of the pipe, plus six (6) inches on each side of the pipe. If the pipe is at a skew to the junction box wall, additional distance is required. When an upstream conduit is smaller than the downstream conduit, it is preferable to match conduit soffits, unless the upstream conduit needs to miss a conflict such as a utility or minimum conduit cover.

Inlets

Area inlets for the storm sewer system shall be either pre-cast or cast-in-place reinforced concrete with frame and grate iron castings conforming to ASTM A48 Class 35B and shall be traffic rated. Curb inlets shall also be either precast or cast-in-place with a manhole frame and cover installed in the top to allow access. In high visibility areas near buildings, at pedestrian drop off points or

within driveways/aisles, inlet tops may be cast-in-place to allow finished lines and grades of the design plans to match evenly with inlet tops. Minimum concrete 28-day compressive strength for inlets shall be 3,000 psi.

Grate Inlets in sump grates should be designed assuming a clogging factor of 50%. When calculating the capacity of a grate inlet the net area of opening should be used, minus 50% for the clogging assumed above when calculating its capacity. The flow of water through grate openings may be treated as the flow of water through a rectangular orifice.

Headwalls

Storm sewer discharge points shall be stabilized with either a pre-cast or cast-in-place headwall structure with adequate surrounding riprap (concrete or appropriately sized loose rock) to control erosion. The typical headwalls for circular pipe or box culverts shall follow the Texas Department of Transportation (TxDOT) standards for cast-in-place or precast headwall structures. Minimum concrete 28-day compressive strength for headwalls shall be 3,000 psi or as directed by TxDOT standards. Headwalls that create a vertical drop of 24” or more near pedestrian access areas shall incorporate an appropriate guardrail or handrail into the structure.

Frames, Grates, Rings, and Covers

Provide 30-inch diameter access openings for all manholes, Junction Boxes and Inlets. Iron castings for manhole rings, grates, frames and covers shall conform to ASTM A 48, Class 35B and be traffic rated. All covers for storm sewer applications shall be marked “Storm Sewer”.

Reinforced Concrete Box Culverts

Precast reinforced concrete box culverts shall be manufactured in accordance with the latest revisions published by the American Society for Testing Materials of the following specifications:

A. ASTM C1577 – Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains and Sewers, Designed According to AASHTO LRFD.

B. ASTM C1677 – Joints for Concrete Box Using Rubber Gaskets

Unless otherwise specified, all boxes furnished shall be fabricated with water-tight rubber-gasket joints.

Trench shall be fine graded to the established sub-grade and re-compacted to a density of at least 90% of maximum as determined using ASTM D 698. Any over excavation of the subgrade shall be filled with 2 sacks per cubic yard of cement stabilized sand.

All box sections must be laid in a straight line with the tongue end of the box section pointed downstream entering the grooved end of the previously laid box section, to full depth.

No box sewer shall be laid in a trench in the presence of water. All water shall be removed from the trench sufficiently ahead of the sewer placing operation to insure a dry, firm bed on which to place the sewer, and if necessary, the trench will continue to be dewatered until after the sewer is bedded and backfilled as directed by the Engineer. Removal of water may be accomplished by

pumping or pumping in connection with the well point installation as the particular situation may warrant. The Contractor shall satisfy himself as to the soil conditions to be encountered.

Where necessary, to comply with OSHA Regulation 1926.650, the side of the trench or other excavation shall be braced and rendered secure to the satisfaction of the Engineer. Board sheeting and/or steel sheeting may be utilized as directed by the Engineer. The bracing shall be in accordance with OSHA requirements.

Following compaction of the trench bottom at the established grade, the Contractor shall place a minimum of a 6-inch thickness gravel bedding in such a manner that once the box sections are laid, the invert elevation in the box section shall conform to the plan elevations. No voids in the bedding material shall be permitted.

Should multiple parallel precast box culverts be used for a storm drain line, the spacing between adjacent boxes shall be six (6) inches. An increase in this dimension will require additional consideration of the fill material between the boxes. Should multiple conduits, other than multiple parallel precast box culverts mentioned above, be used, the minimum spacing between conduits should be one (1) foot to allow for the compaction of backfill around the conduits.

Backfilling to the top of the box culvert (initial backfill) shall be completed by one of the methods detailed below. Backfill behind cast-in-place culvert walls shall not begin until the concrete has attained a compressive strength of 2,000 psi. Backfill on top of cast-in-place supporting slabs shall not begin until the concrete has attained a compressive strength of 3,000 psi. Avoid wedging action of backfill against structures. If necessary, to prevent such action, step or serrate slopes bounding the excavation. Place backfill along both sides of culverts equally and in uniform layers. Where backfill occurs beneath a road surface the material from two (2) feet below subgrade to the established base material shall be compacted to a density of 98% standard proctor density (ASTM D 698). For materials that require backfilling at an elevation of two (2) feet below subgrade and below, follow project geotechnical recommendations.

A. Suitable On-site Excavated Material: Suitable materials shall be CL/CH materials as determined by the Uniform Soil Classification System that are cohesive in nature, free of debris and organic materials and acceptable to the Engineer. Material for backfill shall be placed in uniform layers not more than 12 inches in depth (loose measurement) and shall be compacted to the density specified herein. Each layer of backfill material, if dry, shall be wetted uniformly to the moisture content required to obtain the specified density and shall be compacted to the required density, by means of a mechanical tamper. Each lift shall be compacted to the required density and moisture content as specified in the “Backfill” section of this guideline above.

B. Select Fill: A clean gravel, or gravel approved by the Engineer, may be used for backfill material from the bottom of the trench to the top of the conduit or as otherwise shown on the plans. The gravel shall be placed in the trench in loose lifts not to exceed 12 inches in depth and lightly tamped to consolidate and seat the mass against conduit and earthen surfaces.

C. Controlled Low Strength Material (CLSM): CLSM shall be placed by direct discharge from a mixer truck or other approved method. A minimum of 30 psi at 3 days and maximum strength of 800 psi at 28 days is required. A filter fabric shall be placed on the top and the sides of the gravel backfill (initial backfill) between the trench sides as well as the

secondary backfill. The filter fabric shall conform to the requirements of Texas Department of Transportation Material Specification DMS-6200, Type1.

Mark all precast boxes with the following:

A. Name or trademark of fabricator and plant location

B. ASTM designation

C. Date of manufacture

D. Box size

E. Minimum and maximum fill heights

F. Designated fabricator's approval stamp.

DOMESTIC WATER

The current water distribution system at the RELLIS Campus consists of a 300,000-gallon elevated storage tank, an original distribution system, and a new distribution system that operates on a static pressure between 51-55 psi. The original distribution system consists of cast iron and PVC water lines installed between 1942 and the early 2000s. The new distribution system installed through various infrastructure upgrade projects consists of HDPE piping.

The RELLIS Utility Infrastructure Master Plan has identified the need for a new water tower. Pressure in the existing distribution system has been inadequate to support new facilities on campus from a fire and irrigation pressure perspective. Each new building has typically required fire and irrigation pumps to increase the pressure to code required levels. The new tower is expected to hold 750,000 gallons of water and maintain ~80 psi in the system. The maximum water elevation will be determined based on tank dimensions and volume and will exceed 185'. As of early 2026, design for the new water tower is underway with tentative completion sometime in late 2027 or early 2028.

The domestic water system shall be designed, installed, and tested in accordance with TCEQ requirements.

Domestic water piping and fittings shall meet UES design standards for High Density Polyethylene (HDPE) pipe with a DR 11 or heavier. Exposed piping shall be ductile iron with appropriate coating protection. Fittings may also be ductile iron (AWWA C153) with flanged ends. All angles, bends, tees etc. shall be stabilized with concrete thrust blocks sized by the project A/E. Appropriately spliced and terminated tracer wire shall be laid with all water line. Detector tape shall be place 12" below final grade.

Line valves shall be placed at all points of connection to existing water lines, at branch intersections and any other locations necessary for adequate control of the water system. Typically, the number of valves at an intersection will equal the number of branches less one. "In line" valves shall be placed in long runs of pipe at approximate 1000-foot spacing. Adequately

supported air/vacuum relief valves shall be installed as required along the main line in enclosures to facilitate drainage and maintenance/inspection.

Line valves 3" and larger shall be direct bury resilient wedge gate valves meeting the requirements of AWWA C509 with flange joints and non-rising stem nut operator. Valves shall be poly wrapped in accordance with AWWA C105. All valve operators shall open when turned counterclockwise and close when turned clockwise.

Line valves smaller than 3" shall be bronze body ball valves with threaded connectors, stainless steel ball and stem, lever operated with a rated working pressure of 200 psi.

Cast iron adjustable valve boxes with surface reinforced concrete collar shall be provided over all buried valves to provide access from ground surface to valve operating nut. A gate valve extension shall be provided and terminate 1' from the top of the box when the operating nut is more than 2' from the top of the box. Where multiple valves boxes are located in close proximity, provide a single larger continuous concrete collar to group all valve boxes into a single pad to facilitate turf maintenance. Where valve boxes are located along the slope (i.e. drainage channels or ditches) concrete valve collars shall be constructed to follow the slope of the adjacent finish grade.

Adequate fire hydrants shall be placed around the facility such that no portion of the building is over 300 feet from a hydrant. Fire hydrants shall be 5 1/4" main valve opening with two (2) 2-1/2" hose nozzles and a 4-1/2" pumper nozzle. Coordinate nozzle size and thread requirements with entity providing fire protection. Hydrants shall be dry-top compression type hydrants, traffic model, complying with AWWA C502. Auxiliary gate valves shall be placed in all hydrant leads.

Where necessary, connections to existing water mains shall be a "hot" tap using a tapping sleeve and valve appropriate to the type of pipe being tapped. No size-on-size taps shall be made without approval by the Owner.

The domestic water supply to a facility shall be metered unless directed otherwise by the Owner. Metering shall be in accordance with UES guidelines referenced at the beginning of this section.

The complete site domestic water system installed for the project shall be pressure tested for leakage in accordance with TCEQ requirements along with applicable fire protection codes and shall be disinfected in accordance with the requirements of AWWA C651.

CHILLED AND HEATING WATER DISTRIBUTION (CAMPUS THERMALS)

RELLIS operates and maintains a campus central utility plant (CUP) to provide chilled water and heating hot water to campus buildings via underground thermal piping loops. Additional information on the CUP equipment is included in the Division 23 section of these guidelines.

Distribution mains for chilled water supply and return are 24" HDPE across campus. Distribution mains for heating hot water supply and return are 12" HDPE across campus. All thermal loops also include 3" condensate return piping.

Two primary underground thermal loops currently exist to serve the northern portion of the campus. One loop serves the northwest portion of the campus via Avenue A, RELLIS Parkway and across the runways. The other loop serves the northeast portion of the campus via Avenue

A, RELLIS Parkway, Bryan Road, and 4th Street. All projects shall consult with RELLIS Administration for specifics on both current and future planned thermal piping routes throughout campus as well as available plant capacity during project design.

The RELLIS Campus requires the use of Extra High Molecular Weight Plus (EHMW Plus) High Density Polyethylene (HDPE) pipe due to its additional performance against abrasion, higher pressure and elevated temperatures. This pipe is manufactured with the PE4710 resin. For chilled water a minimum of SDR 17 is required. For heating water, a minimum of SDR 11 is required. Refer to UES design standards for additional details and specifics: Underground Piping Installations.

An isolation valve shall be installed on any lateral feeding a building so that the building can be isolated without bringing down adjacent buildings. The valve shall be a direct buried gate valve. Chilled water and heating water valves in underground systems shall have as an enclosure a concrete valve box with sufficient space to maintain and operate valves. Direct buried valves may be considered if acceptable to the System Mechanical Engineer.

NATURAL GAS

Natural gas service at RELLIS is provided by both TAMU UES and Atmos Gas. Both the UES and Atmos city gates are located in the northeastern portion of the campus near the Joint Library Facility. Existing UES gas service is in the process of being deprecated and replaced with Atmos service whenever possible. New connections to the existing UES gas system are not permitted. New natural gas service required for any new buildings shall be coordinated with RELLIS Administration and Atmos Gas.

The project A/E shall contact Atmos Energy for location of connection and coordinate routing of the service. The project A/E shall also provide a Commercial Customer Load Requirements sheet (provided by Atmos) and properly locate the meter based on current Atmos guidelines for meter location and meter clearances with respect to building features.

All Atmos natural gas mains on campus are protected by an associated easement, typically 10’ wide. The project A/E shall coordinate with RELLIS Administration, TAMUS FP&C and the TAMUS Land Management Office regarding all aspects of the easement process.

ELECTRICAL AND DATA/TELECOM DISTRIBUTION

Refer to the Division 26 and 27 sections of these guidelines for information related to medium voltage electrical distribution and fiber optic cabling infrastructure.

Note that overhead/aerial distribution for both electrical and telecommunications distribution is prohibited for any new construction projects on the RELLIS Campus. Where major renovations are performed to existing facilities which are currently served by existing overhead/aerial lines, the project shall be required to transition to underground distribution unless specific exception is granted by RELLIS Administration.

END OF DOCUMENT