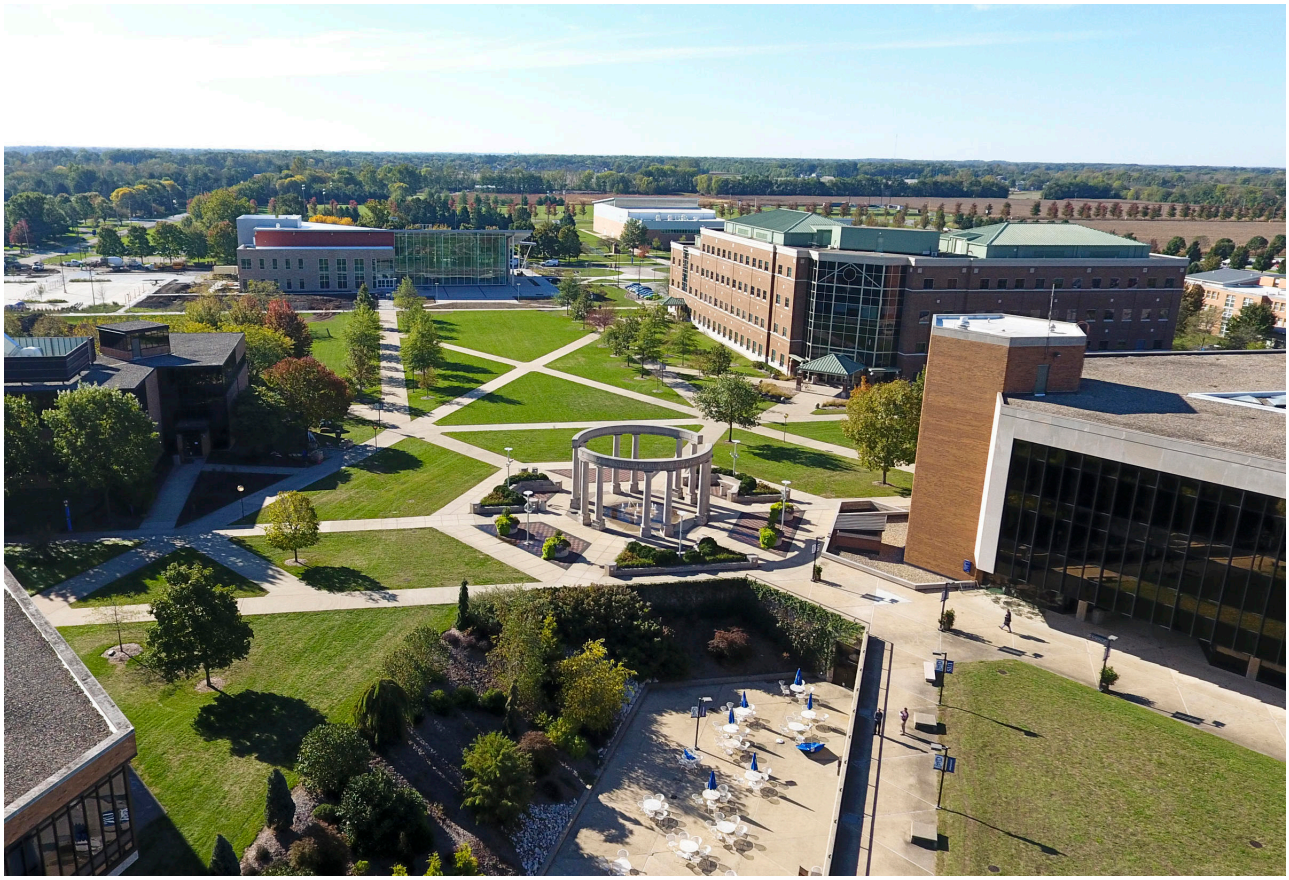
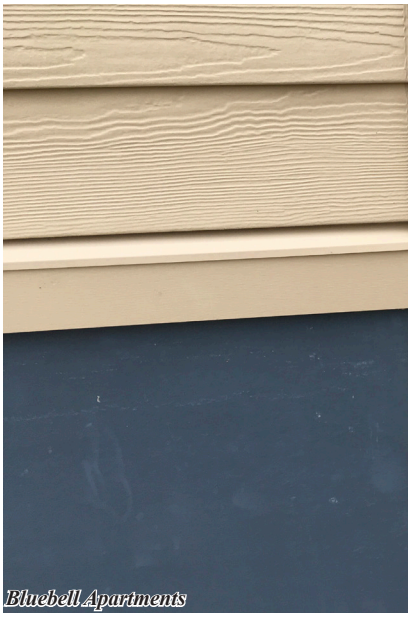
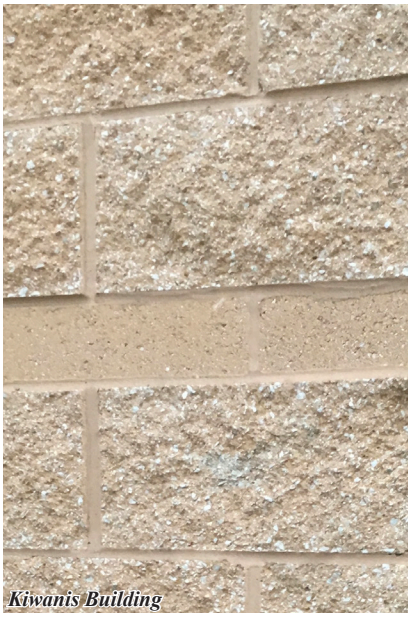
# Table of Contents

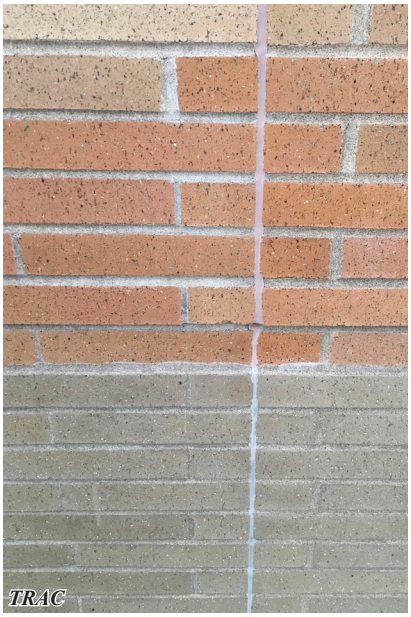


*UIS Campus looking south through the Main Quad.*
*Photo courtesy of peoriapublicradio.org*

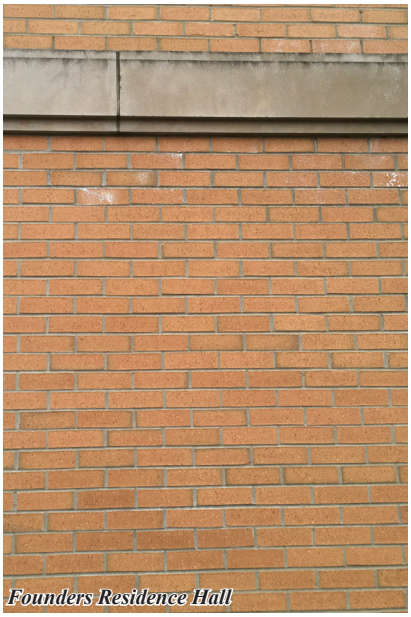

Bluebell Apartments

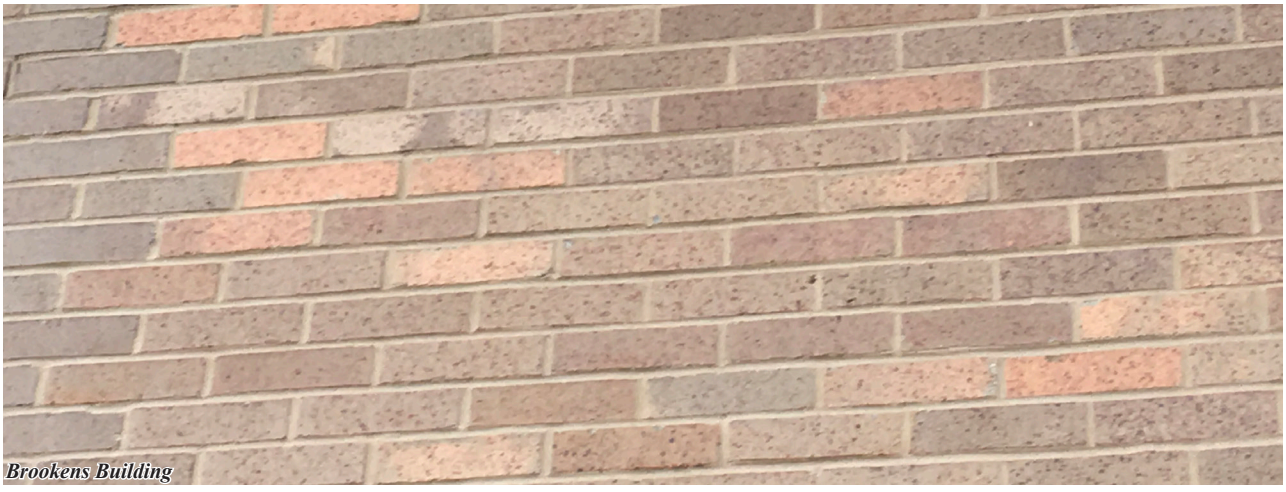

Student Life Building Gym


Kiwanis Building


TRAC


Student Union


Founders Residence Hall


Brookens Building

*Examples of existing building materials.*
*Images courtesy of Lawrence Group.*

*Volume 3a*

# Design Guidelines & Narratives

UNIVERSITY OF ILLINOIS SPRINGFIELD

# INTRODUCTION

The University of Illinois Springfield Design Guidelines is a companion to the UIS 2020 Master Plan, and sets forth a series of performance criteria. The role of the Design Guidelines is to ensure that individual designs implemented within the framework of the Master Plan will be of consistent and high quality. The guidelines are not intended to prescribe a design solution or to stifle analysis or creativity, nor should they be interpreted loosely to permit solutions that do not fit within the conceptual framework that is set forth by the University. The intent is to set a balance between the guidelines and the design decisions that must be made for each project, with the goal of a campus as a cohesive whole.

The University is committed to enhancing the campus environment on each project through the following principles:

Design Excellence – All new buildings must have a unique aesthetic and identity appropriate to its use, while also integrating into the Master Plan framework and being compatible with surrounding buildings.

Universal Design – All new buildings must foster an equal access environment that fosters pedestrian travel around campus.

Sustainability – All new buildings must promote environmentally responsible construction, maintenance and use. All new buildings under 20,000 GSF, additions, and site developments must meet at a minimum Leadership in Energy and Environmental Design (LEED) Silver rating. All new buildings over 20,000 GSF must achieve a LEED Gold Rating. This rating must be met regardless of whether the University decides to pursue certification.

Technical Innovation – As appropriate, new projects must incorporate innovative technologies that support the Master Plan (i.e. Green roofs, solar panels). Care should be taken not to negatively impact the building exterior with technologies at risk of becoming obsolete, and care should be taken to incorporate technologies in an aesthetically pleasing manner.

# ADMINISTRATIVE GUIDELINES

***Review and Approval:*** Each new construction, building modification, grounds improvement or demolition project must be reviewed with regard to its impact upon its surrounding environment. All projects are to be reviewed by the Office of Campus Facilities. Review milestones are typically to occur at the 30% (Schematic Design), 60% (Design Development) and 95% (Construction Document) levels. Approval is required at the end of each phase of design, prior to moving on to each subsequent phase,

and prior to Bidding/Construction. Typical areas of consideration and recommendations are addressed as follows.

***University Office of Capital Programs and Real Estate Services (UOCP & RES)*** The University of Illinois system administration unit supports the University of Illinois' mission by facilitating and overseeing the development of and adherence to policies, procedures, and systems pertaining to the built environment for all universities in the system. UOCP&RES is responsible for all University of Illinois master planning and its related sub-master planning, acquiring property to meet the needs of the master plans, design guidelines, and review of capital facility project designs and site selections that require Board of Trustees approval.

## GENERAL BUILDING DESIGN CONSIDERATIONS

***Basic Principles:*** Design principles can be used to provide guidance in achieving unity among campus facilities in the development of new or expanded buildings. Some of these principals are outlined below.

- Overall building proportions tend to be horizontal.
- Roofs, and other elements, can be used as unifying elements
- Building organization is generally n three parts: base, middle, and top
- Walls, with some exceptions, are solid planes
- Building elements are used to create rhythmic patterns with doors, windows, cornices, material changes. Layering
- Main and secondary entrances are often used to create compositional emphasis
- Windows are often punched openings, grouped to create larger units and patterns within the facade

***Building Setbacks:*** Building locations should conform to average or prevailing setback lines in the UIS 2020 Master Plan. Consideration should be given to alignment with adjacent structures, and response to the definition of existing or planned open space. Respect should be given to existing view corridors, and new view corridors may be created. Generous setbacks should be maintained at parking lots, streets, and main campus pedestrian corridors. Minor setbacks may be considered for building specific access paths and gathering plazas, which, in some cases, may be built with no buffer to the building at all.

***Building Size:*** While diversity is essential in creating an appealing visual experience, building size should be controlled to maintain a common scale relationship between buildings. Building height should

typically be 3-5 stories in height above grade, with the level of detail appropriate to maintain human scale.

Only special building elements may be considered to exceed this height in key locations. These will be considered and reviewed on an individual basis at the time of design.

***Aesthetics:*** Consideration should be given, not only to the appearance of a project itself, but also to the impact it will have on the overall appearance of the surrounding areas. This applies to modifications to existing facilities, as well as, to new facilities.

1. The appearance of new facilities should be appropriate for the immediate and campus-wide architectural context.
2. The finish color of elements added to the exterior of existing facilities should blend with the existing color palette. The elimination and creation of openings in the façade of a building need to take into consideration the rhythm and balance set up by the existing windows and doors.
3. Projects involving additions to or projections from existing facilities should be contextual with the existing and surrounding facilities.
4. The installation of window air conditioning units should be avoided. If approved by the Office of Campus Facilities, window air conditioning units should be installed so as to minimize their projection from the exterior face of the facility.
5. The placement of exterior conduit and piping, while undesirable, is sometimes unavoidable and should be placed so as to take advantage of other vertical and/or horizontal elements.
6. Outdoor equipment (e.g. air conditioning units, emergency generators, transformers, etc.) installed at ground level should be located in remote / less traveled areas. When installing equipment at roof level, careful consideration should be given to site lines from the ground level (especially primary traffic routes) as well as upper levels of facilities. The installation of screening (e.g. walls, fencing and possible landscaping) is necessary, either at ground level or at roof level, depending on the site lines of the installation.
7. The installation of unsightly outdoor structures/objects (e.g. loading docks, storage areas, sheds, tanks, trash / recycling containers, etc.) should be placed so as to take advantage of adjacent building and landscape screening features where available (i.e. within a remote alcove). Installation of additional screening is also required.

***Acoustics:*** Consideration should also be given to the impact a project will have on the acoustic properties of the surrounding area.

1. **Exterior:** The operation of noisy exterior mechanical/electrical equipment (e.g. air conditioning units, high velocity exhaust air discharges, emergency generators, etc.) can be very disruptive to adjacent building occupants and/or research functions.

- Equipment should be selected so as to minimize the transmission of noise to these areas. It may be necessary to locate such equipment, as appropriate, at the roof level rather than at the ground level, or to locate it within an appropriately designed acoustical enclosure.

- Noise-producing service areas (i.e. loading dock / receiving areas, trash / recycling areas, laboratory bulk tank areas, etc.) should be located so as to minimize noise transmission to occupied areas, especially those that are more sensitive to noise.

2. **Interior:** The installation of noisy interior mechanical equipment/systems can have an equally negative impact.

- Equipment should be selected and systems should be designed so as to minimize the transmission of noise to occupied areas. Mechanical equipment, such as air handling units, should be located within a mechanical equipment room rather than within (or above the suspended ceiling within) an occupied space provides an obvious acoustic advantage.
- The allowable HVAC-related background noise level for a given type of occupancy should not exceed the guideline criteria provided in the chapter entitled *Sound and Vibration Control* in the current edition of the *ASHRAE Handbook, HVAC Applications.*

***Odors/Fumes:*** Consideration should be given to the potential impact of objectionable odors and/or toxic fumes that could ultimately result from a project. This is especially applicable to loading docks, "wet" laboratories, laboratory animal facilities and agricultural animal facilities. Each fume exhaust system should be provided with a high velocity discharge stack of sufficient height and discharge velocity to prevent fumes from entering the ventilation systems of area buildings.

***Humidity:*** Evaporative cooling equipment (e.g. cooling towers) should be located such that, when operating under various wind and weather conditions, the associated plume of humid discharge air moves up and away from surrounding buildings, vehicles etc. Typically, this requires such equipment to be installed at roof level.

***Plantings:*** Consideration should be given to the impact a project will have on adjacent trees and shrubs.

1. Structures/objects should be installed so as to minimize the negative impact on significant plantings (e.g. by shading, root damage, root compaction, etc.).
2. Equipment installed at ground level should be located relative to adjacent trees and shrubs such that significant plantings will not be damaged as a result of the long-term operation of this equipment (e.g. due to increased airflow at elevated temperatures).

***Maintainability****:* When exterior equipment is installed at either the ground level or the roof level, consideration should be given to its impact on the maintenance of the surrounding area.

1. **Ground-Level:**

- All ground-level structures, objects, and equipment should be installed so as to facilitate lawn mowing and other grounds maintenance functions.

- All ground-level equipment should be located on poured concrete pads. Each piece of equipment that is located adjacent to a facility should be installed on a pad of sufficient size to eliminate small areas that would otherwise require mowing and/or refuse collection.
- No structure, object or piece of equipment should be located so close to the exterior of a building so as to greatly hinder exterior maintenance functions. Similar consideration should be given to the location of significant plantings.

2. **Roof-Level:**

- Each piece of roof-level equipment should either be located on an enclosed box type curb or should be supported above the roof surface a minimum distance of 3 ft to allow sufficient access for roof maintenance.

3. **Interior and Exterior Equipment Access:**

- The necessary clearances should be maintained to access areaways and other access openings that are required for the future replacement of existing mechanical and electrical equipment and/or the future installation of additional equipment.

***Traffic/Access:*** Consideration should be given to the impact a project will have on traffic patterns and vehicular access to area facilities including pedestrian and bicycle traffic. Special consideration should be given to maintaining adequate emergency vehicle access.

***Impact of Surroundings on a Project:*** The reverse thought process should also be applied. Consideration should also be given to the impact that the existing surrounding area/environment will have on a new project. These issues are often overlooked.

1. Objectionable noise from existing equipment, service areas or vehicular traffic may have a negative impact on a new project.
2. Odors/fumes from other facilities in the area may have a very negative impact on a new project and should be addressed early on in the design process. The location of intake air openings relative to potential sources of odors such as loading docks should be considered.
3. Exterior air-cooled mechanical/electrical equipment installed by a project should be located relative to adjacent structures, trees and/or shrubs such that intake airflow is not impeded and exhaust airflow is not re-circulated. Otherwise, the proper function of new equipment may be hindered.
4. Exterior structures/equipment installed by a project should be located such that they are not vulnerable to damage by falling ice from roof overhangs.
5. Consideration should be given to the potential negative impact of roosting pigeons with regard to exterior structural/architectural features such as building canyons, cavities and shafts as well as louvers, overhangs, outcroppings, ledges and sills. The same is true of exterior mechanical equipment/systems such as window air conditioning units, cooling towers, and other air conditioning equipment. Appropriate steps should be taken to minimize such problems (see the *Bird and Pest Control* section in these *Standards*).

6. Consideration should also be given to the negative impact of large expanses of glazing and the potential for bird strikes. Preventative measures that include UV designs installed in the glazing unit are preferable to post construction applied solutions, including exterior applied UV film and some physical barriers such as paracord installations.

# EXTERIOR BUILDING ELEMENTS

## SPECIAL CONSIDERATIONS FOR SPECIFIC CAMPUS AREAS

### MAIN QUAD

The original existing building on the Main Quad are all designed in a fairly traditional aesthetic, using a large amount of brown colored brick, aluminum windows and storefront, and some decorative metal elements. Newer buildings, such as the Student Union, incorporate more modern materials and more color and decorative elements.

New building design on the Main Quad should strive to continue the direction set by the Student Union, using a variety of decorative materials in a more modern design aesthetic. At the same time, new design should be compatible with the original masonry buildings as well.

New buildings on the Main Quad should use any of the materials outlined under the section BUILDING ENVELOPE.

### EAST QUAD

The buildings on the East Quad were originally constructed as temporary space for the University. As the University has grown, the need for this space has remained, and these buildings have undergone several interior renovations, with no renovation to the exteriors.

These buildings were simple, single story metal buildings, designed as functional space, with simple, practical exteriors without much consideration to their exterior appearance. Windows are narrow. Material used are predominantly metal panels, with EIFS, metal windows, and unit masonry in limited areas.

Looking forward, the intent is to renovate, rather than demolish and rebuild, the East Quad buildings. These renovations will include full exterior and interior renovation.

Overall, it is intended to change the appearance of the East Quad by reimagining the building exterior facades, as well as the surrounding landscape and hardscape, to give the East Quad its own new unique identity and aesthetic, to create an area of campus on equal standing as the other Quads. The building facades should be considered an extension of the outdoor spaces, enclosing the interior as well as framing the exterior spaces.

When designing the exterior facades, the consideration should be given to a more modern design aesthetic, unique from the other areas of campus. Consideration should be given to larger expanses of glass, and larger windows to emphasize natural light and emphasizing building areas. Building entrances should be emphasized and clearly designed transitions from the exterior spaces.

Façade materials should be limited to those that can be supported by the wall framing behind, rather than by foundations or brick ledges below. The lack of existing foundation support makes materials such as unit masonry difficult and costly to implement, and should be avoided, unless by approval of the Office of Campus Facilities.

Building interiors should be designed in accordance with the section BUILDING INTERIOR ELEMENTS.

**RESIDENTIAL**

The residential buildings on campus are designed in one of two basic arrangements – Residence halls, or Apartments.

Residence Halls should be designed with any combination of the materials listed below.

The campus apartments have a more residential feel unique from the rest of the campus. In addition to a more secluded setting, apartments should be designed in one or two story arrangements, with separate exterior entrances to each apartment.

Apartments should use materials typical of more residential building types. The goal is to maintain a more residential feel to set these buildings apart from the academic building. Materials to consider include:

- Unit Masonry
- Cementitious Siding
- Aluminum Single Hung Windows
- Asphalt shingle (sloped) roofing

**ATHLETIC**

Athletic buildings can vary widely in their design, due to the specific use and needs of each building. These buildings may be designed with any combination of the materials suggested under the section BUILDING ENVELOPE.

## BUILDING ENVELOPE

**WALLS**

The exterior building envelope should be designed in such a manner as to complement the existing buildings on campus. It is not the intent of this guideline to impose a single design aesthetic on new or renovation work on campus. However, each area of campus has unique aesthetic and considerations, as outlined previously.

Exterior Envelope may be built with any material, or combination of materials, below:

Unit masonry
Anchored Stone Veneer Masonry
Metal Panels
Terra Cotta Panels
Composite Materials
Cementitious Panels or Siding
EIFS
Aluminum Storefront or Curtainwall
Other materials may be approved by the Office of Campus Facilities

**WINDOWS & DOORS**

Natural light in campus buildings is a priority. Buildings should be designed with an effort to bring natural light to as many interior spaces as possible. The architect must balance this goal with the energy efficiency of the building envelope.

***Doors:*** Exterior doors shall be of aluminum. Interior doors shall generally be hollow metal doors or solid core wood doors with steel frames. Interior doors which are wood must be solid core construction. Construction must be ANSIWDMA Custom Grade Extra Heavy Duty with Structural Composite Lumber or

solid stave core. Particle Core and Medium Density Fiberboard cores are not permitted. Doors edges must feature matching hardwood bands finished at the factory with edge before face construction.

Wood veneer, mineral core fire rated doors shall not be used, due to issues with the narrow hardwood band on the hinge edge delaminating from the core. The only uses under which mineral core wood fire rated doors may be used are in low use situations: if the door(s) is on a magnetic hold open, always open except when a fire alarm device causes the magnetic hold open to close the doors, or if the door is to a mechanical or electrical room and is normally locked. Under any conditions other than those described above, approval must be given by the Office of Campus Facilities.

Doors with more than 40-50% glazing shall be metal frame construction, or solid lumber construction. All glass doors shall not be used unless as approved by the Office of Campus Faciliteis. Full glass doors must be of stile and rail construction that will permit the use of standard door hardware complying with *Section 08 71 00 – Door Hardware*. Door stile shall be a minimum of 5-inch to accommodate card access hardware.

***Windows:*** Windows shall be of the highest quality available, with a proven balance mechanism. Casement sash windows shall be avoided due to high maintenance costs of crank operated rotary devices. All windows shall be securable, preferably with locks, especially those located on ground/lower floors. Security screens or gratings shall be considered for installation where additional security is needed. Building Fenestration should use the following materials:

Aluminum Windows
Aluminum Storefront
Aluminum Curtainwall

***Glazed Curtain Walls:*** Glazed curtain walls shall be of true “curtain wall” construction, as opposed to “storefront” construction. All glazing systems shall have fully captured glass with pressure plates at all glass edges and snap on mullion covers. Structural sealant glazed systems or exposed sealant joint systems are permitted as approved by the Office of Campus Facilities. Structural glazing systems, the design of which does not facilitate convenient pane replacement, shall not be permitted.

***Exterior Glazing:*** All exterior glazing shall be of the insulated double pane type that incorporates metal framing separated by a thermal break that is “locked” into the extrusions, not merely a sealant. Triple glazed units may be used, provided the size is limited. See *Section 08 80 00 – Glass Glazing* for information on size limitations. The use of “Low-E” exterior glazing is encouraged for energy conservation and occupant comfort. While colored glass is discouraged, any colors or tints that are used shall be standard colors readily available from a variety of manufacturers. Custom tints shall not be used because it is virtually impossible to match the color years later when a piece needs to be

replaced. Tinted glazing shall be pyrolytic, not applied film. Glazing in more vulnerable locations (e.g. doors, ground/lower floor windows and curtain walls, etc.) shall be of especially durable construction (e.g. laminated glass, tempered glass, wire glass, or polycarbonate) even if not specifically required by code.

***Special Construction:*** Special exterior window/glazing construction shall be employed as appropriate in conjunction with a winter interior design relative humidity greater than 35% and/or a summer interior design space temperature less than 65 degrees F.

***Natural Lighting vs. Energy Conservation*:** Full advantage shall be taken of opportunities to provide natural lighting. However, full compliance with the current revision of *ASHRAE Standard 90.1* and approved addenda shall not be sacrificed in the process.

***Large Expanses:*** Large expanses of exterior glazing, particularly on building faces exposed to solar gain (especially on west exposures) shall be carefully planned and designed with special consideration for potential summer heat gain, winter heat loss, glare and wind loading issues.

## BUILDING ENTRANCES

Building entrances occupy a zone of transition between exterior and interior spaces. As such, building entrances must clearly stand out from the rest of the building, and clearly signify the entrance to the building for users. Using materials distinct from, but compatible from, rest of the building can be considered. This zone should be considered an extension of both the exterior landscape, and the interior public areas.

Canopies may be used as part of the building entrance transition. Materials should be compatible with the rest of the building, but may also stand out through the use of color, materials, etc .

Materials used for building entrances and canopies should comply with the building envelope materials listed above. Exposed steel may be used, but building infrastructure should not be visible, and must be covered in some manner.

***Wind Protection:*** Each building entrance that is used by the public shall be recessed or shall incorporate exterior wing walls as required to adequately protect it from the wind. Proper operation, and durability are difficult to ensure on doors that are not protected against high wind forces.

***High-Usage Public Entrances:*** In addition to wind protection, each high-usage public entrance shall incorporate a vestibule with two sets of doors to provide an air-lock to accomplish energy conservation

and occupant comfort. Each vestibule shall be served by one or more dedicated heating units. However, this shall be accomplished in a manner that minimizes the potential for freezing the heating equipment and/or associated piping. Consideration shall also be given to freeze protection of sprinkler piping and/or any other piping located above the vestibule ceiling. Each high-traffic entrance shall also incorporate floor matting within the vestibule.

***Low-Usage Public Entrances**:* Each low-usage public entrance shall be served by one or more dedicated heating units.

***Service Entrances:*** Each large service entrance with overhead doors (or equivalent) that allows large quantities of outdoor air infiltration shall be accompanied by a heated receiving room. The same considerations regarding freeze protection shall be applied here. Each smaller service entrance shall be provided with a heated vestibule unless the frequency of usage is expected to be low, in which case it shall simply be served by one or more dedicated heating units as required for a low-usage public entrance.

***Canopies:*** All canopies shall slope away from the building. Canopies shall be properly flashed to building wall in a way that complies with NRCA, SMACNA, and roofing manufacturer details. Termination bars shall be counterflashed similar to roof curbs. Canopies shall not drain water back into the building. Rain water and snow shall drain through exterior downspouts.

# INTERIOR BUILDING ELEMENTS

## INTERIOR FINISHES

***Ceiling Finishes:*** Generally, a suspended ceiling system will be installed as required to satisfy the *Ceilings* section within these *General Guidelines*. These should require no additional finishing. In a non-standard area where an exposed structural ceiling or a suspended drywall or plaster ceiling is used, they shall be painted in coordination with and using similar materials as the wall finish.

***Wall Finishes:*** Generally, wall finishes shall be painted drywall or masonry block. Locations where a higher level of finish is desired over masonry block, a finish coat of plaster should be provided over the block. Painted drywall is only appropriate in low impact areas such as private offices because of its poor durability. See *Technical Sections* within *Division 09* for detailed requirements for all types of wall finishes. Wall finishes in restrooms, locker rooms, shower rooms, etc. shall incorporate ceramic tile. Wall finishes in the balance of these types of rooms as well as all wall surfaces within laboratories, animal facilities, service facilities, etc. that are exposed to high humidity and/or require water wash-down for cleaning shall be water-resistant (e.g. one that incorporates a two part epoxy finish coat).

***Base Molding:*** Generally, base molding shall be rubber construction (not to be confused with vinyl). Base molding in restrooms, locker rooms, shower rooms, etc. shall be ceramic tile cove base construction to match the floor and/or wall tile. Terrazzo, marble, hardwood and other specialty base molding may be used to match other finishes and features. Integral cove bases may be used with certain flooring products. Light colored base that shows black scuffmarks shall be avoided, especially in classrooms and high traffic areas, even at the expense of not matching light colored flooring.

***Floor Finishes:***

***General:*** Flooring for all spaces shall be selected with durability, life cycle cost as the first and foremost considerations. All flooring materials shall be able to maintain their appearance and functionality for extended periods of time with minimal maintenance.

***Standard Spaces:*** Flooring for standard occupied spaces within campus buildings shall be vinyl composition tile (VCT) or another system of higher quality and greater durability. Systems of higher quality and greater durability include Linoleum, Rubber, and Vinyl Enhanced tile. Floor product shall be a minimum of 1/8" thick, and shall be homogeneous. Products which feature a thin wear layer over a generic core material (such as Luxury Vinyl Tile) shall not be used. Imported tile should be avoided. New and "unproven" floor systems should also be avoided. All resilient flooring products are to be provided in tile format, not sheet.

In light of recent changes to the formulations of glues and adhesives, it is prudent to perform moisture tests on all floor slabs, regardless of the age of the building, prior to bidding to determine if moisture mitigation needs to be included in the contractor's work. It is also suggested that for certain classrooms and lab spaces especially in slab on grade areas, concrete with either a steel trowel finish, or polished concrete, with a clear sealer, be considered. Concrete may be used in elevated slab areas, but is particularly appropriate for slab on grade.

***Lab:*** Floors for chemistry, medical and other wet labs need to be designed for the specific use of the lab. Epoxy coatings may be preferable over other standard or high use finishes.

***Corridors and Public Areas:*** For corridors and public areas which require the greatest consideration to durability, appropriate flooring includes: Terrazzo, ceramic tile (including porcelain and quarry), polished concrete, sealed concrete, rubber tile and Linoleum. VCT may be used in certain circumstances. Carpeting shall NOT be used in high traffic areas. .

***Restrooms:*** Flooring in restrooms shall be ceramic tile.

***Elevators:*** Flooring in passenger elevators shall be rubber tile or linoleum.

***Equipment/Service Areas:*** Typically, floors in equipment rooms and service areas shall be sealed concrete. The office spaces within equipment and service areas may be finished in this same manner.

***Color:*** Light colored floor finishes, whether carpet or tile should be Mottled patterns that incorporate a variety of "earth tones". They help to mask spots, spills, dirt accumulation, traffic wear, etc.

***Carpeting and Wood Flooring:*** Installation of carpeting shall generally be avoided, especially in high traffic areas, food service areas and public restrooms, as well as classrooms and conference rooms and other public use areas. Carpeting should be avoided in auditoriums because food and drinks inevitably end up in these types of spaces, resulting in major cleaning problems. Installation of wood flooring should also be avoided. Maintenance of these systems will not be provided by the F & S Division, but will be the responsibility of the using department/agency. When carpeting is installed, it shall be of high quality and shall be in tile format, not broadloom. See *Section 09 68 00 – Carpet* for specification requirements. The only locations in which carpeting may be installed without a variance is in private offices.

***Wood Doors, Framing, Trim, Cabinets, Etc.:*** See *Technical Sections within Division 09* for detailed finishing requirements. Wood trim and chair rail shall be installed in moderation and only where needed. Trim and chair rail with wide, horizontal surfaces should be avoided.

***Metal Doors, Frames, Cabinets, Etc.:*** See *Technical Sections within Division 09* for detailed painting requirements.

***Lead Paint:*** When existing lead paint is encountered it shall be addressed in compliance with the requirements of the *Occupational Safety & Health* section within these *Standards.*

***Blinds:*** Each window that is located within a room shall be evaluated for light controlling devices. Blinds that are integral to multi-pane windows (i.e. located between the panes of glass) are not acceptable. "Black-out" shades or other special window treatments shall be installed only as directed by the *Program Statement.*

## BUILDING PUBLIC AREAS

***Free of Obstructions:*** All building exit access corridors shall be fire-rated according to the Code and free of obstructions including display cases, fire extinguishers / cabinets, drinking fountains, public telephones, vending machines, etc. When located in an egress corridor, frequently used items such as drinking fountains and telephones shall not obstruct the full flow of traffic, even when in use. In many cases this will require that an alcove be provided. Vending machines shall be located in separate areas that are appropriate for such usage.

***Durable Construction:*** Corridors and other interior public areas shall be constructed to be significantly more durable than other lower traffic areas. Design within corridors and public areas shall be driven by durability requirements, which typically exceed the minimal requirements established by the *Life Safety Code.*

***Fire–resistance Rating*:** The appropriate fire–resistance rating of exit corridors and openings therein, shall be determined by the applicable Building Code or Life Safety Code. When new utility system installations create penetrations of the corridor walls, appropriate fire-stopping protection shall be installed to restore the corridor fire-resistance rating.

***Communications:*** Consideration shall be given to the installation of voice and data outlets and wireless access connections in public gathering spaces. Power outlets shall also be provided at each communication outlet. The location of the communication outlets shall be coordinated with the furniture plan.

## AUDIO VISUAL SYSTEMS

**Introduction**

Facility design criteria should support the latest and most appropriate in audio video communication. Audio video applications should be considered in the very beginning of the planning process during the pre-design phases.

**AV Designer Requirements**

New construction and major remodeling or renovation projects with audio-visual scope will require the services of an audio-visual consultant/designer.

Minimum qualifications for the AV consultant are:

1. Designer firm must have AVIXA APEX Designation;
2. Designer must have an AVIXA CTS-D certification in good standing.
3. Six (6) years working experience in the audio-visual industry;
4. Documented and verified design and project experience with like projects and technologies as the University project being contracted;
5. Ability to develop and author detailed specifications, and other project documents described in these facility standards related to AV;
6. Ability to prepare detailed construction drawings;
7. Ability to inspect, evaluate, and report on various project deliverables both in the field and written submittals;
8. Experience in a campus environment.

Technology Services-CCME must review and approve any variance requests of these designer qualification requirements.

**Third Party Commissioning**

New construction and major remodeling or renovation projects with audio-visual scope will require the services of a third party Commissioning Agent.

1. Commissioning Agent must have a Certified Quality Technician (CQT) certification through AQAV in good standing.
2. Design reviewer must have a CTS-D as well as a Certified Quality Designer (CQD) certification through AQAV in good standing.
3. Five (5) years commissioning experience on audio-visual industry.
4. Documented and verified commissioning experience with like projects and technologies as the University project being contracted

**Quality Assurance Deliverables**

The AV system commissioning process, or "Quality Control," is started during the Needs Assessment phase by the University's Technical Representative with a technical needs write-up. This will be the beginning of the Owner's Project Requirements (OPR).

1. ***Basis of Design [BOD]:*** *(the work document):* The process of continually refining the AV requirements will be the work of the Architect and AV Consultant with the development of their BOD document for the physical space(s) and AV system(s). The BOD shall give the reasoning, assumptions, and formulas used to determine layouts, equipment chosen, and the expected levels/results in an objective manner throughout the AV system ending with the end-user's experience--in other words, the combination of technology and environment for total human experience.
2. ***Design Phases and Contract Documents:*** The BOD shall be updated and submitted for review and approval by the University's Technical Representative with each of the design phases' deliverables.
   The bid document will show the final product of all work in narrative and drawings in a clear, concise, and measureable manner. Tests and testing procedures shall be a part of these bid documents. Any bid addendums issued that may cause an elimination, addition, or modification to the individual test items required and/or testing procedures must also be included. Please refer to section 4, Testing and Testing Procedures.
3. ***After Awarding:*** Once the AV portion of the bid is awarded, engineering work of the AV Integrator will be requested. This work will show the reasoning, assumptions, and calculations used for the Integrator's full project submittal, bill of materials, and installation plan. Any project-change orders or approved substitutions, modifications, or installation variances issued that may cause a modification to the tests required and/or testing procedures must also be included.
4. ***Testing and Testing Procedures:*** All information from OPR through construction, and up to Final System Checkout, will be tracked and used where applicable by the Consultant to develop a final set of current and relative tests and testing procedures that will be carried out by the AV Integrator at the proper times. Any changes to these tests and testing procedures will be developed in a cooperative manner with input from the AV Integrator and will be updated to reflect system changes or changes with the project as a whole. These tests and testing

procedures will be submitted to the University's Technical Representative (Technology Services-CCME) for final approval before any testing. All testing and testing procedures will follow the Association for Quality in Audio Visual Systems (AQAV) procedures. See AQAV.org for additional information.

5. ***Milestones:*** The main AV milestones for verification will start with conceptualization / schematic design, depending on the first AE deliverable, and will end with completion of warranty. The documents being used for quality assurance, along with when and what for are:

**Compliance and References**

*Industry standards, guidelines, and best practices (InfoComm):*

1. ANSI/ INFOCOMM 3M-2011 *Projected Image System Contrast Ratio*
2. ANSI/INFOCOMM 4: 2012 *Audiovisual Systems Energy Management*
3. AV Design Reference Manual, from INFOCOMM International.
4. Audiovisual System Design and Coordination Components, from INFOCOMM International.

*Quality Management is guided by The Association for Quality in Audio Visual Technology (AQAV, and that association's standard)*

1. AV 9000:2017 *Quality Management System (or latest revision)*

*Conduit, pathway, and dedicated equipment room considerations shall follow:*

1. *ANSI/TIA-569B Commercial Building Standard for Telecommunications Pathways and Spaces*

*Acoustical guidelines for classrooms, consult:*

1. ANSI/ASA S12.60; *Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools*

*Intelligibility of sound systems and public address systems:*

1. NFPA 72*; National Fire Alarm and Signaling Code*

*Further Reference*

1. Davis and Davis, 1987 *"Sound System Engineering"*
2. Giddings, 1990, *"Audio Systems Design and Installation"*
3. 2010 Standards for Accessible Design, Americans with Disabilities Act

**Design Considerations**

This is a partial listing of design considerations. No one document is going to cover all details for all projects. This section is meant to give general AV design considerations relating to the building mechanical design, sightline considerations, and infrastructure guidelines.

***Line of Sight:*** The coordination of the room layout (e.g. the three-dimensional location of seating relative to blackboards, projection screens, equipment cabinets, etc.) and the installation of audio-visual

equipment to ensure optimal lines of sight for all occupants, and the optimal projection lines and field of view for the AV equipment is of special importance in the design of classrooms and lecture halls.

***Coordination of Ceiling Height / Interstitial Areas:*** The bottom of the image will be placed so all audience members can see the complete image. Therefore, the height of the finished ceiling will have to account for this requirement to allow for the actual extended screen (or image height).

This is typically the biggest building design challenge with implementing AV and requires special attention at the beginning of the design when the building's floor heights are being determined, and must take into account:

1. Seating capacity requirements that will determine the size and layout of the space;
2. Screen size and placement necessary to properly cover the intended area and display the intended content;
3. Above ceiling area required for mechanical equipment.

Allow for conduit / cable tray, media support accommodations (projector lifts, speaker housing, etc.), and other specialty equipment in the area above the finished ceiling and below the deck of the floor above.

All AV support/mounting accommodations will be attached directly to the building's structure and not shared with any other support structure for other building systems. AV mounting accommodations must be vibration free.

***Projection Screen(s):***

***Screen Size:*** When displaying images, there is a direct relationship to the room seating. When calculating the image height to be displayed, measure the distance to the farthest seat from the screen. For detail type of viewing (most common use) divide the distance by six (6). This will give you the minimum image height required. The width of the image should accommodate a 16:10 aspect ratio for computer resolutions.

***Screen Type:*** The material for the screens will have a matte white finish. Choosing between a manual pull-down screen and an electrically operated screen will be determined by the physical layout of the room and the project budget. All screens ten (10) feet or wider will be electrically operated.

***Placement of the First Row:*** The first row of seats will not have a vertical viewing angle greater than $30^0$ (thirty degrees).

***Intelligibility:*** All sound systems and public address systems must be intelligible. This intelligibility requirement has a direct relationship to room acoustics, required volume, and minimal system distortion.

The NFPA 72*; National Fire Alarm and Signaling Code,* is referenced for the speech intelligibility requirements and testing procedures that it contains for designing sound systems and public address systems that may be part of a campus emergency alert system (for immediate or future use).

***Acoustics / Sound Transmission:*** Internal acoustics are more critical in the design of rooms with AV than in most other types of spaces. These rooms will also be designed and constructed so as to minimize sound transmission into and out of the spaces. Avoid locating rooms with AV close to exterior and interior noise sources such as service entrances, equipment rooms, restrooms, or high traffic areas. Take appropriate measures to minimize unwanted noise in rooms with AV for instruction.

ANSI standard; *Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools* (ANSI/ASA S12.60) will be used as a baseline for classrooms and ancillary learning spaces that do not exceed 20,000$ft^3$.

For specialty rooms such as rooms using video and audio conferencing technology and/or recording, the noise control requirements are even more stringent.

Acoustical design goals need to be established early on by the architect so all structural and mechanical designs can conform to these criterion. Further, these designated design goals are a baseline for the AV design (amplifiers and loudspeakers). Designs and/or construction that fail to develop a reasonable acoustical environment will prevent the successful implementation of AV into the space.

***HVAC:*** The portion of the HVAC system that is designed for an AV enhanced room will be designed and constructed with special consideration given to noise control.

Each large venue projection booth and AV equipment room will have a dedicated HVAC system tailored to the specific needs of the area being served and will create positive pressure to keep dust at a minimum. To create positive pressure and for occupancy requirements, a minimum amount of outside air shall be supplied from a central AHU. The dedicated system will control the temperature and humidity of the space.

All AV rooms that are heavily equipped and generate more heat than can be reasonably vented year round will allow for maintaining proper temperature and humidity with the implementation of specific control strategies. These rooms must be evaluated and if there is a continuous process load due to AV and/or other equipment they must have a dedicated cooling system. These rooms may also need a minimum amount of outside air due to occupancy schedule of equipment operators. The dedicated systems will be subject to the University's requirement to utilize Campus Central Chilled Water unless it is not available or can be proven not to be economical/practical, in which case a variance request must be submitted.

***Electrical:*** In a room with AV enhancements, the various equipment locations will have their power supplied from the same phase and power panel wherever possible. In rooms that are heavily equipped with AV, dedicated audio-visual power panels must be considered. In either venue, the circuits (or power panel) will be dedicated to the AV needs and isolated from other electrical needs of the room.

***Conduit Pathway:*** Follow *ANSI/TIA-569B Commercial Building Standard for Telecommunications Pathways and Spaces* for determining conduit capacity, conduit routing, and pull-box positioning and layout. The conduit pathways will utilize sweep bends and pull-boxes; no hard 90-degree bends will be used. All pull-boxes will be easily accessed and promote ease of use.

***Lighting:*** Electrical lighting in AV enhanced rooms is not only planned using the *University of Illinois at Springfield Design Guidelines,* but there are special lighting/darkening requirements for note taking and media projection. Determination of lighting controls is part of the architectural planning process, and must account for AV usage and requirements.

In rooms with AV projection, pendant lighting fixtures will be designed to allow the AV projected image light to be properly displayed onto the screen. The lighting fixtures must not block the projection path, or direct/reflect too much light on the screen surface.

**AV Hardware List**

1. Equipment racks will be Middle Atlantic or Lowell brands unless an alternate is approved by University's Technical Representative (Technology Services-CCME). Equipment racks will be designed to allow for future upgrades or additions to the system. No more than 75% of the rack space will be filled.
2. Lecterns (small) will be Spectrum Industries brand or fabricated by the University of Illinois' Mill Shop. Lift mechanism must be electric.
    a. Work surface height adjustability (floor to top of work surface)
        i. 42"H (fully-raised)
        ii. 34"H (fully-lowered)
    b. Total lower internal area (nominal) 19.74"W x 21.44"D x 21.74"H
    c. Keyboard tray
        i. 20"W x 11.63"D x 1"H - 2.38"
        ii. Pulls out 7.94"
        iii. Can be flipped and used as a drawer
    d. 3" Twin Wheel casters
    e. Work surface is constructed from 1" thick NAUF (No Added Urea Formaldehyde) composite board with .030" high-pressure laminate on one face, and a balancing phenolic backer on the opposing face
    f. Metal components consist of 16-gauge steel
    g. Work surface edges are covered with 3mm vinyl
    h. All metal components are finished with a scratch-resistant powder coat epoxy

   i. Solid wood corner trim
3. Lecterns (Large) will be Spectrum Industries brand or fabricated by University of Illinois' Mill Shop.
   a. Lectern is 62"W x 30"D x 32.5"-40"H
   b. Equipment Rack is 14RU in front, 10RU in back
   c. SCS Indoor Advantage Certified
   d. Meets or exceeds applicable ANSI-BIFMA test standards
   e. Warranted to be free of all defects in materials and workmanship for 10 years
   f. Designed and assembled in Chippewa Falls, WI USA
4. All display devices must be laser with a minimum native resolution of 1920x1200 and an aspect ratio of 16:10. The exception is for ultra-short throw projection, which may have a lower resolution of 1280x800. Any display slaved to an ultra-short throw must be of the same aspect ratio. Display devices must be capable of accepting digital inputs such DVI-D, Display Port or HDMI. Approved manufacturers are NEC and Epson unless an alternate is approved by University's Technical Representative (Technology Services-CCME).
5. Control equipment is exclusively AMX brand for touch panel applications and Extron brand for small room push button control systems unless otherwise specified. The control system must be compatible with the campus Universal Systems Manager (USM) monitoring system. If a system requires a control product that cannot be supplied by AMX or Extron any variation will not be accepted without written permission from the University's Technical Representative. In such cases, the relevant data sheet must be supplied to the University's Technical Representative before the design is approved and installation arranged.
6. AV Switchers, Distribution Amplifier's (DA), Extenders, and scalers must be Extron or AMX brand for typical spaces. The switcher must be capable of the following minimums:
   a. HDCP compliance with full key management on all inputs and outputs.
   b. EDID management
   c. Scaling/frame rate conversion
   d. HDMI Audio embedding and de-embedding
   e. 1920x1200@60Hz
   f. Color space management
7. AV over IP equipment can be used where applicable. University of Illinois, Technology Services-CCME requires AMX SVSI AV over IP devices. Any other system specified must be approved and tested by University's Technical Representative (Technology Services-CCME) and University of Illinois' Networking before being placed on the campus network. The following products have been tested and verified for use by University's Technical Representative (Technology Services-CCME):
   a. AMX SVSI 2000 series low latency.
   b. AMX SVSI 2000 series 4k.
8. A Radio Frequency (RF) Assistive Listening System must be used in any space with an amplified audio system. Listen Technologies is preferred. The supply and installation of any hearing augmentation system into a teaching space is to comply strictly with the following:
   a. ADA Standards for Accessible Design
   b. RF receivers with a minimum of 95% coverage
   c. 1 RF receiver for every 25 persons up to 500 persons

9. Audio Digital Signal Processors (DSP) must be BSS or Extron brand unless an alternate is approved by University's Technical Representative (Technology Services-CCME).
10. Audio amplifiers must be Crown or Extron brand unless an alternate is approved by University's Technical Representative (Technology Services-CCME).
11. Speakers and line arrays must be JBL Pro, Rhenkus Heinz, or Extron brand unless an alternate is approved by University's Technical Representative (Technology Services-CCME).
12. Flat panel monitors must be NEC unless an alternate is approved by University's Technical Representative (Technology Services-CCME).
13. Mounting for projectors and monitors must be Chief brand unless an alternate is approved by University's Technical Representative (Technology Services-CCME).
14. Microphones
    a. Lapel and Hand Held must be Shure QLXD
    b. Gooseneck must be Shure brand
    c. Wireless Conferencing must be Shure or Revolabs brand
    d. Ceiling Microphones must be Shure or Beyerdynamic brand
15. Document cameras must be Elmo brand unless an alternate is approved by University's Technical Representative (Technology Services-CCME).
16. Lecture capture must be Extron or Echo brand. Actual equipment must be verified by University's Technical Representative (Technology Services-CCME) and, if applicable, the department involved with the project.
17. Lecture capture cameras must be network device as well as having a HDMI or HD-SDI output. Axis model V5915.
18. Wireless video devices must be Mersive Solstice with an extra 3-year warranty. Setting up of these units will be coordinated with CCME to make sure network settings are correct.
19. Ceiling boxes must be FSR brand 1x2 or 2x2 ceiling boxes.
    a. CB-12
    b. CB-22
20. Equipment boxes located behind flat panel displays must be Chief Manufacturing brand.
21. All PC's will be owner furnished equipment unless noted.

## SUSTAINABILITY

All new construction and major renovation projects shall incorporate sustainable design principles to the maximum extent practical by project scope and when life cycle cost effective. The University has adopted the USGBC's LEED Green Building Rating System as a tool to measure sustainability elements achieved during design and construction. All projects, regardless of scope or funding source, shall use the LEED rating system as a self-assessment metric to determine the sustainable design goals for the project. USGBC LEED Silver should be achieved for all new construction projects under 20,000 GSF and

whole-scale renovations which include changes to building envelope and interior building systems. All new construction projects over 20,000 GSF should be designed to achieve LEED Gold.

## ACCESSIBILITY

***Accessibility Code:*** All remodeling and new construction on the UIS campus shall comply with the *Illinois Accessibility Code, [Title 71: Public Buildings, Facilities and Real Property; Chapter I: Capital Development Board; Subchapter b: Accessibility Standards; Part 400 Illinois Accessibility Code.] and Architectural and Transportation Barriers Compliance Board, Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Final Guidelines (36 CRFR Part 1191) Federal Register, Part II, Rules and Regulations, Friday July 26, 1991, 56(144). (ADAAG)]* or updated versions thereof as they become mandated by statute.

***Universal Design:*** The standards given in the *Illinois Accessibility Code* and *ADA Standards for Accessible Design* are to be recognized as being minimal standards required by law for designing facilities that are readily usable by persons with disabilities. The University of Illinois Springfield strives to provide facilities that are universally usable by persons with diverse physiologic and sensory abilities. The design of campus facilities shall provide for full and independent use of the facility by persons with disabilities. Following are examples of universal design standards that exceed minimum code requirements:

1. A power-operated entry door with a continuous vertical push plate shall be provided at no less than one entrance, preferably the main entrance, at each new or remodeled building.

2. A standard 5’ x 5’ accessible toilet stall is required to accommodate side transferring. Alternative stalls (Dims) described in the codes are not acceptable. End of row accessible stall configurations are preferred.

3. All elements within a facility should be planned to minimize architectural barriers to physically challenged individuals.

4. Large facilities with public spaces such as classrooms shall be constructed with multiple elevators to ensure continuity of accessibility when elevators are out of service due to repairs.

5. When technically feasible, Areas of Rescue Assistance (ARA) shall be considered in structures undergoing major remodeling. See the document entitled *Remodeling, Special Considerations* within these *Standards*.

## BUILDING SERVICES & WASTE MANAGEMENT

***Service Entrance:*** Each service entrance should incorporate a loading dock for material handling. The loading dock should be reinforced concrete construction with metal angle edge protection and rubber bumpers. The height of the loading dock should be 42 in. above the surface of the adjacent service drive. Each building should incorporate a service entrance that is specifically designed for the handling/transporting of various supplies, waste and recyclable materials into and out of the building, as well as for use by service and vending personnel. Adequate lighting should be provided for the convenience and protection of service personnel who work at night. Consideration should be given to providing a measure of rain and wind protection at each service entrance. Consideration should also be given to providing a receiving room with an overhead door for any service entrance that is *heavily* used for material handling. Additional considerations include adjacencies, storm water management, preventing slippage for forklifts, and mechanisms to prevent runaway trucks.

A service drive and associated access area should be provided to access the service entrance that serves each new facility. Each service drive and associated access area should be sized and laid out so as to safely and conveniently accommodate the vehicular traffic associated with the pick-up and delivery of materials as well as the dumping and/or pick-up/delivery of waste and recycling containers (see *Waste Handling* and *Recycling* below). A minimum of 60-65 ft. is required in front of each type of waste/recycling container for this purpose. Turn-around space should be provided as appropriate. Parking space for multiple service vehicles should also be provided as appropriate and practical. Each service drive and associated access area should also be sized and laid out to provide adequate access for emergency vehicles. Consideration should be given to providing a vision barrier to hide any aspect of the service drive and/or service entrance / loading dock area that is unsightly.

***Waste Handling:*** Buildings that generate smaller quantities of waste are typically served by an 8 CY "front-load" type waste container that is 74.5 in. wide x 68.5 in. deep x 82.75 in. tall. Buildings that generate larger quantities of waste are typically served by a "roll-off" type waste container that is 94 in. wide x 210 in. long x 87.5 in. tall. For screening purposes, the height at the peak of the roll-off access lids is 113.5". In either case, an access platform should be provided for the purpose of providing a safe and convenient means of accessing the applicable container. The height of each platform should be 24" below the top lip of the container. For 8 CY container, this would be 58.75 in. above the surface of the adjacent service drive and the width should be 48 in. minimum. For roll-off containers, the platform should be 63.5 in. above the adjacent service drive. The length of each platform should match the length of the associated container. Access to the elevated surface of the platform should be by means of a concrete ramp. In cases where a ramp cannot be constructed, stairs may be used if a variance is

approved. Handrails and guardrails should be provided as required by OSHA. Service areas should be appropriately screened using standard building materials, will all materials and locations to be reviewed and approved by the Architectural Review Committee.

***Recycling:*** Buildings that generate smaller quantities of recyclable materials are typically served by portable "toters" that are stored on an extension of the loading dock. Loading docks that serve this type of building should be laid out such that sufficient wall space (and corresponding dock area) is available for the storage of these "toters". Buildings that generate larger quantities of recyclable materials are typically served by a "front-load" type recycle container as described above for waste handling. An access platform should be provided (as also described above) in addition to the one required to access the waste container.

***Integrated Dock Design:*** As outlined above, either one or two waste/recycling containers will be located near the service entrance of each building, each requiring an access platform with a ramp. The preferred manner for accomplishing this is to integrate the access platforms and ramps into the design and construction of the loading dock such that it becomes a universal structure serving multiple functions. When this approach is taken, the rubber bumpers that are typically installed at the loading dock should not be installed where the dock serves as an access platform. Eliminating these bumpers allows containers to be located closer to the platform. A "No Parking Anytime" tow-away zone should be provided in front of the loading dock and each container.

## POINTS OF CONTACT

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# FURNISHINGS

### SITE FURNISHINGS

Furnishings at the UIS campus vary in style from place to place, although certain styles and products have been identified by facilities staff as being preferred for future use. Specifically, a standard waste container that is durable and convenient to maintain has been selected. Benches were selected for the new Student Union that could be used in other locations on campus.

Uniform styles of furnishings should be used throughout central campus area. Specialty furnishings may be used in less public areas such as courtyards, residential areas, and remote pathways and trails to develop character and uniqueness.

Movable furniture should be reserved for areas where its use can be monitored.

# ELECTRICAL

### EXTERIOR LIGHTING

Campus lighting must conform to any specifications in the U of I Facilities Standards. Light fixtures and optics should be selected to best illuminate the necessary areas.

Along streets with sidewalks lighting should typically include a combination of high-mast streetlights at regular intervals with lower height pedestrian-scale fixtures between streetlights. The combination is both functional and attractive. Along sidewalks or walkways through open areas, the lower height lights should be uniformly spaced along one side of the walkways. In particular locations where a light poles are not wanted for aesthetic reasons, low-profile lights can be used to line sidewalks, light outdoor terraces, or highlight areas for improved pedestrian safety.

Special features on the campus landscape such as signs, buildings, entrances, other architectural features, sculpture, and trees can be highlighted with flood or spotlights. The lights can be mounted on structures, on the ground, or in trees. The number of highlighted elements and the intensity of lighting should show restraint.

Selections of new poles and light fixtures should be based on several criteria. First is their overall capability to perform as required. With lighting technology advancing rapidly, consideration should be given to the capability of light sources (fixture) to be replaced in the future with improved units. A second criteria is the visual compatibility with other light fixtures used within campus. Although there is convenience in using the same fixtures, doing so can be overly repetitious. Use of contrasting fixtures in certain areas can help create a strong visual statement.

Environmental considerations must also be respected. Areas should not be lighted to excess, showing disregard for energy use and economy. Lights should have cut-offs and optics that restrain lights within the areas to be lighted. Economic lighting technologies and controls should be employed where possible to encourage energy conservation.

# EARTHWORK

### TOPOGRAPHY

The UIS Campus is built on flat land that was once tall-grass prairie with woodlands along its shallow drainageways. Because of the minimal topographic change, providing adequate drainage within the campus is often a challenge. Deep swales and ditches along roadways and large underground storm sewers have been constructed to collect and discharge water beyond the developed campus areas. In some areas sustainable stormwater management techniques, such as the permeable pavers, bioswales, rain gardens, and green roofs, have been employed to reduce stormwater runoff.

To only a limited extent have landforms been utilized on the campus. The entrance sign is set on a large berm. Additionally, "negative" landforms create sunken courtyards at the Public Affairs Center (PAC) and the Health & Sciences Building (HSB). One pond has also been built to provide stormwater detention.

Because this campus is on naturally flat prairie land, use of berms or other landforms should be largely avoided as they appear forced and artificial. Rather, the campus should celebrate the horizontal lines of the land.

### FINISH GRADING

Projects such as drainage swales, roadway ditches, rain gardens, and detention ponds involve excavation and finish grading. Topsoil removed during construction projects should be stockpiled and reused on the site if needed for turf or plant development. Where topsoil is not needed at the construction site, it should be stockpiled for future use by the University.

### EROSION AND SEDIMENT CONTROL

Erosion and sediment control is needed where earthwork and construction projects are being done. Both sheet erosion and rill and gully erosion should be mitigated to keep wind and run off from carrying soil off-site or into drainage channels or pipes that empty within the watershed of Lake Springfield. Some controls are temporary such as temporary turf cover, straw mulch, silt fences, straw wattles, and excelsior blankets, and should be used until work is completed and permanent controls are in place. In other situations, controls should be permanent such as turf reinforcement mats, planted drainage channels, and revetment mats.

# EXTERIOR IMPROVEMENTS

### GENERAL PAVEMENT

Pavements within the campus include streets and parking areas, service drives and utility pads, patios and terraces, sidewalks and bikeways. Each has a distinct purpose and use.

Where streets are being widened or new connector streets constructed, attention should be paid to controlling drainage where possible with sustainable approaches to minimize stormwater runoff into storm

sewers. Additionally, attention should be given to providing for associated bicycle and pedestrian circulation. If bicycle routes are provided on-street, adequate lane widths and signage for safety is imperative. Similarly, for sidewalks, separation from vehicle lanes and safe street crossing must be provided.

Terraces, patios, and plazas within campus can be built from a variety of materials. Concrete, pavers, or other non-permeable surfaces add to the volume of stormwater runoff and drainage concerns within the area. Permeable surfaces can reduce runoff considerably, although permeable pavers do require subsurface drainage.

**SPECIAL CONCRETE (Concrete Borders, Paver Base, and Footings)**

This section provides standards for the materials, mixes, and applications of concrete for landscape elements. Concrete borders are recommended around areas of pavers, tree grates, and planting beds. A 4" deep concrete base with drainage holes every 24" on-center and in low spots is recommended for non-permeable pavers. Concrete footings are recommended for site elements, with any exposed surfaces to have a smooth, hand-rubbed finish.

**UNIT PAVING (Precast Concrete or Brick)**

Unit pavers provide color, texture, and interest to pavement areas. Unit paving may be used to enhance building entrances, gathering areas, and courtyards. They can also be used in niche areas and to define circulation routes within pedestrian areas. Pavers for pedestrian areas should be a minimum of 2-3/8" thick. The length, width, texture, finish, and pattern of pavers in pedestrian areas can vary to relate to adjacent buildings, structures, or adjacent pavements. The recommended installation is to set pavers on a ½"-1" deep sand bedding over a 4" thick concrete base. (Criteria for use of pavers in vehicular areas is substantially different than for pedestrian-use only areas.)

**PERMEABLE UNIT PAVING (Precast Concrete or Brick)**

Permeable unit pavers add color, texture, and interested to pavement areas. Permeable pavers are recommended in large plaza areas where a significant reduction of stormwater runoff can be achieved, and the pavers can be installed economically by mechanical methods. Permeable pavers are also recommended in parking lots if large vehicles can be restricted. Pavers in vehicular areas should be a minimum of 3-1/8" thick and have an aspect ratio less than or equal to 4:1. A 45 or 90-degree herringbone pattern or "L"-shaped paver is recommended for all vehicular applications.

Permeable pavers are not recommended for small or linear applications as the benefit of reducing stormwater runoff is minimal and the installation cost is relatively high due to hand installation and the quantity of edge restraints.

Permeable pavers reduce stormwater runoff by allowing stormwater to quickly flow down between the paver units into a subsurface drainage system. Water is collected and detained within graduated aggregate courses where it percolates into the ground and slowly discharges through a pipe system. A sub-base course of CA-1, base course of CA-7, and bedding course of CA-16 is recommended. Base aggregate depths vary with the existing soil conditions and the type of application.

**AGGREGATE SURFACING (Gravel Borders and Cobble Areas)**

A narrow aggregate edge is often used around buildings to provide ease of maintenance, to keep vegetation away from buildings, and to reduce damage to buildings from mowing. Gravel borders should not be used adjacent to turf areas as mowers could throw the gravel. In these locations, 12" square unit pavers are recommended along building edges to keep turf away from the building and make maintenance easier.

Cobbles areas can define water-like areas or protect surfaces that cannot support vegetation.

**CAST-IN-PLACE CONCRETE WALLS**

Concrete walls are used as retaining wall, amphitheater sitting walls, and free-standing sitting benches. The use and needs will determine the scale, size, and materials selected. Typically, a smooth, hand-rubbed concrete surface is recommended.

**STONE RETAINING WALLS**

Dry laid stone walls can be retaining walls or free standing. The scale and height can vary greatly, with the structural and visual qualities being the primary considerations. Standard 8" wide drywall stone is recommended for walls under 24" high. Large stone slabs should be used for walls over 36" high. A CA-7 aggregate trench and perforated drain tiles are recommended behind all retaining walls.

**SCREENING**

To the extent possible, service areas and equipment should not be located in plain view of motorists and pedestrians on campus. Where such areas are visible, screening should be provided. The type of screening should be determined by the nature of the service component including its frequency of use, the possible generation of noise, and its size and visual impact.

Site walls may be used for screening when they can be attached or visually associated with a building. Walls should be compatible with the design and materials of the associated structure. Durable gates may be a necessary component of certain wall enclosures. Trees or other plant material may also be used to soften the appearance of the site walls.

Where service areas are remote (not associated with a building) screening with plant material instead of structural walls will usually be more compatible with the campus environment. Evergreen trees or shrubs that are adapted to the Mid-west can be used. Where evergreen screening must have a rigid layout, some deciduous plants may be added for a more naturalistic appearance. This would apply most directly to areas beyond the center of campus where native and naturalistic landscapes are important.

Parking lots should also be screened, or partially screened, to avoid the appearance of vast areas of uninterrupted pavement. Screening with trees and other plants can be done within parking lot islands and around the perimeters. (Trees in these areas provide the added benefit of shade for cars and motorists using the areas.) The placement and species selected for parking lot areas should not block visibility needed for safe vehicular use or for a sense of security within the areas. Strategies and guidelines established by Crime Prevention through Environmental Design (CPTED) such as natural surveillance, access control, and territorial

reinforcement should be considered during the design process.

**SCULPTURE AND FOUNTAINS**

Art can be a special element within the campus landscape. The existing UIS Colonnade Terrace and Fountain is a focal center north of the quadrangle. Other works of art and sculpture are located throughout the campus, generally in locations that pertain to the sculptural subject.

Any additional pieces of art and sculpture should be located where they have a purpose or a relationship to the campus. Those locations could include prominent positions to highlight the campus entrances, environmental settings to emphasize particular themes, or campus building vicinities where they relate to academic studies.

The grounds around any sculpture or artwork can be enhanced to create a more compatible setting. The elevation may be raised, a base built, and restrained lighting provided for nighttime viewing. Generally, elements should not be "dolled-up" with unnecessary accouterments. Fine artwork is complete unto itself.

Generally, sculpture and fountains should be scaled to fit the environment in which they are located. Pieces should be selected that will have a timeless quality. If pieces are of a contemporary nature, consideration should be given to whether they will remain significant in the future. This is not to say that temporary or limited-term art should be not be exhibited. Such additions can add a sense of spontaneity, growth, and energy to a campus setting.

**PLANTS**

Throughout campus, tree, shrub, and hedge plantings should be appropriate to the scale of the space. A broad stroke use of plants in large rows and masses is generally preferred to fussy, intricate plantings in order to maintain a proper scale relationship with large university buildings. More intricate and small-scale plantings are appropriate only in smaller courtyard spaces and in proximity to smaller campus buildings.

Plantings should reinforce the basic campus structure defined by streets, buildings, and walkways. Plantings should provide structure to open spaces. Plant material should be used for ground stabilization, climate moderation (wind, sun, and precipitation), and aesthetic qualities.

Throughout campus, plantings must avoid creating conditions that cannot be easily seen and monitored for safety. In vicinities of streets, driveways, and sidewalks, plants should be positioned to avoid obstructing visibility. A 25' x 25' visibility triangle free from obstructions, should be maintained at every street intersection. Strategies and guidelines established by Crime Prevention through Environmental Design (CPTED) such as natural surveillance, access control, and territorial reinforcement should be considered during the design process.

In general, plantings should be simple and restrained. The variety of species within a defined area should be limited. Planting should not, however, be monocultures and plants should not be used such that species-targeting insects or disease would adversely affect the design. The currently ongoing devastation of ash trees is such an example. This principle should also apply to the streetscapes and walkways within and approaching the campus.

Throughout campus, plant selections should favor plants that are well adapted to the climate and conditions of the site. Native species and their cultivars are adapted to local conditions when planted in species-appropriate locations. Over the years, many non-native species have been planted on the UIS campus and found to be adapted to site-specific conditions. Because so many species of plants, natives and non-natives, are present the campus has somewhat of an arboretum collection already.

Plants should be selected for their overall suitability for their purpose and site conditions. The recommended tree list includes but is not limited to the following species.

| *Scientific Name* | *Common Name* |
|---|---|
| <u>Shade Trees</u> | |
| Acer saccharum | Sugar Maple |
| Celtis occidentalis | Hackberry |
| Ginkgo biloba | Ginkgo |
| Gleditsia triacanthos var. inermis | Thornless Honeylocust |
| Nyssa sylvatica | Black Tupelo |
| Quercus bicolor | Swamp White Oak |
| Quercus macrocarpa | Bur Oak |
| Quercus muehlenbergii | Chinquapin Oak |
| Quercus rubra | Red Oak |
| Taxodium distichum | Bald Cypress |
| Tilia americana | American Linden |
| Ulmus hybrids | Asian Elm Cultivars |
| <u>Evergreen Trees</u> | |
| Juniperus virginiana | Eastern Redcedar |
| Pinus strobus | Eastern White Pine |
| <u>Ornamental Trees</u> | |
| Amelanchier arborea | Downy Serviceberry |
| Carpinus caroliniana | American Hornbeam |
| Cercis canadensis | Eastern Redbud |
| Crataegus crusgalli vas. Inermis | Thornless Cockspur Hawthorn |
| Hamamelis virginiana | Common Witchhazel |
| Malus x ‘Prairifire’ | Prairifire Crabapple |
| Ostrya virginiana | Ironwood |

Use of other species will be allowed as approved by the University.

All trees are to conform to the American Nursery Stock Standards. Upon installation, trees within the main campus area should not be less than the following sizes:

| | |
|---|---|
| Shade Tree: | 2-1/2 inch caliper minimum, as measured 48 inches above grade |
| Evergreen Tree: | Six (6) feet tall, minimum |
| Ornamental Tree: | 1-3/4 inch caliper minimum, as measured 48 inches above grade (single-stem) or six (6) feet tall, minimum (multi-stem) |

Typically, trees are to be located a minimum of ten feet from the edge of the sidewalk or pavement. Shade trees with larger canopies at maturity should be positioned greater than ten feet away.

Plant choices for the center of campus could be made to further develop the arboretum-like campus. To do this, species should be grouped or sorted in meaningful ways, ie. plants from a certain region or country could be grouped together. Similarly, native plants could be grouped in other areas. Information could be provided by tours, labels, QR codes, and/or brochures.

For areas outside the central campus, where forest management and enhancement are recommended, and where prairies are an option in replacing row crops, only native species and in some cases native ecotypes must be used.

For courtyards, residential sites, and other small areas within the campus, planting should be done to suit the character and purpose of each space.

**TURF SEEDING**

Seeding for mowed turf should be scheduled to coincide with optimum climatic times of the year, with a late-summer seeding typically the best. Areas that can be irrigated or watered could have a broader seasonal window. Seeded areas should generally have 4-6” of topsoil in place. Seed mixes should be selected to suit the conditions and fertilizing during establishment should be planned. A turf-type tall fescue seed mix is recommended due to its good drought and wear tolerance and low maintenance requirements. A mix of three or more varieties of turf type-tall fescue with one of the varieties being rhizomatous is preferred.

**PRAIRIE SEEDING**

Marginal land and farm fields may be converted to native prairie area. Prairie development is a 3 to 5 year process. Soil preparation may or may not involve disturbance of the soil surface. Seed selection should include grasses and forbs, and species and rates should be selected with an understanding of the competition among species. The optimum seeding time is late spring for these are warm-season species. Monitoring and maintenance by knowledgeable individuals are essential.

**WETLAND DEVELOPMENT**

Tributaries and areas along Lake Springfield could be converted to wetlands in keeping with the desire to promote sustainable environments. Development of wetlands may include seeding with wetland species as well as planting of plugs. The recommended minimum plant plug size is 3-1/2” deep. Protection from geese and other birds is necessary.

**REFORESTATION**

Reforestation of select areas and planting along existing forest areas to create an irregular, transitional forest edge is proposed. Site preparation to remove undesirable species and planting of various size woody species should be done optimally in fall. Tree sizes in reforestation areas can be smaller than those planted on the main campus. Bare root or container grown trees are recommended in reforestation areas. Protection from deer is necessary.

## HVAC SYSTEMS

***Purpose of HVAC:*** The twofold purpose of HVAC at UIS is…

1. Provide a comfortable and healthy environment for building occupants, thus promoting learning, personal performance and productivity.
2. Provide reliable environmental control to support research activities.

***Guiding Principles:***

- Quality: Provide systems/components of high quality. Typically referred to as "institutional quality" as opposed to "commercial quality".
- Reliability/Redundancy: Provide systems that operate properly with minimal service interruptions.
- Maintainability: Provide systems that require minimal service and that facilitate convenient service when required.
- Operability: Provide systems that are as intuitive and easy to operate as possible while providing required functionality.
- Flexibility: Maintain options for potential future changes to spaces served within appropriate limits.
- Sustainability: Provide environmentally responsible designs with focus on energy efficiency and conservation.

***Life Cycle Cost:*** Life cycle cost analysis shall be included as a significant factor in design decision making. As such, installed cost shall be weighed against long term cost of ownership. It is common knowledge that first cost is typically dwarfed by operating cost over the life of an HVAC system. However, it is not commonly considered that operating cost is dwarfed by the value of human performance and productivity. Unfortunately it is difficult to assign a numeric value to human productivity or to the impact of the HVAC system upon it. Yet, substantial value shall be assigned to it, numeric or not. At the end of the day, good engineering judgement shall prevail.
See previous paragraph titled *Purpose of HVAC.*

***Compliance:*** Design and construction of HVAC systems shall be in compliance with all applicable codes and standards including:

- *International Mechanical Code*
- *Illinois Energy Conservation Code*
- *ASHRAE Standard 90.1 - Energy Standard for Buildings*
- *ASHRAE Standard 62.1 - Ventilation for Acceptable Indoor Air Quality*
- *ASHRAE Standard 55 - Thermal Environmental Conditions for Human Occupancy*

***ASHRAE Handbook:*** HVAC system design issues not addressed within these *UIS Facilities Standards* shall be governed by recommendations of the latest version of *ASHRAE Handbook – HVAC Applications.*

***Climatic Design Conditions:*** Climatic design conditions for HVAC systems shall be as published within the latest version of the *ASHRAE Handbook – Fundamentals.* Station Location: *Springfield.*

***Outdoor Design Conditions:*** Design conditions for cooling, evaporation and dehumidification shall be based upon 0.4% annual cumulative frequency of occurrence. In order to achieve a conservative design, heating design conditions shall be based upon mean extreme DB in lieu of the 99.6% value. Humidification shall be based upon 99.6% annual cumulative frequency of occurrence.

***Indoor Design Conditions, Occupied:*** Default indoor "design-to" conditions for HVAC systems that serve standard occupied spaces:

Heating DB: 70 Degrees F
Cooling DB: 75 Degrees F / 50% RH

When a system that serves a standard building/space is provided with positive humidity control, the space humidity set-point shall be limited as follows:

Heating: 30% RH Maximum
Cooling: 50% RH Minimum

***ASHRAE Standard 55:*** Proposed indoor design conditions for occupied spaces other than the default *values provided above will be considered by Owner* for approval on a project-by-project basis. However, consideration will only be given to design conditions that fall within the range of acceptable thermal conditions presented in *ASHRAE Standard 55*.

***Equipment Room Set-points:*** Space temperature within mechanical and electrical equipment rooms and similar support spaces shall typically be maintained between 55F and 85F. However, each such space shall be evaluated individually based upon specific equipment requirements.

***Special Environmental Requirements:*** It is acknowledged that it is inappropriate to require "across the board" compliance with the indoor design conditions identified above for all space types. Non-standard spaces often require non-standard environments. Examples of such spaces include library archival storage, musical instrument storage, museums, clean rooms, animal facilities and data centers. Maintaining temperature and humidity requirements for such spaces often requires application of specialized HVAC equipment and/or special building construction. Consideration: Provision of low space temperature in conjunction with high space humidity is a common professional recommendation and/or

User request. Achieving and maintaining such environmental conditions is typically difficult and/or costly to accomplish. As such, non-standard HVAC systems required to support such conditions shall be provided only if truly required. For all projects involving special environmental considerations an evaluation shall be conducted to determine which conditions are recommended versus those that are truly required.

***Energy Conservation:*** HVAC systems of significant scope shall incorporate occupancy sensing to facilitate implementation of energy reduction strategies. Systems shall be configured to take advantage of energy recovery opportunities when possible without violating other design priorities.

***Institutional Quality:*** HVAC equipment/systems shall be institutional grade as opposed to standard commercial grade. For the purposes of this writing, intuitional grade equipment/systems shall have minimum life expectancy of 25 years for dynamic system components such as motors, switches, pumps, valves, fans, dampers, compressors and burners, and a minimum life expectancy of 50 years for static system components such as casings, cabinets, ductwork and piping.

***Central Utilities:*** HVAC systems in the central campus core currently utilize central distributed chilled water, central distributed steam and central distributed electricity. The chiller plant is currently at capacity. The Student Union and Health & Sciences Building (HSB) have dedicated chiller equipment. The East campus utilizes local D/X equipment.

***Central HVAC Systems:*** Each building shall be served by a minimal number of central HVAC systems rather than numerous smaller systems (e.g. less than 5,000 CFM). Each central system shall typically include an air handling unit, a return and/or exhaust fan or fans and air supply, return and/or exhaust ductwork.
The installation of a smaller number of larger systems typically results in higher equipment quality and reduced maintenance requirements while providing adequate opportunity for application of energy conserving features and control strategies.
Geothermal and/or variable refrigerant flow (VRF) systems may be considered on a case-by-case basis.

***Disallowed Equipment:*** The following types of HVAC equipment/systems shall not be installed in campus facilities without an approved variance:

1. Window air conditioning units
2. PTACs: Packaged Terminal Air Conditioners
3. Residential furnaces
4. DX split air conditioning units
5. Commercial or residential grade air source heat pumps.

6. Electric resistance heating equipment. Exception: Electric resistance heating may be used within packaged HVAC units with dehumidification control (CRAC units).
7. Fan coil and blower coil units. Exception: Cooling-only fan coil and blower coil units may be used for specialty cooling applications such as telecommunications rooms, computer server rooms and certain equipment room cooling applications (e.g. electrical transformer rooms, elevator machine rooms).
8. Two-pipe combination hydronic heating/cooling units/systems

***System Architecture:*** Spaces with similar uses, environmental conditions, fresh air ventilation rates and occupancy schedules shall generally be grouped together on the same HVAC system. Spaces with significantly dissimilar usage types and/or schedules shall not be served by the same system. Space types that require dedicated HVAC systems include:

1. Offices*
2. Classrooms*
3. Chemical and biological laboratories (aka "wet labs")
4. Lecture halls/theaters**
5. Sizable public assembly areas/atria

Any area with distinct non-standard temperature and/or humidity requirements shall be served by a dedicated system. This overall approach to system architecture allows the design of each system to be tailored to the specific needs of the area it serves while facilitating energy conservation strategies. Night setback, system cycling and optimized demand control ventilation serve as examples.

*In some cases it is acceptable to serve offices and classrooms from a common system. This shall be discussed with *F&S Engineering* prior to project design.

** A lecture hall or theater is typically defined as a room with assigned occupancy of 100 or more individuals. Each room of such capacity shall be served by a dedicated system.

***Dedicated Cooling:***
Each space requiring uninterrupted cooling shall be served by a dedicated cooling unit independent of any centralized building system. Examples of such spaces include:

1. Electrical transformer rooms
2. Elevator equipment rooms
3. Telecommunications rooms
4. Data processing rooms
5. Mechanical equipment rooms, as applicable. See paragraph below entitled *Equipment Rooms* as well as section entitled *Mechanical Equipment Rooms* within these *General Guidelines*.

***Equipment Rooms:*** HVAC for mechanical and electrical equipment rooms and similar support spaces shall be "divorced" from applicable central HVAC systems given that uninterrupted operation is required. Further, in the case of ventilation systems, potential exists for compromising the central system via transfer of objectionable noise and odors.

***Future Expansion:*** Within practical limitations each HVAC system shall be sized and configured to accommodate potential future expansion of capacity and/or infrastructure.

***Flexibility:*** Within practical limitations HVAC systems shall be designed to be flexible and adaptable to accommodate changes in room layout and usage. This is particularly the case for laboratory spaces given that research objectives frequently require changes in laboratory operations and programs. Extreme flexibility such as that required to support major changes such as the conversion of an office to a wet lab or vice versa shall generally be avoided due to its negative impact on energy consumption.

***Terminal Zoning:*** HVAC systems shall be configured such that each occupied space may be controlled as a separate zone with regard to temperature and/or airflow. In other words, a minimum of one terminal control unit (e.g. VAV unit with reheat coil) shall be provided for each occupied space. Each occupied space shall have a minimum of one dedicated thermostat (or equivalent). For the purposes of this writing, reception areas, lobbies, atria and public assembly spaces shall be considered occupied spaces.

***Equipment Location:*** Each piece of motorized HVAC equipment shall be located within a building mechanical equipment room with the following exceptions:

- Approved grade-mounted equipment aesthetically screened
- Approved roof mounted air handling equipment
- Roof mounted exhaust fans
- Unit heaters, cabinet unit heaters and similar unitary heating units
- CRAC units and similar specialty equipment designed for location within the space served

Location of motorized HVAC equipment above finished ceilings is not allowed. This includes suspended grid / drop-in tile ceilings. In no case shall motorized equipment (e.g. fan coil or blower coil units) be installed above a hard finished ceiling (e.g. sheet rock or plaster).

Motorized HVAC equipment shall not be located above sensitive equipment such as telecom switches, elevator control panels, computer server and sensitive lab equipment. This is particularly true of HVAC equipment that generates condensate.

***Janitor Rooms:*** Given that janitor rooms are not accessible to maintenance personnel, mechanical equipment and devices shall not be located within them. Provision shall be made to adequately access mechanical equipment and devices without passing through a janitor room.

***Outdoor Equipment:*** Air-cooled equipment such as chillers and condensing units need not be located within equipment rooms. Each outdoor unit shall be supported by and firmly anchored to a steel reinforced concrete pad with appropriate subgrade footing. The pad shall be of sufficient height above grade to effectively reduce exposure of equipment to dust and debris. Pad height shall be 6" minimum.

***Support:*** All indoor floor-mounted mechanical equipment shall be supported upon and affixed to a steel reinforced concrete pad anchored into the structural floor. If required for vibration control, a spring supported inertia base shall be provided as addressed in the following paragraph entitled *Vibration Control.*

***Vibration Control:*** Most floor-supported rotating HVAC equipment located within the lowest level of a building, with the exception reciprocating equipment (e.g. air/refrigeration compressors and internal combustion engines) may be installed with virtually no special provisions for vibration isolation between the equipment and its support system or associated hydronic piping. This equipment shall typically be "hard mounted" directly to its concrete support/housekeeping pad without use of vibration isolation devices and "hard connected" to the piping systems they serve without the use of flexible pipe connectors. The use of flexible pipe connectors shall be minimized since they have proven to be leak/failure prone. An exception to these general rules may be necessary in cases where laboratory equipment is especially vibration sensitive (e.g. an electron microscope) is located in close proximity to an equipment area. Rotating HVAC equipment that is supported from any ceiling or supported by any floor other than the lowest floor of the building shall be individually evaluated to determine if vibration isolation devices, inertia bases and/or flexible pipe connectors are needed to prevent unacceptable levels of vibration from being transmitted into the building structure.

***Access:*** Adequate access shall be provided within mechanical equipment rooms to facilitate operation, maintenance and repair activities. (See *Mechanical Equipment Room* section within these *General Guidelines* for requirements). Similarly, adequate (as in *generous)* access shall be provided to operate, maintain and repair all mechanical devices located outside of equipment rooms. Such devices include, but are not limited to, finned tube elements, VAV boxes, reheat coils, valves, dampers, controllers and control devices. Thus, office furniture shall not be located so as to hinder access to finned tube cabinets. Piping, conduit and ductwork shall not be located so as to hinder access to VAV boxes and controllers. Equipment and devices that are vulnerable to damage or tampering by building occupants or activities shall be located and/or protected accordingly.

***Backup Equipment:*** A 100% backup or duplex unit shall be provided for each critical piece of HVAC equipment. Included are the following:

- Hot water perimeter heating pumps
- Pneumatic control air compressors

- Steam condensate pumps
- HVAC for research animals
- HVAC for critical laboratory equipment
- HVAC for critical computer equipment
- HVAC for critical telecom equipment
- Critical lab exhaust systems -
  - At a minimum, one of multiple ganged exhaust fans

In general terms, N+1 redundancy shall be provided for each truly critical piece of equipment. Careful evaluation in conjunction with Owner input is required to determine the necessity of such redundancy.

***Redundant Components:*** For critical applications, redundant components shall be provided within HVAC equipment as deemed prudent. Examples include multiple fans within an air handling unit, multiple control valves serving a single device, and multiple compressors/refrigerant circuits within a chiller.

***Emergency Power:*** Critical HVAC equipment shall be provided with emergency power as deemed prudent. Consideration shall be given to each system listed above in the paragraph entitled *Backup Equipment*.

***Variable Speed:*** All HVAC equipment with three phase motors shall be equipped with variable speed drives. When such requirement is deemed excessive for a given application concurrence shall be sought from the Owner.

***Sound Control:*** Sound control as it relates HVAC systems shall be given adequate priority. As mentioned elsewhere, the best way to control noise is to not create it in the first place. When focused attention is given to maximizing the efficiency of HVAC systems, noise is much less of an issue. HVAC-related background noise in a given space shall not exceed the guideline criteria provided in the chapter entitled *"Sound and Vibration Control"* in the *"ASHRAE Handbook, HVAC Applications"*.

***Troubleshooting:*** System components shall be located to facilitate troubleshooting procedures. For example, VAV boxes and control valves for heat transfer devices shall be located on the same floor as the spaces they serve. Specific example: control valves shall not be located on the floor below to serve up-fed finned tube elements.

***Humidification:*** HVAC equipment/systems shall not incorporate space humidification unless required for a specific application. Humidification is costly, not only in terms of first cost but also in terms of maintenance and energy consumption. With the increased use of dedicated outdoor air ventilation systems and total enthalpy heat recovery wheels the need for space humidification has been reduced. When humidification is required it shall be provided by means of a steam-to-steam humidifier located

adjacent to the applicable air handling unit. Makeup water to each humidifier shall be softened to reduce scaling. In some applications further conditioned with reverse osmosis and/or deionizing equipment is required. Steam from the campus central steam distribution system shall not be used for direct injection humidification.

***Freeze Protection:*** Neither water, steam nor condensate piping systems shall be installed in locations where they are vulnerable to freezing (e.g. outdoors without sufficient earth cover, within unheated spaces, within building exterior walls or wall cavities, within exposed overhangs, within exposed exterior walkways, etc.) Exception shall not be granted for systems to be protected via the use of glycol solution. Over time, glycol solution can become diluted to the point that it is no longer effective at providing freeze protection.

***Temporary Use of New Equipment:*** HVAC equipment shall not be used for temporary heating and cooling during construction except by specific approval by the Owner. Only after approval from the Owner, the AE shall document the conditions by which HVAC equipment may be used during construction and clearly require the Contractor to implement measures to assure equipment will be like new when delivered to the Owner. The AE shall balance the expediency of using new HVAC equipment with the negative consequences of compromised indoor air quality, equipment warranty, cost to restore the equipment to like new condition and the impact of commissioning out-of-sequence. The use of permanent HVAC systems for construction purposes is discussed in *Section 01 76 00 – Protecting Installed Construction*.

***Utilities Sub-Metering:*** Utilities shall be sub-metered within the building level to better allow for monitoring, trending, recommissioning, etc. Utilities to be considered for sub-metering include gas, electric, domestic water, chilled water, steam, condensate, irrigation, etc. Sub-metering requirements shall be reviewed with *F&S Engineering* during the project design.

***Identification:***

Equipment tags should be stamped metal for a long wear life and to prevent the information fading over time.
Pipes to be marked shall be labeled with the text as shown in the following table regardless of which method or material is used:

| Pipe Service | Lettering Color | Background Color |
|---|---|---|
| STEAM - 12 PSI | Black | Yellow |
| STEAM - 5 PSI | Black | Yellow |
| CLEAN STEAM - 0 PSI | Black | Yellow |
| GLYCOL WATER SUPPLY | Black | Yellow |
| GLYCOL WATER RETURN | Black | Yellow |
| HEATING WATER SUPPLY | Black | Yellow |
| HEATING WATER RETURN | Black | Yellow |
| LOW PRESSURE CONDENSATE | Black | Yellow |
| PUMPED CONDENSATE | Black | Yellow |
| CHILLED WATER SUPPLY | White | Green |
| CHILLED WATER RETURN | White | Green |
| CONDENSER WATER SUPPLY | White | Green |
| CONDENSER WATER RETURN | White | Green |
| CONDENSATE DRAIN | Black | Yellow |
| REFRIGERANT LIQUID | Black | Yellow |
| REFRIGERANT SUCTION | Black | Yellow |
| REFRIGERANT HOT GAS | Black | Yellow |
| Underground Piping | Varies | Varies |
| Tracer Wire - All other buried types | --- | Green |

Steam pipe markers shall include operating steam pressure within pipes.
Ductwork and Fan Systems: All fans, filters housings, and access doors shall be labeled with the text as shown in the following table:

| Ductwork Label and System | Lettering Color | Background Color |
|---|---|---|
| WARNING – CHEMICAL FUME EXHAUST | Black | Orange/White |
| WARNING – ISOLATION ROOM EXHAUST | Black | Orange/White |

## PLUMBING SYSTEMS

***Codes:*** The Illinois Plumbing Code shall govern as a minimum and the International Plumbing Code shall only govern in regards to storm drainage.

***Domestic Water System:*** Avoid locating domestic water lines in exterior walls and unheated spaces in the building. Routing water lines near un-ducted outside air louvers where exposure to freezing temperatures may occur shall not be permitted.

Water line sizes shall be hydraulically calculated to conform to the decreased demand of low water use fixtures or they shall be based on sizing tables for the low water use fixtures being used Note that written approval is required by the Illinois Department of Public Health.

All piping shall be secured against movement. Provide water hammer arrestors in accordance with PDI when necessary.

Once-through cooling using potable water is not permitted on any equipment.

***Thermostatic Mixing Valves:*** Water heaters shall produce at least 140F water. However, 95-100F may be delivered through a building domestic tempered water system after a master thermostatic mixing valve (TMV). This approach eliminates the need for individual TMVs for emergency showers and eye wash stations and lavatories, and also eliminates the need to insulate these lines. Hot and tempered water systems shall be recirculated to provide hot or tempered water upon demand at each fixture unless the water heater is located directly adjacent to the fixture(s) served. Circulating pumps shall be on timers and schedules. For most scenarios, localized instantaneous hot water heaters are preferred in lieu of building wide recirculation systems.

***Drinking Fountains:*** Preference is to install high/low water coolers and drinking fountains with bottle fillers in alcoves. Units shall not include filters requiring replacement or associated counting feature until filter replacement.

***Sill Cocks:*** Buildings shall be provided with an appropriate number of exterior sill cocks to facilitate not only Grounds maintenance operations, but exterior window washing as well. Minimally, one sill cock shall be provided on each side of the facility. On larger buildings, two or three per side may be necessary to prevent the unnecessary placement of hose.

***Building Sanitary System:*** Booster pumps, storm water pumps, and sanitary sewer lift stations shall be avoided when possible. When storm water pumps or sanitary sewer lift stations are necessary, only those fixtures requiring pumping shall incorporate these pumps.

Sewer line sizes shall be hydraulically calculated to conform to the decreased demand of low water use fixtures or they shall be based on sizing tables for the low water use fixtures being used. Note that written approval is required by the Illinois Department of Public Health.

***Floor Drains at Area Ways, Entrances:*** Provide a floor drain inside all below grade building entrances to intercept water that may accumulate within the area way.

***Building Storm Systems:*** Primary roof drains shall discharge to the underground storm sewer system. A secondary roof drainage system, when scuppers or other non-piped overflow methods are not used, shall discharge in a visible location without causing a safety hazard. Appropriate ground cover shall be utilized to support runoff discharge at these locations.

Vertical storm piping should avoid offsets below the uppermost floor line.

***Identification:***

| Pipe Service | Lettering Color | Background Color |
|---|---|---|
| HIGH TEMP HOT WATER - OVER 240ºF | Black | Yellow |
| CONDENSATE DRAIN | Black | Yellow |
| COMPRESSED AIR | Black | Yellow |
| CONTROL COMPRESSED AIR | Black | Yellow |
| DOMESTIC COLD WATER | White | Green |
| DOMESTIC HOT WATER - 115°F | Black | Yellow |
| DOMESTIC HOT WATER - 140°F | Black | Yellow |
| DOMESTIC HOT WATER CIRCULATING - 115°F | Black | Yellow |
| DOMESTIC HOT WATER CIRCULATING - 140°F | Black | Yellow |
| SANITARY SEWER | Black | Yellow |
| VENT | Black | Yellow |
| STORM SEWER (PRIMARY AND SECONDARY) | White | Green |
| NATURAL GAS | Black | Yellow |
| TEMPERED WATER | Black | Yellow |
| TEMPERED WATER RETURN | Black | Yellow |
| NON-POTABLE WATER | Black | Yellow |
| DEIONIZED WATER | White | Green |
| DISTILLED WATER | White | Green |
| RO WATER | White | Green |
| FUEL OIL SUPPLY | Black | Yellow |
| FUEL OIL RETURN | Black | Yellow |
| All Underground Pipes | Varies | Varies |
| Tracer Wire - Water Pipe Lines | --- | Blue |
| Tracer Wire - Natural Gas Pipe Lines | --- | Yellow |
| Tracer Wire - All other buried types | --- | Green |

## FIRE PROTECTION SYSTEMS

***Compliance:*** The design, installation, and placement of all fire protection systems shall be in complete compliance with the applicable edition *National Fire Codes*, *NFPA Standards #13* and *14* and other applicable codes therein. These *Codes* are to be viewed as providing minimal requirements for fire protection. Where the requirements of these *Standards* exceed the minimum requirements for compliance referenced above, they shall be complied with.

***Sprinkler System Requirements:*** Automatic fire suppression systems shall be installed through all new buildings and all buildings that are completely renovated. Partial systems that are installed with areas of major renovation must be designed in accordance with NFPA 13 so as to ensure adequate water supply, system performance, fire alarm system interface, system supervision, and the potential to be expanded should future projects be undertaken at the subject site. For the purpose of this section, "completely renovated" shall be defined as renovation projects in which 75% of the gross floor area of the building is affected by the scope of the project. When there are multiple, phased renovation projects planned to occur in a building, the total affected floor area shall be considered the sum of all such project areas.

***Design Water Pressure:*** All fire protection systems shall be sized using water supply tests performed not more than one year prior to construction.

***Modifications/Additions*:** Any modifications or additions to an existing automatic fire suppression system shall require the entire system to be hydraulically calculated.

***Wet vs. Dry Pipe Systems:*** Wet pipe systems are to be used exclusively with one allowable exception: in areas where freezing may occur. Dry pipe systems are allowed in these areas only. If, due to building remodeling, an area served by a dry pipe system is no longer exposed to freezing temperatures, the fire protection system serving this area shall be converted to a wet pipe system.
***Other Systems:*** Other more specialized types of sprinkler systems such as preaction, combined dry pipe / preaction, and antifreeze systems shall not be installed without special approval (i.e. without an approved request for variance). The use of a pre-activation system in computer rooms will not require a variance. Fire suppression systems shall not contain ozone-damaging substances such as Halon.

***Electrical Load Centers and Distribution Centers:*** In lieu of a sprinkler system, these electrical equipment rooms shall be housed in a 2-hour fire-rated enclosure including protection for penetrations. This enclosure shall be dedicated to electrical equipment only and use only dry-type electrical equipment.

***Water Service:*** Each building shall be provided with a combined domestic/ fire protection water service. The domestic and fire protection lines are separated inside the building.

***Fire Department Connection:*** A freestanding fire department connection (FDC) shall be connected to the automatic fire suppression system within each building. The FDC shall be located as far from the building and as near to a hydrant as practical, permitting ready access by a fire truck. Its location shall be subject to approval by F&S. The ball drip valve associated with the FDC shall be located in the basement of the building or within a shallow sump depressed within the lowest floor of the building such that the line outside of the building remains completely free of water. A wall mounted FDC is permitted when the building does not have a basement.

***Double Check:*** Each fire protection water service fed from a University water main shall incorporate a double check valve assembly at the building service entrance.

***Fire Pumps with Associated Jockey Pumps, Ancillary Equipment, Electrical Service, and Controls.*** Their installation shall be required for new construction only when the utility water pressure cannot meet NFPA flow and pressure requirements at the hydraulically most remote area with no additional hydraulic safety factors applied. When required, their design shall comply with *National Fire Code NFPA #20* and other applicable *NFPA Fire Codes*. They shall be base-mounted, horizontal, centrifugal type pumps. A bypass line shall be provided in the event the fire pump fails.

***Flow Switches:*** Flow switches shall be installed as required by code and shall interface directly with the building fire alarm system. Each flow switch shall include an adjustable time delay feature. Electronic bells are generally not needed.

***Sprinkler Zones:*** Each zone of an automatic fire suppression system shall not cover more than one floor of a building.

***Inspector's Test Connections:*** Each zone of each sprinkler system shall incorporate an inspector's test connection (ITC). If the sprinkler system is a wet type system, the ITC shall be located at the riser. Each ITC shall discharge outdoors or into an open-site drain located in a mechanical equipment room. Any drain that is used for this purpose shall be capable of accepting the full flow of water under system pressure without creating water damage to the surroundings. In order to facilitate routine inspection, ITC's shall not require the use of ladders or temporary hoses.

***System Main Drain:*** A main drain for the fire protection system shall be provided. The drain must be arranged such that no water remains in the line following a main drain test. The main drain test is done under utility water pressure. Therefore, this line must discharge outdoors or into an 8" hub drain.

***Standpipe Systems:*** In those cases where a standpipe system is required, a combined sprinkler/standpipe system shall be installed rather than require a separate fire sprinkler standpipe. Hose cabinets and hoses shall not be installed with these systems. Combination Extinguisher & Fire Department Valve Cabinets shall be installed. The recessed or semi-recessed cabinets shall be installed at each mid-landing of each floor.

***Special Systems:*** The design and installation of special fire suppression systems such as inert gas and chemical systems are to be closely coordinated with, and are subject to approval by, F&S.

***Fire Extinguishers:*** Fire extinguishers and recessed or semi-recessed cabinets shall be provided in all buildings in accordance with NFPA 10, Standard for Portable Fire Extinguishers, and the Campus Fire Extinguisher Program coordinated by F&S covering the inventory, inspection and testing of extinguishers.

At least one (1) 10 lb. ABC dry chemical fire extinguisher shall be provided for every 3,000 GSF in a Low Hazard Occupancy facility, every 1,500 GSF in a Moderate Hazard Occupancy and every 1,000 GSF in a High Hazard Occupancy facility. The travel distance to the extinguisher shall not exceed 75 feet.

Except in special cases, the number and location of the extinguishers shall be based upon Class A Fires.

In laboratories or areas containing Class B Hazards, a 10 lb. ABC dry chemical fire extinguisher with a UL rating of 4A-80B:C shall be provided such that the travel distance shall not exceed 50 feet.

It is in the environmental interest of UIS that a suitable substitution fire extinguisher, such as Halotron or CleanGuard, be used to protect "sensitive areas" that were formally protected by Halon. Extinguishers shall not contain ozone-damaging substances. See *Section 10 44 00 - Fire Extinguisher Cabinets and Accessories* for detailed requirements for fire extinguishers and cabinets.

## COMMUNICATIONS SYSTEMS

***Ownership:*** The University of Illinois at Springfield (UIS) owns and operates the telecommunications system that serves the campus, including all system hardware located within buildings as well as outside of buildings.

***Operation and Maintenance:*** The management, operation and maintenance of the UIS-owned system are the responsibility of Information Technology Services (ITS). ITS is also responsible for the design/engineering of all data, Wi-Fi, voice, and video. ITS also works with local cellular carriers to enhance their cellular coverage at campus facilities.

***System Scope:*** The UIS telecommunications system is designed to provide a uniform, comprehensive and flexible distribution system to meet the complete telecommunication needs of the campus. This system supports all forms of information transport and processing as required for data (including computer networking), Wi-Fi, voice (both digital and analog), video, and audio.

***AE Requirements:***

On all new construction or major remodeling projects, the AE must use a Registered Communications Distribution Designer (RCDD) for the design of all communications infrastructure. This encompasses all

designs for outside plant (OSP) and inside plant (ISP). All designs must follow the Campus Facilities Standards. ITS Plant Engineering will review all AE designs for compliance.

The minimum qualifications for the Telecommunications Engineer are:

1. A Building Industry Consulting Service International Inc. (BICSI) Registered Communications Distribution Designer (RCDD).
2. Ten years working experience in the telecommunications industry.
3. Three years working experience in the planning and design of telephone OSP and building riser facilities (e.g., OSP Engineering or Building Industry Consultant Service (BICSI).
4. Ability to author detailed specifications, punch lists and other bid documents.
5. Ability to prepare detailed construction and as-built drawings.
6. Ability to inspect and supervise projects.
7. Experience in a campus environment.

F&S Engineering will review and approve the qualifications of all Telecommunications Engineers to provide telecommunications services.

***Contract Documents Drawing Submittal Requirements:***

The commissioned Project AE shall provide floor plans that show the locations of existing and new telecommunications main terminal rooms, equipment rooms, and floor terminals. The floor plan drawings may be submitted in either of the following two formats:

1. AutoCAD compatible drawing files scaled to the true dimensions of the building. AutoCAD Release 2013 drawings are preferred; however, a minimum of Release 2004 will be accepted.
2. On reproducible media scaled no smaller than 1/8" = 1'-0".

Drawings shall also show the proposed locations for all communications outlets, intermediate distribution frames (IDFs),communications equipment rooms (CERs), and floor distribution frames (FDFs) destinations.

In addition, all conduits, raceways, cable trays, floor ducts, junction boxes, camera mounts, wireless access locations, pull boxes, and manholes shall be shown for all proposed telecommunications facilities.

All telecommunications drawings shall be separate from other disciplines, and will be identified as Telecommunications and System Drawings within the Electrical section.

Floor plan drawings shall include separate layers identifying the floor plans with distribution raceway and voice and data station outlets.

Unscaled drawings shall be provided for distribution and riser cables showing:

1. Backbone distribution cable routes
2. Service entrance

3. Riser distribution cable routes
4. Distribution cable support systems
5. Type, size, sheath, gauge and length of all cables except station cables
6. All splice locations with cable number and count
7. Protector location and count
8. Terminal locations and quantities of major hardware components

Scaled drawings shall be provided for nodes/main distribution frame (MDF), IDFs, CERs, and FDFs showing:

1. Room layout (plans and elevations) showing location of splices, backboards, protectors, protector counts, frames, racks, mounts, power supplies, ground bus, and cable counts.
2. Terminating location of distribution, station and riser cables.
3. Riser cable count and number of station jacks to be terminated.
4. Dimensions of devices, fixtures, etc.
5. Details of special supports that are required for clarification.

Provide a voice/data schematic drawing.

***System Description:*** The system includes the following components/features:

***Outdoor Distribution:*** All buildings on "campus proper", as well as a number of outdoor emergency telephones, through an extensive underground conduit and manhole distribution system. The outdoor cable infrastructure consists of copper cable, multi-mode, and single-mode fiber optic cables.

***Data Networking:*** Data network switches are connected to routers in HSB and UHB. The router is connected to the ICCN via single mode fiber optic cable.

***Wi-Fi Networking:*** Wi-Fi, also known as wireless connections, is distributed throughout the campus, both in buildings and at exterior locations and are connected to communications equipment rooms (CERs) via network cabling.

***Nodes/Main Distribution Frames:*** The UIS telecommunications system is connected to the AT&T Central Office through a separate "main distribution frame" (MDF), referred to as "nodes", as mentioned above.

***Intermediate Distribution Frames:*** Each MDF is connected to an "intermediate distribution frame" (IDF), also called a "main terminal room", in each of the buildings it serves.

***Floor Distribution Frames:*** Each IDF is connected to one or more "floor distribution frames" (FDFs), also called "terminal closets", on each floor of the building it serves to primarily handle voice communications.

***Communications Equipment Rooms:*** Each IDF is also connected to one or more "communications equipment rooms" (CERs) in each building to primarily handle data communications.

***Outlets:*** Each FDF is connected (primarily) to the voice jacks on the floor, or portion of thereof, that it serves. Each CER is connected (primarily) to the data jacks in the building, or portion thereof, that it serves.

***Typical Circuits:*** A typical complete data circuit consists of a data jack wired back to the CER. A typical complete voice circuit consists of a voice jack wired to the FDF; the FDF wired to the IDF; the IDF wired to the MDF; and the MDF wired back to the central office.

***Building System Requirements:*** Each building shall incorporate the following features/devices to support the telecommunications system that serves it:

***Main Terminal Room*:** A 7x4.5 ft. (minimum) room shall be provided at the telecommunications service entrance on a lower level of each building to serve as the "intermediate distribution frame" (IDF) or "main terminal room". The exact IDF room size required to serve a specific building shall be determined/confirmed by ITS.

***Floor Distribution Closet:*** Multiple 8x5.5 ft. (minimum) rooms shall be provided to serve as "floor distribution frames" (FDFs) or "terminal closets". As stated above, FDFs primarily support voice communications. These rooms shall be "stacked" vertically to create a riser up through a building (with an FDF on each floor). Multiple FDF risers shall be provided as required to support the number of voice jacks that are expected to be installed within a building. The exact number and location of FDFs to serve a specific building shall be determined/confirmed by ITS.

***Communications Equipment Rooms:*** One or more rooms shall be provided to serve as "communications equipment rooms" (CERs). The minimum dimension of this room is 10x8 feet. Depending on jack density and equipment requirements, the size of the CER may have to be increased. The CERs are there to support data, voice and Wi-Fi. Other systems and/or equipment that do not service the CER cannot be installed in CERs. CERs shall be provided in number and location as required to limit the cable length to 100 meters from a CER to the most remote data jack. The exact number and location of CERs to serve a specific building shall be determined/confirmed by ITS.

***Outlets:*** Outlets shall be installed as indicated by the *Program Statement* and UIS representatives for a given project. The density of telephones and computer equipment used within UIS buildings is quite high. Also, the usage of spaces changes often. Therefore, a generous number/distribution of outlets shall be provided. An outlet consisting of two data jacks shall be provided in each room that may

someday be occupied (e.g., storage rooms). Where applicable, the location of outlets shall be coordinated with the layout of modular furniture/partitions with integral raceway. This has been a repeated problem area in the past. Outlets shall be provided for emergency and service telephones (refer to paragraphs individually addressing each of these items below). This requires coordination and is easily overlooked. Data jacks shall be provided for the building automation control unit(s) that serves each building. An Ethernet data jack and voice jack shall also be provided in each elevator machine room. Both of these are also often overlooked. Generally, outlets shall be flush mounted in walls. Flush-mounted floor outlets are not allowed. However, recessed floor boxes with hinged/removable covers that contain power and/or voice/data receptacles may be installed to serve equipment that is located remotely from the nearest wall.

***Raceway:*** Cable raceway shall be provided as required to interconnect all system components within a building. All cables shall be installed in conduit or cable trays. The exact type and routing of raceway within a building shall be determined/confirmed by ITS.

***Emergency Telephones****:* An emergency telephone shall be installed within each elevator cab and at each area of refuge within stairwells. One outdoor kiosk with an emergency telephone shall also be installed at each new or remodeled campus building. All emergency telephones shall be placed so as to be noticeable to pedestrians in the area and not hidden from view.

***Outdoor System Requirements:*** Buried concrete-encased conduits shall be provided as protective raceway for outdoor cabling between nodes and/or buildings. A manhole/vault shall be provided at each junction point in the system. Conduit number/configuration/routing and manhole size/configuration/location shall be determined/confirmed by ITS.

***Brand Name Products:*** Long-term management to maintain the integrity of the campus distribution system through consistent standards requires the designation and use of certain brand name products (refer to *Section 27 00 00 – Communications)*.

***Additional Information / Requirements:*** Refer to *Technical Section 27 00 00 – Communications* for detailed information / requirements related to all of the above topics.

## ELECTRICAL DISTRIBUTION SYSTEMS

***Compliance:*** The design and construction of all electrical distribution systems shall be in complete compliance with the current adopted revision of the *National Electric Code (NEC) and the National Electrical Safety Code (ANSI C2)*.

***Distribution System:*** Electricity is distributed to campus from the Main Campus Distribution Center located in the lower level of Brookens Building (BRK) or by City Water, Power and Light (CWPL) the Utility company. The electricity on campus is distributed via an underground distribution system. Extensions or upgrades of the electrical distribution system are accomplished by installing conductors within underground ducts. The primary voltage on campus is 12,470V.

***New Service:*** Provision for a new electrical service to a facility will be arranged with CWPL and requires extension of the CWPL electrical distribution system to the facility. Installation of a pad mounted transformer, including metering, per Utility company standards. The metering and transformer will be owned and maintained by the Utility Company.

***Future Loads:*** Electrical distribution systems/equipment shall be sized and configured to accommodate future loads.

***Documentation and Submittals:*** The AE shall review the *Project Submittal Requirements.*

## ELECTRICAL SERVICE ENTRANCES

***Primary Service Connections to Building:*** Extensions of the Utility electrical distribution system, including underground duct, conductors, and pad mounted electrical switches, shall be furnished and installed by that Project.

***Source of Electrical Power:*** The Utility Company City Water Power and Light electrical distribution system on the Springfield campus is the required source of electrical power for new building projects.

***Special Requirements:***

Extensions of the electrical distribution system shall be included in capital projects.

Provide a single line drawing showing the complete final building distribution system, suitably framed in 24" x 36" size under glass to be mounted in the substation or main switchgear room.

***Documentation and Submittals:*** The AE shall review the *Project Submittal Requirements.*

## ELECTRICAL SYSTEMS, BUILDING

***Compliance:*** The design and construction of all building electrical systems shall be in complete compliance with the National Electric Code. This code is to be viewed as the "final authority" for establishing the minimum requirements for electrical devices, equipment and systems. The requirements of these *UIS Facilities Standards* often exceed the minimum requirements of the Code, requiring further compliance.

***Emergency Generator:*** A natural gas-powered engine generator set shall be provided as the required emergency power source for each new building 25,000 square feet or larger. Renovations of buildings of this size shall include the addition of an emergency generator if possible. Emergency generators shall not be located within buildings. In addition to using up valuable indoor building space, potential problems include: engine exhaust fume discharge, indoor radiated noise, remote exhaust discharge noise, ventilation, cooling and heating requirements, remote fluid cooler requirements, fuel storage and transfer issues, fire protection, electrical power and control requirements, as well as compliance with all applicable codes. If the building does not have a generator, provisions shall be made to connect a portable generator for the building including a weatherproof connection box, manual transfer switch, and kirk key connection with the main electrical switch for the building.

***Transformer Rooms:*** Each building shall incorporate one or more main electrical rooms These should generally be located on the lowest level of the building, adjacent to the electrical service entrance. This room shall house the building's, switch gear and associated equipment.

***Smaller Buildings:*** In smaller buildings, a single switchboard or service rated distribution panel shall be installed that supports the building loads. A 277/480 volt, three-phase, four-wire system to serve lighting and mechanical equipment shall be utilized with a 208Y/120V to support receptacle loads. This is preferred and shall be done when the project budget can support it. It is preferred to utilize VFDs to serve mechanical equipment, in lieu of installing distributed motor starters, when it is cost effective to do so and the project budget can support it.

***Transformer Redundancy:*** A building with expected maximum demand of over 750 KVA, generally, shall have two separate main transformers of equal capacities. This is recommended for reasons of safety, reliability and equipment handling. Buildings with large auditoriums or assembly areas shall have two transformers as required to ensure reliability of the lighting.

***Overcurrent Protection / Coordination:*** Each overcurrent protective device shall be properly sized for the protection of the connected downstream component. Fusible switch type equipment shall be used where required. All protective devices, including the primary fuses, the secondary main protection

device and the secondary distribution protection devices shall be coordinated for a purely selective system.

***Harmonics:*** Electrical design shall take power system harmonics into consideration. Each transformer shall be K factor rated where applicable.

***Electrical Closet Location:*** Electrical closets shall be vertically "stacked" to the greatest degree possible, thus facilitating distribution riser configuration.

***Panels:*** Each distribution panel located within the building shall be served by a dedicated circuit breaker within the distribution section of the unit substation. Distribution and branch panels may be located in electrical closets that are directly accessible from a public corridor. These closets shall be labeled "Electrical". They may also be located in public corridor walls and, if so, shall be flush mounted. Each panel shall only serve electrical devices that are located on the same floor as the panel. The only acceptable exception to this is an emergency panel, which may serve multiple floors. Branch panels shall be located such that branch circuits will not exceed 100 ft. in total developed length. Each flush-mounted panel shall be fitted with four spare one-inch conduits that extend above the suspended ceiling or to a point near the structural ceiling. Each new distribution or branch panel shall have 42 spaces and shall have a minimum of nine spare spaces when the entire installation is complete.

***Emergency Panels:*** Generally, emergency panel(s) shall be located in the main electrical room and shall serve only lighting and devices required by Life Safety Code as well as other critical equipment as deemed appropriate and necessary. Critical equipment includes, but is not limited to:

- Sump pumps
- Sewage ejectors
- Hot water perimeter heating pumps
- DDC panels
  - At a minimum, controls required to operate perimeter HW generation equipment and pumps

- Pneumatic control air compressors
- Steam condensate pump units
- Elevators (as required)
- Card access systems
- Security systems
- Cold room cooling units, condenser water pump/controls as applicable
- Critical lab equipment, HVAC
- Research animal HVAC, other support systems
- Critical computer equipment, HVAC
- Critical telecom equipment, HVAC
- Critical lab exhaust systems
  - At a minimum, one of multiple ganged exhaust fans

***Circuiting:*** Wall outlets shall be served by 20 amp circuits with a maximum of six duplex outlets per circuit. Lighting and outlets shall be served by separate dedicated circuits. Circuits that serve outlets located in corridors shall serve corridor outlets only. They shall not also serve outlets located in other spaces (e.g., offices or laboratories where computers or other critical equipment may be in operation). These outlets are used by custodial staff to power cleaning equipment, resulting in the occasional tripping of a circuit breaker. Each substantial piece of hard-wired single-phase electrical equipment shall be served by a dedicated circuit. Every piece of hard-wired three-phase electrical equipment shall be served by a dedicated circuit. Equipment that incorporates duplex units for the sake of redundancy, such as air compressor units, sump pump units and condensate pump units, shall be served by two separate power and control circuits such that one unit can continue to operate when the other has failed. Each piece of equipment or system shall be served by a dedicated control circuit that is wired so as to be disabled when the power circuit is disabled. Standard control circuits shall be 120 volt.

***Outlets:*** The density of portable electrical devices used within University buildings, especially laboratory buildings, is quite high. Also, the usage of spaces changes often. Therefore, a generous number/distribution of 20 amp duplex outlets shall be provided in new or remodeled areas. For example, even the smallest and simplest office area shall have at least two duplex outlets. A 20 amp duplex outlet shall be provided every 50 feet (maximum) in corridors and public areas for use by custodial staff. Mechanical equipment rooms, electrical equipment rooms, elevator machine rooms, janitor closets and other service and support areas shall not be overlooked with regard to the need for an adequate number/distribution of outlets. The location of outlets shall be coordinated with the layout of modular furniture/partitions with integral raceway. Generally, outlets shall be flush mounted in walls. Flush-mounted floor outlets are not allowed. However, recessed floor boxes with hinged/removable covers that contain power and/or voice/data receptacles may be installed to serve equipment that is located remotely from the nearest wall.

***Exterior Outlets:*** An exterior outlet shall be provided adjacent to each piece (or grouping) of mechanical equipment (at the ground and roof levels) to facilitate service.

***Motor Starters and Variable Frequency Drives:*** Each three-phase motor shall be served by a configured variable frequency drive in lieu of a magnetic starter with a hand-off-auto switch, where possible, as opposed to a manual starter. This facilitates the application of automatic controls.

***Flexible Design:*** As mentioned previously, the usage of spaces within University buildings, especially laboratory spaces, changes often. Remodeling is a common occurrence. Therefore, the building electrical systems shall be designed with sufficient flexibility and spare capacity to accommodate substantial future changes. Generally, a spare capacity of 25% (minimum) shall be provided throughout each electrical system, from the reserve transformer capacity to the number of spare spaces in each branch panel.

***Panel Identification Label:*** Every electrical unit substation, switchboard, automatic transfer switch and panel shall be identified with a label designating the building number, floor number, panel type designator. For example, if a lighting panel is located in Building 014 on the second floor and is the only lighting panel on that floor, it will be labeled as 014LP11, where a number on the end would designate a 277/480 panel and a letter would designate a 120/208V panel. See F&S for additional information regarding equipment labeling.

## FIRE ALARM SYSTEMS

***Compliance:*** All fire alarm systems shall be designed and installed in full compliance with all applicable requirements of the *National Fire Alarm Code* as published by the NFPA. These documents may exceed the minimum requirements of the current *Code*. When the *Facilities Standards* exceed the *Code*, the *Facilities Standards* shall supersede the *Code*.

***JCI/Simplex Panel:*** Each new facility is to be equipped with the latest Simplex fire alarm panel model available on the market. Contact Owner in regard to the Capital Project Brand Name Policy. Refer to *Technical Section 28 30 00 – Fire and Smoke Detection System*. Existing facility fire alarm panel upgrade or modifications should take into consideration the age of the equipment, the availability of parts and cost.

***Central Communication Capability:*** Each new fire alarm panel shall be networked such that it communicates with the campus central fire alarm panel which is located in the Police Station.

***Fireman's Service:*** If a new facility is equipped with one or more elevators, the elevator controller(s) shall be equipped with Fire Fighters' Service Requirements.

***Retrofit Systems:*** When a new fire alarm system is retrofitted into an existing building, the following shall be accomplished in conjunction with the installation of the new system:

***Interface with Existing System****:* The new system shall be interfaced with any preexisting system that is left in operation.

***Tamper Switches:*** Tamper switches shall be added to any fire protection system isolation valves that were previously chained and locked in the closed position. Chaining and locking valves are no longer allowed.

***Flow Switches****:* A flow switch shall be installed to monitor flow in each standpipe system. All flow switches that serve sprinkler and standpipe systems shall be tied into the new fire alarm system.

***Fire Pumps****:* A status switch shall be installed to monitor the operation of each fire pump. Each fire pump status switch shall be tied into the new fire alarm system.

***Elevator Controllers:*** All existing elevators shall conform to the Fire Fighters' Service Requirements of ASME/ANSI A17.3 Safety code for existing elevators and escalators. Each elevator controller shall be upgraded to incorporate "Fireman's Service" in a manner that satisfies the requirements of *Division 14* of these *Standards*. Elevator upgrades in buildings that are not equipped with the campus standard fire alarm system shall conform to the requirements herein stated. It shall be recognized that the cost-effective method of conformance would be to include the installation of an upgraded fire alarm system in the Project.

***Early Detection Devices:*** The installation of early detection devices such as smoke and thermal detectors is encouraged for the purpose of increased safety in buildings not protected throughout by an automatic fire suppression system.

***Temporary Protection:*** Where modifications to existing fire alarm devices or equipment cause Interim Life Safety Measures to remain in place for a period of time exceeding 48 hours, temporary protection shall be provided to the affected area. Temporary protection shall comply with the requirements listed in *Section 28 3000 – Fire Alarm and Smoke Detector Systems*. Any project that requires removal or replacement of detection or notification devices shall include a survey by a professional fire alarm engineer or designer.

## ELECTRONIC DOOR ACCESS CONTROL SYSTEM

***Coordination of Design:*** AE shall coordinate design of the electronic door access control system with the UIS Public Safety Department once the floor plans with door locations have been developed for the project.

***Exterior Door(s):*** Each new or remodeled building shall be equipped with an S2 electronic door access control and monitoring system on each of its exterior doors.

***Interior Doors:*** Consideration shall be given to providing door access systems, not only at exterior doors, but also at selected interior doors, to provide increased security for specific limited-access areas such as computer labs, research labs, etc. Specific options and information shall be obtained from the UIS Public Safety Department.

***Installation:*** The Contractor is responsible for installing electronic door access raceway, cable, panels, and the assurance of a complete, functional, and operational system.

***Operating Force in Manual Mode:*** To ensure that the required exit doors will be able to be opened readily in the manual mode of operation, the closing mechanism of the electronic door access device

shall be adjusted in accordance with requirements of the NFPA 101 Life Safety Code, the International Building Code (IBC) and the Illinois Accessibility Code.

For delayed egress door hardware, special signage shall also be provided on the egress side of such doors. The sign shall be readily visible and use lettering of at least one-inch height on a contrasting background to convey the following message: “IN EMERGENCY, PUSH TO OPEN”.

***Raceway:*** All electronic door access system wiring shall be installed in conduit or cable tray with future available fill capacity.

Provide a 6"x6"x4" (minimum) J-box above drop ceiling on secured side of door for card reader, door position, electric power transfer, request to exit, ADA pushbuttons, and other low voltage wiring to door area. Provide a 1" conduit from this same J-box to the nearest cable tray or S2 control panel location.

Provide a 1" conduit for Ethernet communication from each S2 panel location to the nearest cable tray or the UIS Technology Services Hub location.

All electronic door access system wiring shall be installed in a minimum 3/4" EMT conduit, except to an electric power transfer (EPT-10) at door frame*)*. All conduits shall be continuous and be connected to a box or fitting (not stopped inside a wall or door frame). Card reader, remote I/O, or any other communication/data cable shall not be spliced between controller and device.

***Cable:*** All input cables and card reader cables shall be grounded at the S2 control panel while taped and installed at the device.

Cables from inside and outside pushbuttons for a handicap door with electronic door access shall run to an S2 control panel input and not to the door operator.

***Card Reader Location:*** All card readers shall be offset by a minimum of 12" if mounted on opposite sides of wall.

***Commissioning:*** All systems shall be commissioned by the Owner. A minimum of 72 hours in advance notice is required.

## LIGHTING, EXTERIOR

***Exterior Lighting:*** Plan lighting to provide maximum visibility along walkways and near entrances. Provide adequate lighting and make provision for the natural view of “gathering areas” such as benches, tables and smoking areas, as well as bike racks and trash collection / pickup locations.

General exterior illumination shall use the most efficient method available that is compatible with the ambiance of the surrounding area. Use of LED sources is strongly preferred. Life cycle cost analysis shall be performed when multiple systems are being considered. Color temperature of the lamp(s) shall not exceed 4500K. The quality and quantity of illumination shall be in compliance with the requirements of *Technical Section 26 56 00 – Exterior Lighting* and the *IESNA Handbook*. Particular attention shall be paid to enhancing vertical illumination for safety, while minimizing glare and light pollution.

***Street/Roadway Lighting:*** Lighting for roadways shall be via full cutoff cobra-head or decorative luminaire as directed for the specific project and location. Pole shall be round tapered steel or aluminum, black, with concrete base. If roadway luminaires are not adequate to light the sidewalk, then secondary luminaires shall be added on the same pole as the roadway luminaires. Two separate rows of poles for street and sidewalk will not be allowed. Particular attention should be paid to lighting levels at crosswalks, bike paths and intersections. Roadway lighting levels, quality and uniformity shall be in compliance with the *IESNA Handbook*.

***Pedestrian Walkway Lighting:*** Lighting for pedestrian walkways (not along roadways) shall be via pole-top luminaire. Walkway illumination levels shall be in compliance with the *IESNA Handbook*. *Refer to Standard 26 56 00, Exterior Lighting.*

***Parking Lot Lighting:*** Lighting for parking lots shall be simple and efficient, via full cutoff luminaire on a UIS standard aluminum or steel pole similar to roadway lighting. Parking lot lighting shall have motion sensors to provide two levels of lighting.

***Exterior Lighting Controls:*** Exterior lighting shall be controlled by a single photocell installed to control the operation of exterior lighting, as well as being turned on via the campus DDC system. Avoid using individual photocells per fixture.

***Project Outages:*** If project work requires outages of any exterior lighting (including building, sidewalk or street lighting), adequate temporary lighting shall be provided for the entire duration of the outage as part of the project. Location, placement and number of temporary lights shall be coordinated to the satisfaction of the Owner's Representative before existing lighting is disrupted. Pedestrian and vehicle safety shall be given utmost importance.

## LIGHTING, INTERIOR AND EMERGENCY

***Illumination Levels:*** Illumination levels and quality for areas and tasks in campus buildings shall be within 10 percent of that recommended by the IESNA Handbook for each type of space and task. It is not the intention of the standard to sacrifice safety, comfort or performance for the sake of energy conservation. Sample foot-candle calculations (for each typical space in the project) shall be provided to the Owner as part of the design review submittals. Calculations shall also be submitted for review indicating illumination levels and energy consumption are in compliance with program requirements, IESNA recommendations and ASHRAE 90.1.

***Fixture Selection:*** Provide high quality equipment to meet the requirements of the design while providing low cost illumination with a minimum of installation and maintenance expense. For this reason, fixture selection will include, but is not limited to, evaluation of the following:

1. Minimum life cycle cost.
2. Ease of obtaining and replacing lamps, lenses, lamp sockets, ballasts, drivers, and LED light boards.
3. Structural integrity and fixture finish durability, including ease of cleaning.
4. Preference for LED sources, in support of the University's "LED Campus" initiative.

***Energy Performance:*** Installed lighting power density shall conform to ASHRAE 90.1, and the AE shall endeavor to exceed this standard by the widest margin practical. Calculation sheets shall be provided to the Owner as part of the design review submittals.

***General Illumination:*** General illumination for typical interior spaces, such as offices, classrooms, laboratories, lecture halls, stairwells, corridors and other public areas, restrooms, equipment rooms, service areas, storage rooms, etc., shall be provided by LED fixtures. LED fixtures are preferred where dimming is required by code or programmatic requirements.

Indirect lighting shall be kept to a minimum due to its high installed, operating and maintenance costs.

LED fixtures shall be preferred whenever they offer lowest life cycle cost, including all downlighting, task lighting and exit light applications. Incandescent fixtures shall not be installed unless no other lamp source is suitable. Compact fluorescent fixtures shall be kept to a minimum and shall not be used for general illumination purposes.

***Larger Areas:*** Illumination for larger interior areas, such as atriums, auditoriums, gymnasiums, warehouses, etc., shall be provided by fixtures and lamps that represent the lowest life-cycle-cost installation. The quality and quantity of illumination shall be in compliance with the requirements of the *IESNA Handbook.* Fixtures shall provide direct illumination. As mentioned above, indirect illumination shall be avoided due to its high operation and maintenance costs.

***Specialty Lighting:*** If used, display case, decorative, accent and other specialty lighting shall be kept to a minimum and used only in the highest profile areas, such as main entry lobbies, theaters, etc. or where appropriate for historical preservation. LED shall be the preferred source for specialty lighting whenever appropriate. In rooms where reduced lighting levels are necessary to allow note-taking during video presentations (e.g., conference rooms, lecture halls, as well as some classrooms and instructional labs), dimmable LED shall be considered first. Dimming range shall be appropriate for programmatic use of the space.

***Maintenance Responsibility:*** Maintenance of specialty lighting, including all incandescent and dimmable fluorescent lighting systems, will not be provided by the F&S Division, but will be the responsibility of the using department/agency.

***Circuiting:*** Lighting and outlets shall be served by separate dedicated branch circuits.

***Lighting Controls:*** The interior lighting that serves an area shall be controlled by local switches that are installed as close as possible to the entrance that serves the area. For example, locate light switches at the ends of hallways rather than the middle. Master switching of the lighting that serves a larger area shall not be used. Where multiple circuit switching is necessary, multi-pole contactors shall be used. Occupancy sensors shall be used wherever practical and where required by code. If a building-wide lighting control system is used, it must be integrated with the building automation system (BAS) for mechanical systems controls. Interior lighting controls shall be provided to meet the requirements of applicable energy code.

***Lenses:*** Fixture housings shall be appropriate to the application. The use of glare-reducing baffles or parabolic style lenses shall be minimized. Direct/indirect "basket" style fixtures shall be avoided in favor of lensed "wrap" style due to insect contamination issues.

***Conference Rooms, Classrooms and Lecture Halls:*** Reduced general lighting levels are typically necessary to allow note-taking during video projection presentations, so incremental switching of LED lighting shall be provided. If the desired level/distribution of lighting cannot be achieved in this manner, dimmable LED lighting shall be provided. Specialty lighting (e.g., to illuminate blackboards, presentation areas, etc.) and associated controls shall be provided as directed by the Program Statement.

***Emergency Lighting***: Provide emergency egress lighting and exit signage in accordance with all applicable codes and standards, including *NFPA 101* and *NEC 700*. Egress lighting systems shall be designed with the minimum possible maintenance requirements. The power source for egress and exit lighting shall be, in order of preference:

1. Standby generator, if available. Consider extending circuit from a neighboring building's generator if practical.

2. Individual battery units, with multiple external heads sharing a single battery when possible. Batteries shall be installed only when no other power source is available.
   It is preferred to connect standard LED fixtures to emergency power sources whenever possible. When unswitched "night light" fixtures are installed in corridors, they shall be kept to the minimum necessary for egress lighting and designed so as to use the least amount of energy possible. LED adjustable-head type emergency lights, if used, shall have self-diagnostics and self-testing capability.

All exit signs shall use red LEDs and shall be *UL 924* listed. “Self-powered” LED signs are not permissible.

Refer to *Section 26 52 00 – Exit and Emergency Lighting* for additional requirements.

The site development and construction of new facilities on the University of Illinois Springfield (UIS) campus should address the impacts with the surrounding existing topography, soil conditions, location of existing utilities, existing easements and right-of-way, subsurface environmental conditions, site drainage, temporary and permanent stormwater management strategies, accessible routes, parking availability, construction phasing and staging locations and other site specific conditions.

## SITE CLEARING AND EARTHWORK

- *Temporary and Permanent Stormwater Management:* The University of Illinois Springfield campus has a relatively flat topography and poorly draining soils which will need to be addressed during all phases of Project Design and Construction. Best Management Practices (BMP) guidelines will be followed for the design and construction of temporary and permanent stormwater runoff collection systems at all new site developments impacting the campus. These BMP's will be utilized to improve water quality and reduce stormwater runoff and soil erosion. Land Disturbance guidelines established by the Illinois Environmental Protection Agency (IEPA) require the development of a Stormwater Pollution Prevention Plan (SWPPP) which will be incorporated into the project construction documents.
  Permanent Stormwater Management Strategies to help reduce stormwater runoff into Lake Springfield should utilize the use of bioretention basins/rain gardens, bioswales and permeable paving systems and prairieland reclamation techniques. However, the university does not allow the use of underground detention systems.
- *Existing Utilities:* Location of existing utilities, whether owned by the University, City of Springfield or other privately-owned utility companies will be investigated with these entities to determine any conflicts or obstructions on the project site that would require demolition or relocation of any utilities. Utility coordination is critical and can often times impact the Project's design. This utility coordination effort should begin early on in the design process.
- *Topsoil Stockpiling:* The stockpiling and reuse of topsoil on the university campus is mandatory. Topsoil not reused during construction will be stockpiled elsewhere on the campus as directed by UIS Facilities.
- *Site Grading:* The grading of the site should minimize the amount of excessive cut or fill to maintain a balanced site. The main grading design considerations will be to maintain positive stormwater runoff away from building and reduce any ponding of water on the finished project site.
- *Geotechnical Soil Analysis:* For all site development projects a geotechnical soil analysis should be performed to determine existing soil conditions and provide guidance to the civil and structural engineering teams for their design.

## EXTERIOR IMPROVEMENTS

Aggregate Base Courses

- *Aggregate Base Courses for Asphalt or Concrete Pavement:* The aggregate base course for asphalt and concrete pavement shall follow the Illinois Department of Transportation (IDOT) Standard Specifications for Road and Bridge Construction, latest edition. Type B material with a CA-6 gradation will be used for

the aggregate base course under all pavements. It should be noted that the engineer should consult the geotechnical report for soil conditions and design recommendations. Typical thicknesses for pavement are below:

-4 ft up to 6 ft wide sidewalks: Minimum aggregate base thickness of 4-inches.
-6 ft wide sidewalks: Minimum aggregate base thickness of 6-inches.
-Sidewalks wider than 6 ft: Minimum aggregate base thickness of 6-inches.
-Asphalt parking lot paving/roadway paving: Minimum aggregate base thickness of 8-inches.
-Concrete parking lot paving/driveway approach pavements: Minimum aggregate base thickness of 6-inches.

- *Aggregate Base Courses for Small Utility Equipment Pads:* The aggregate base course for small utility equipment pads shall follow the Illinois Department of Transportation (IDOT) Standard Specifications for Road and Bridge Construction, latest edition. Type 5 material will be used for the aggregate base course under all equipment pads. The minimum aggregate base thickness for small equipment utility pads will be 6-inches. It should be noted that the engineer should consult the geotechnical report for soil conditions and design recommendations. Small utility equipment types include, but not limited to, transformers, air conditioning condensers and switchgears. The weight of this equipment should be a maximum of 500 lbs.
- *Aggregate Base Courses for Large Utility Equipment Pads:* The aggregate base course for large utility equipment pads shall follow the Illinois Department of Transportation (IDOT) Standard Specifications for Road and Bridge Construction, latest edition. Type 5 material will be used for the aggregate base course under all equipment pads. The aggregate base thickness will be determined by the structural engineer and geotechnical analysis. Large utility equipment types include, but not limited to, transformers, switchgears, generators and other equipment exceeding a 500 lb weight limit.

Asphalt Paving

- *Asphalt Pavement for Roadways, Parking Lots, Sidewalks and Bike Trails:* The asphalt paving for surface and binder courses shall follow the Illinois Department of Transportation (IDOT) Standard Specifications for Road and Bridge Construction, latest edition. Recommended mixtures for Bituminous Concrete Binder Course will include IL-19.0 or IL-9.5 and for Bituminous Concrete Surface Course mixture IL-9.5. Recycled asphalt pavement can be used in these mixtures with a maximum of 25% for binder course mixes and maximum of 15% for surface course mix. The thicknesses for binder and surface courses are as follows:
  -Roadway and Parking Lot Paving: Minimum thickness for binder course is 2-inches and surface course is 2-inches.
  -Sidewalk and Bike Trail paving: Minimum thickness for binder course is 2-inches and surface course is 2-inches.
  It should be noted that the engineer should consult the geotechnical report for soil conditions and pavement thickness design recommendations.

Concrete Paving

- *Concrete Pavement for Roadways, Parking Lots, Curbs, Curbs and Gutters, Headers for Permeable Paving Systems, Sidewalks and Bike Trails:* The concrete paving shall follow the Illinois Department of Transportation (IDOT) Standard Specifications for Road and Bridge Construction, latest edition. The recommended classes of concrete include PV or SI. The thicknesses for concrete pavement are as follows:
  -4 ft up to 6 ft wide sidewalks: Minimum concrete pavement thickness of 5-inches.
  -6 ft wide sidewalks and bike trails: Minimum concrete pavement thickness of 6-inches.
  -Sidewalks and Bike Trails wider than 6 ft: Minimum concrete pavement thickness of 7-inches.
  - Parking Lot/Roadway/Driveway Approach Paving: Minimum concrete pavement thickness of 8- inches.
  -Curb and Curb and Gutter: Follow IDOT Standards.
  -Headers for Permeable Paving Systems: Minimum 6-inches wide and 18-inches tall.
  (It should be noted that the engineer should consult the geotechnical report for soil conditions and pavement thickness design recommendations.)
  The concrete reinforcing used for the applications listed above are as follows:
  -Synthetic fiber reinforcement will used for all concrete types listed above.
  -4 ft up to 6 ft wide sidewalks: Welded-Wire Reinforcement will be used.
  -6 ft wide sidewalks and bike trails: Grade 60 Galvanized Reinforcing Bars will be used.
  -Sidewalks and Bike Trails wider than 6 ft: Grade 60 Galvanized Reinforcing Bars.
  - Parking Lot/Roadway/Driveway Approach Paving: Grade 60 Galvanized Reinforcing Bars/Chairs and Welded-Wire Reinforcement.
  For all concrete sidewalks, geosynthetic fabric will be placed between the soil subgrade and aggregate base course.

Permeable Paving Systems

- *Permeable Paving Systems for Parking Lots and Plazas:* In areas where a large amount of impervious pavement is to be used, Permeable Paving Systems should be considered to provide an opportunity to reduce the amount of stormwater runoff. Large impervious areas include, but not limited to, large gathering plazas and parking lots. Permeable paving systems are not to be used for sidewalks for bike trails. These paving systems consist of solid concrete pavers that when installed have a larger than normal ancillary opening between each paver. The subbase drained is comprised of several aggregate courses of varying aggregate size and depth. These layers of aggregate promote infiltration into the subsoil and detain a portion of stormwater runoff reducing the release into the stormwater collection system.

Curb Ramps

- *Curb Ramps:* Curb Ramps are an essential component in accessible design which allows the handicapped to safely traverse routes around the campus. They are used to bridge the elevation difference in locations where vertical curb is present. The addition of detectable warning panels guides the sight impaired for safe passage when crossing streets and roads. The design of ADA accessible sidewalks and curb ramps should follow the Illinois Accessibility Code, latest edition. The Illinois Department of Transportation (IDOT) Standard Specifications for Road and Bridge Construction, latest edition, should

be used for curb ramp design standards. Curb ramps shall be constructed of concrete pavement and detectable warning panels shall be cast iron. Detectable warning panels made of other materials is not acceptable.

Parking Bumpers

- *Parking Bumpers:* Parking bumpers or wheel stops are used in parking facilities to prevent vehicles from pulling into parking stalls and hanging the front bumper over the adjacent sidewalks, which often times hinders pedestrians from traversing the sidewalk accessible routes. They are also used in head-on parking to prevent a vehicle from pulling too far into a stall and damaging the vehicle facing it. Parking bumpers shall be 4-inch high low profile, 6-inches wide and 6-feet long and made of concrete. Asphalt installation hardware will be a flat head rebar stake, 5/8-inches in diameter and 14-inches long.

Pavement Markings

- *Pavement Markings:* Pavement markings are necessary on streets, roads and in parking lots to help drivers navigate and guide them along their routes. In addition, pavement markings are used to designate ADA parking stalls and locations where pedestrians will be crossing traffic. Pavement Markings shall comply with the standards set forth in the Illinois Department of Transportation (IDOT) Standard Specifications for Road and Bridge Construction, latest edition. The following is a list of pavement striping widths, colors and paint material for various conditions:
  -Roadways: 4-inch wide, yellow, Thermoplastic, Polyurea or Modified Urethane.
  -Crosswalks: 12-inch, white, Thermoplastic, Polyurea or Modified Urethane. The configuration of the crosswalk striping will be two parallel lines on each edge of the sidewalk. Piano key striped crosswalks are not to be used.
  -Parking Lots: For regular stalls: 4-inch, white, Paint.
  For ADA stalls, handicap symbols: 4-inch, blue, Paint.
  (For all Pavement Markings: Preformed plastic or thermoplastic pavement markings are not allowed by UIS facilities.)

## UTILITIES

Water Utilities

- *Water Utilities:* On-site private and public water facilities are essential to any large campus. These include service lines for chilled water lines, domestic potable water, fire protection lines including fire hydrants. The water service lines should enter the development site with separate domestic and fire protection lines and not a split service. Redundant fire protection and domestic water service lines should be considered for larger facilities. The water line service shutoff and isolation valves for each new facility will be located near the water main tap on the university's property and not in any public right-of-way. Alignment of the domestic and fire protection service lines will be straight and not meander on the site to provide easier location of the underground piping. Trace wire will be installed above the water piping to aide in location of the lines once installed. Smart meters will be located immediately outside the building or in the building's mechanical room. Location of Post Indicator Valves for fire protection lines should follow NFPA 24 and local fire codes. The Standard Specifications for Water and

Sewer Construction in Illinois, latest edition and NFPA 24-Installation of Private Fire Service Mains and Their Appurtenances will be followed for new site development design and construction.
Water piping and structure materials will consist of the following:
-Domestic potable and fire supply piping: Seamless Copper Tubing, Type K (for pipes 3-inches or less), Ductile Iron, AWWA C151, Pressure class 350 (4-12-inches), Pressure class 250 (14-16-inches)
-Gate valves: Iron body, non-rising stem with square nut
-Ball valves (2-inches and smaller): Brass body, Teflon coated brass ball, rubber seats and stem seals
-Check valves, Post Indicator valves and Backflow preventors: Consult City Water Light and Power/Local Fire Codes/NFPA 291
(Note: provide cathodic protection for ductile iron piping.)

Sanitary Sewage Utilities

- *Sanitary Sewage Utilities:* The UIS campus has separate sanitary and storm sewer systems and should be maintained for any new facilities connecting to either. The sanitary sewer lines serving the campus are gravity type, but some facilities may require that the sewage be pumped up to a sanitary line. Manholes and/or cleanouts will be necessary where the piping alignment changes direction. For new or existing facilities having kitchens, grease/water separation vaults will be required before final connection to the sanitary main and located immediately outside the building. New parking garages will require sand/oil interceptors located just outside the structure and before final connection to the sanitary sewer main. The Standard Specifications for Water and Sewer Construction in Illinois and Illinois Department of Transportation (IDOT), Standard Specifications for Road and Bridge Construction, latest edition and requirements from the Sangamon County Water Reclamation District will be adhered to for new facility design and construction.
  Sanitary sewer piping and structure materials will consist of the following:
  -Sanitary sewer piping: PVC SDR 35 or 26
  -Sanitary sewer force mains: HDPE AWWA C901 (SDR 11 for 150 psi pressure rating), PVC AWWA C900 (for 4-inch diameter and less), DIP, Class 50 (Provide cathodic protection)
  -Sanitary sewer structures: Precast concrete.
  -Manhole frames and covers and cleanouts: Traffic-rated cast iron.

Storm Drainage Utilities

- *Storm Drainage Utilities:* The storm water conveyance systems on the UIS campus discharge into Lake Springfield west of campus. To help maintain the health and water quality of Lake Springfield, sustainable measures should be considered when designing the stormwater collection system for a new facility's site. Consider the use of bioswales, rainwater gardens, prairie reclamation areas, permeable paving systems, green roofs and other Best Management Practices which help to reduce runoff to the lake and improve water quality. It should be noted that UIS Facilities does permit the use of underground detention structures.

  The Standard Specifications for Water and Sewer Construction in Illinois and Illinois Department of Transportation (IDOT), Standard Specifications for Road and Bridge Construction, latest edition and

requirements from the Sangamon County Water Reclamation District will be followed for new facility design and construction.

Storm sewer piping and structure materials will consist of the following:

-Storm sewer piping: Reinforced concrete.

-Storm sewer structures: Precast concrete.

-Manhole frames and covers, curb inlet, grate inlets and trench drains: Traffic-rated cast iron.

Natural Gas Distribution

- *Natural Gas Distribution:* The UIS campus utilizes natural gas for its individual facilities within the property. The gas service is presently provided by Ameren Illinois and comes to the meter at 100 psi. Service lines past the meter on the UIS campus side is considered private which means it is maintained by the University. The present metering system steps the gas pressure coming to campus from 100 psi to 10 psi. Future plans for a new high-pressure gas service main is planned for the UIS campus. This will be metered separately and additions to the campus natural gas lines will be constructed by the University. The new high-pressure main will provide a 100 psi and will be used mainly to serve natural gas generators at new facilities.

  Natural Gas piping materials will consist of the following:

  -Above grade piping: Steel ASTM A53 or A120, Schedule 40 Black

  -Below grade piping: Plastic ASTM 2513

  -Piping paint color: Yellow