Clarkson™

Construction Standards/Design Manual

Chapter 3

Design Standards

3.1 EXTERIOR SPACE STANDARDS

3.1.1 GENERAL

References:

- 2010 ADA Standards for Accessible Design: http://www.ada.gov/regs2010/2010ADAStandards/2010ADAstandards.htm
- Clarkson Master Plans: http://www.clarkson.edu/facilities/masterplan_hill.php

3.1.2 BUILDING ENVELOPE

3.1.2.1 Architectural Character

The Design Manual is intended to provide general guidance for the typical development of Clarkson University Campuses. Within such parameters, the guidelines for architectural character represent a more articulated and unified set of recommendations for the design of campus buildings.

The design guidelines are not intended to be prescriptive, but rather serve as a guide for the harmonious development of the campus, as well as a reflection of the physical elements and character of Clarkson University. The architecture and image of the building, along with its surrounding landscape, pathways, open and public spaces help to create special and identifiable sites within the campus. Clarkson's overall goals for the architectural character of its campuses are described below:

- Buildings should extend and enhance the underlying planning and architectural strengths of the campus.
- New buildings should balance individual expression with contextual sensitivity.
- New buildings should reflect the character of the university as an institution with a rich past, vibrant present, and promising future.
- Program, site, and budget parameters should all be addressed in an integrated fashion.

The following guidelines specifically aim to assure the quality and consistency of the architectural language on all Clarkson Campuses, establishing a standard of design excellence that is consistent with the character of Clarkson University while looking forward in its design philosophy. In particular, these guidelines are focused on a consistent architectural expression in the design of the building; articulation of the façade, adequate variation in the building envelope and the use of certain building materials consistent with the Campus's modern design approach.

3.1.2.1.1 Roof Forms, Roof Lines and Silhouette

- Distinctive roof forms, profiles and cornices shall be encouraged to provide visual interest to the tops of buildings.
- The visual impacts of utilities, mechanical equipment, and other services and equipment shall be minimized through screening or buffering.
- Well-developed and articulated rooflines are encouraged.

- Sloped roofs and flat roofs are both acceptable.
- Sloped roofs should be of high quality self-finished material as approved by Clarkson.
- Flat roofs should have carefully selected aggregate or pavers if visible. Visible roofs capes must be as carefully designed as any other exterior surface of the building.
- It will be necessary for designers to explain all aspects of their design selection including material, color, patterning, and other details.
- Parapets shall be well articulated and trimmed with cut stone. Profiles and scuppers are acceptable. Other ornamental devices must be approved by Clarkson.
- Dormers and pediments are also acceptable and encouraged, as are cupolas, chimneys, and other traditional roofing embellishments. Their intersection with the main roof must be well detailed and will receive careful scrutiny. These elements should not be viewed purely as ornamental elements without functional attributes.
- Variations in rooflines, particularly in long buildings, shall be used to create visual interest and to break down the mass of the building.

3.1.2.1.2 Details and Ornament

- Special detailing of ornament and materials at significant locations must be approved by Clarkson.
- Buttresses, coping, string courses, and other traditional architectural details are acceptable and encouraged.
- The joining of dissimilar materials shall be resolved carefully and will be rigorously reviewed.
- Where possible, caulk joints shall be placed in less visible locations such as inside corners or reveals.
- Extreme care and experienced oversight should be given to details designed to prevent water infiltration.
- The campus currently has minimal ornament reflective of its lengthy history. Future buildings shall have well-developed ornamental programs appropriate to a university with such a broad contemporary mission.
- Heraldry, plant, animal, and geometric motifs are all acceptable and encouraged in a coordinated program.
- Building identification integrated into building facades are key elements of an ornamental program.
- The use of new technologies to economically produce ornamental elements is acceptable and encouraged.
- The creative use of Masonry patterning is also acceptable as an ornamental strategy.

3.1.2.1.3 Facades

- Buildings must clearly articulate a base, middle, and top.

- Windows shall comprise a minimum of 20% of upper facades visible from public rights-of-way.
- Windows shall be vertically proportioned to enhance the overall surface articulation.
- Buildings shall incorporate vertical elements such as multi-story bay windows, balconies, and fenestration which break the facade planes and create visual play of light and shadow. Avoid long uninterrupted horizontal elements.
- All buildings shall have ground level articulation such as awnings, overhangs, signage, and glazing at building entrances and retail use.
- Facades should be simple and well ordered.
- General fenestration patterns should be regular, but some vertical hierarchy is appropriate. Where affordable, cut stone window surrounds are preferred to precast concrete. Window openings shall be subdivided to create a vertical proportion where they form horizontal groupings.
- The use of bays, giant order elements, or special accents to provide a large overall order must be approved by Clarkson.
- Window frames and glass shall be set back approximately 6". Sills and heads should be detailed to shed water and alleviate the possibility of unattractive weathering patterns.
- Windows shall not be operable in non-residential buildings (to limit indoor air quality issues.)

3.1.2.1.4 Massing

- Use simple massing.
- Buildings shall be tall enough to define adjoining spaces. This will require a minimum 3-story or 45' high building.
- Bays, porches, towers, and other minor adjustments to massing are encouraged.
- Articulation of vertical surface through form and/or material changes shall be utilized to decrease the apparent mass of the building.
- Corner buildings shall incorporate articulation and forms that emphasize the corner, including roofline articulation and form that emphasizes the corner.

3.1.2.2 Exterior Enclosure

3.1.2.2.1 Exterior Building Features and Materials

3.1.2.2.1.1 Exterior Building Features

- All roofs accessible to Clarkson employees shall have permanent anchor points. Anchor points must also be placed so that the lanyard is never longer than the fall to a lower elevation. Refer to Chapter 4, Division 07 in the Design Manual for additional information.
- Requirement for access doors: TBD.

- Emergency generators, electrical transformers and refuse dumpsters associated with each building shall be screened from public view behind enclosures constructed with materials used on the base of the building. Gates are required for dumpster access.

3.1.2.2.1.2 Materials and Colors

- Use high-quality, durable materials which enhance the building and convey a sense of permanence. Desirable facade materials include brick, stone, concrete, glass, metal and tile.
- In general, use heavier materials such as stone and concrete at the building's base.
- In general, use materials such as brick, stone cladding, metal, and stone as major building surface materials with stone, precast concrete, and/or metal accents.
- In general, use the lightest materials such as metal and glass at the building top.
- Special architectural features may be highlighted by the use of complementary materials that differ from the main body of the building.
- Materials shall reflect and respect local climate conditions and context, and where practicable should be sourced locally and have recycled content.
- Select materials to reinforce existing campus patterns.
- Masonry design must comprehensively consider unit size, texture, color, hording pattern, mortar, and striking. These design choices will be rigorously reviewed.
- Pre-cast concrete, poured-in-place concrete, and cast stone may be proposed as alternatives to limestone trim.
- Wood, metal, and glass doors are all acceptable.
- Doors should have a quality and character appropriate to the overall façade.
- Vision panels, reveals, and carvings are appropriate and encouraged.
- Significant exterior colors such as brick, mortar, window and curtain wall frame and window colors, etc. shall be established early in the construction stages. These colors shall be reviewed and approved by the university. A mock-up panel shall be made by the Constructor in order to approve final colors and workmanship. Color choices for brick must be coordinated with the existing campus and reinforce the overall campus design
- The Design Team shall carefully monitor submissions from the Constructor, especially on those items requiring color selection and shall remind the Constructor of any submissions not made which may hold up the color selection. The Design Team is encouraged to include in the Specifications clear instructions to the Constructor to make this process as painless as possible.
- The official Clarkson University "Green" color is represented by Sherwin William, Industrial Enamel, Green (SW-4072) (this is not intended to indicate a standard paint manufacturer).

3.1.3 CAMPUS SITEWORK

References:

- Refer to Section 3.4.4 – Sustainable Sites in the Design Manual for additional information regarding sustainable site development.
- NYSDOT Manuals and Guides: https://www.dot.ny.gov/doing-business
- MUTCD: https://www.dot.ny.gov/divisions/operating/oom/transportation-systems/traffic-operations-section/mutcd
- NYS Supplement (2010 or current version): https://www.dot.ny.gov/divisions/operating/oom/transportation-systems/traffic-operations-section/mutcd
- Landscape Furnishings and Materials: http://afsweb.clarkson.edu/projects/physplantwiki/index.php/Landscape_Furnishings_and_Materials
- Campus Signage - Exterior Master Plan: http://afsweb.clarkson.edu/projects/physplantwiki/index.php/Campus_Signage_-_Exterior_Master_Plan
- Banners and Lot Signs: http://afsweb.clarkson.edu/projects/physplantwiki/images/2/29/Banners_and_Lot_Signs_-_R2_-_11-09-2011_%283%29_Final.pdf
- Yard Sign Standard: http://afsweb.clarkson.edu/projects/physplantwiki/images/4/42/Approved_yard_sign_spec_sheet.pdf

3.1.3.1 Site Improvements

3.1.3.1.1 Roadways

3.1.3.1.1.1 Vehicular

The Design Team shall consult all pertinent Campus Master Plans to determine whether major vehicular travel ways are included within the limits of the project, and which roads are to be improved or constructed. Roadways shall be designed in accordance with all NYSDOT requirements, unless amended by the Facilities. Where such roads are onsite roadways maintained by Clarkson, they shall additionally meet the design criteria outlined below.

Except where further supplemented herein, the design of vehicular roadways must meet NYSDOT standards.

Clarkson University aims to achieve several main objectives in its system of vehicular roadways: mobility, compatibility and orientation. The goal of mobility refers to the maintenance of a connected network, with congestion minimized to the greatest extent possible. To achieve compatibility, the over-building of campus roadways should be avoided and vehicular roadways should maintain an appropriate scale for the

campus context. This also contributes to orientation, or the visitors' ability to navigate the campus through road design and wayfinding.

Specific design criteria for vehicular roadways are described below:

- Travel ways must be constructed of flexible pavement meeting NYSDOT pavement design criteria.
- Drainage shall be designed in accordance with the NYSDOT Drainage Manual.
- Striping and signage shall be in accordance with the current edition MUTCD and 2010 NYS Supplement or newer version.
- Street lighting shall utilize campus standards for fixtures, poles, bases and controls.
- Fire lanes shall conform to local (first responders) requirements for size, signage, striping, and surfacing.
- Truck turning movements must be verified at all proposed intersections or entrances to roads. WB-50 trucks must not enter opposing traffic lane on campus roads.
- Reduce the perceived width of roads with granite cobble or concrete paver borders. Highlights for traffic calming are encouraged.
- Refer to the Master Plan for minimum road cross sections.

3.1.3.1.1.2 Shuttles and Transit TBD

3.1.3.1.1.3 Bicycle Routes

It is the goal of Clarkson University to provide a network of bicycle paths on the campus, supported by amenities such as secure storage and shower facilities, with connections to surrounding bicycle infrastructure (refer to NYSDOT for Bike Lanes on Public Roads and to the Village of Potsdam Trails Map for county trails). New routes shall be established to meet the demand, providing options for both commuting and recreation. It is important that bicycle routes are designed to minimize conflicts with pedestrians and motorized vehicles.

Off-road bicycle paths are shared with pedestrians, and for this reason they must also meet the design standards for the pedestrian system as described in this manual, as appropriate.

- Separate bicycle paths shall be 8' wide. Refer to detail 3.1-4 – Shared Use Trails.
- Additional paved width for bicycle routes is required for primary roadways in accordance with MUTCD. Lanes must be well-marked and safely separated from vehicular and pedestrian traffic where possible.

3.1.3.1.2 Parking Lots

The following parking design guidelines refer to both surface lots and parking garage facilities. For additional information regarding campus parking systems, refer to the Clarkson University Master Plan. For accessibility guidelines related to parking, refer to Section 3.6 in the Design Manual.

Clarkson University follows two main guiding principles in regard to its Campus parking system:

- Design facilities consistent with the Campus Master Plan's safety, ecological, and aesthetic goals.
    - Provide safe and convenient entrance/exit points.
    - Minimize traffic, pedestrian and bicycle conflicts.
    - Respect and preserve aesthetic and ecological resources.
    - Develop facility scale and appearance consistent with campus architectural aesthetic
    - Maximize opportunities to share parking resources among various users (employees, residents, visitors and event attendees).
    - Proposed parking equipment shall be compatible with existing system or replace existing system to make compatible.
- Use innovative parking management and policies to reduce demand and improve operations.
    - Deploy management systems to track facility use.
    - Install modern and innovative signage to manage traffic flow and wayfinding.
    - Use information technology to advise drivers regarding facility use and alternative options.

In addition to these guiding principles, sustainability is a high priority for Clarkson University; all new parking areas and facilities shall be designed to minimize their financial and environmental impact. It is also important that parking facilities are both flexible and efficient, serving as many users as possible through aggressive parking management measures. Refer to Section 3.4.4 – Sustainable Sites in the Design Manual for additional information regarding sustainability guidelines.

The following standards apply to the design of new parking areas on any Clarkson University Campus:

- The number of parking spaces to be provided within the project is to be determined in consultation with Clarkson's Facilities Office.
- Typical perpendicular parking space shall be 8.5' x 18'. Any space less than a minimum width of 8'-0" will be considered a compact space. Compact spaces shall represent no more than 20% of any designated parking area. Compact spaces must be marked with signage and have a painted end line. The only allowable encroachment into this space is a light pole base at front corner of space.
- Avoid angled parking spaces; when necessary, angle = 60 degrees.
- Service Vehicles: Provide a parking space of 9'-0"x 18'-0" minimum for service vehicles. Parking for service vehicles must be considered, reviewed, and approved by Clarkson for all building projects.
- Surface Lots: Construct surface parking lots using flexible pavement. The maximum slope in any direction in a parking lot shall be 5%. Surface parking lots shall have minimum 22'-0" travel isles
- Loading Areas: All projects must review the loading area with Clarkson's Facilities Office. Delivery truck loading spaces shall be minimum 12'-0" wide. Truck routes to a loading dock must be confirmed using WB-50 truck turning templates or computer software. List types and sizes of waste and recycling

receptacles (compactors – with or without sanitizers; co-minglers for recycling; typical trash receptacles – steel fluted 30 gal; typical 48 gal recycling bins).

- Landscaping within the project limits shall consider and avoid conflicts with vehicle overhangs, mirror overhangs and snow plowing and removal requirements.
- Consider medians and parking spaces of concrete pavers to reduce large expanses of asphalt.
- Use granite cobbles or cobble-like concrete pavers in contrasting gray or tan tones for edges of parking spaces and parking space delineators.
- Refer to detail 3.1-18, Parking Bay/Travel Way.

3.1.3.1.3 Pedestrian System

The pedestrian system throughout Clarkson's campuses is comprised of walkways, trails and foot bridges. It is the goal of Clarkson University for its pedestrian system to improve orientation on the campus, improve accessibility, address conflicts with other modes of transportation (cars, service vehicles, and bicycles), and connect campus neighborhoods with transit services and parking facilities. There should be a clear hierarchy within the pedestrian system, helping to create a legible and identifiable means of travel on and around the campus.

Each Clarkson campus has its own unique character, which is reflected not only in their physical facilities but also in the material and texture of the landscape. Concrete paving on the Hill, Beacon Institute and Downtown campuses shall have the following characteristics or otherwise specified by Clarkson:

- Hill Campus: Specify naturally buff-colored concrete, or include a color admixture, avoiding cool-gray toned concrete.
- Beacon Institute Campus: Intermix concrete and unit pavers, incorporating the same tones as indicated above for pavers on this campus. Avoid strong yellow or brown tones.
- Downtown Campus: Specify concrete with tan or beige tones.

Sustainability is an important priority for Clarkson University and the Design Team shall apply sustainable strategies in the development of the landscape. Refer to Section 3.4.4 – Sustainable Sites for additional information regarding permeable surfaces and stormwater management.

For information regarding accessibility for pedestrian walkways, refer to Section 3.6 – Accessibility Standards in the Design Manual. For product and construction information, refer to Chapter 4, Division 32 – Exterior Improvements.

Sidewalk widths (included below) are measured as clear widths.

3.1.3.1.3.1 Pedestrian System Accessories

- If benches are provided along walks, refer to detail TBD.
- If trash and/or recycling receptacles are provided along walks, refer to detail TBD.
- Where railings are necessary, they shall be provided and shall meet detail TBD.

- All walkway plans must include a lighting and signage plan. Consult with the Clarkson Facilities Office for specific requirements of these plans.

3.1.3.1.3.2 Primary Walkways

Primary walks are those that comprise the major corridors of pedestrian movement within a campus at Clarkson University. For the location and orientation of the primary walks, refer to the Master Plan. Primary walks have the following characteristics:

- Primary walkways shall be 12 feet wide.
- At the intersection of primary walks with each other a patterned paver and concrete pattern as shown in detail 3.1-12 shall be used.
- Utilize borders along the outer edges of walkways to reduce the perceived width. Apply border material to special landings, intersections and crossings.

For additional information regarding paving materials and construction, refer to Chapter 4, Division 32 – Exterior Improvements.

3.1.3.1.3.3 Secondary Walkways

Secondary walks fall directly below primary walks in the hierarchy of the campus pedestrian system. For the location and orientation of secondary walks, refer to the Transportation Master Plan.

- Secondary walkways shall be 8 to10 feet wide..

3.1.3.1.3.4 Tertiary Walkways

Tertiary walkways are any smaller, supplemental walks that fall below primary walkways in the hierarchy of the pedestrian system.

- Tertiary walkways shall be 6 feet wide.

3.1.3.1.3.5 Crosswalks

- Provide curb cut ramps wherever a walkway intersects a raised curb or enters a vehicular travel way.
- At street intersections, these ramps will be provided at each curb return.
- Street crossings shall be designed to be perpendicular to the street and the ramps positioned appropriately.
- Crosswalks of streets from 0-10% may be approved by Clarkson University.
- Pave crosswalks with granite colored brick or cobble-shaped smooth concrete pavers.
- Pave crosswalk borders and areas between crosswalks at intersections with large granite cobbles or cobble-like, granite-colored concrete pavers for traffic calming and to provide a finished look.
- Consider raised crosswalks when pedestrian traffic is high.

3.1.3.1.3.6 Trails TBD

3.1.3.1.3.7 Foot Bridges

Foot bridges should be designed in a clean, modern style decked with pressure-treated lumber or, if possible, sustainably harvested wood for longevity. The railings should be steel or wood with steel cable slats. The structure of the bridge can be steel or sustainably harvested treated yellow pine stained to match the wood. Piers and decks can be wood with concrete piers.

3.1.3.1.3.8 Plazas and Stairs

- For large areas of paving, provide a mixture of paving colors, textures, patterns and materials to create a lively, attractive space. Granite colored concrete pavers, local granite cobbles, or brick must be used for plazas and terraces. For materials, refer to Chapter 4, Division 32 – Exterior Improvements.

- Use gray cobble pavers to highlight or border brick plazas. Use light gray, granite colored concrete pavers in simple shapes for plaza paving. Important plazas may utilize gray granite paving in bands. Gray concrete pavers in a running bond brick pattern may be used in prominent plazas as a contrast to granite.

- For stairs, use light colored concrete. In special areas, where budget allows, use light gray granite.

3.1.3.1.4 Site Development

3.1.3.1.4.1 Site Furnishings

For specific product information regarding site furnishings, refer to Chapter 4, Division 12 – Site Furnishings.

It is the goal of Clarkson University to achieve consistency among all campuses in the materiality and aesthetic of its site furnishings, while at the same time reducing materials cost. Furnishings have been selected based on affordability, low maintenance, sustainable principles and aesthetic appearance. A single palette of site amenities is recommended for all campuses; within each campus, however, furnishings and materials are specific to the corresponding landscape character zone. For a description of landscape character zones, refer to Section 3.1.3.1.5 – Landscaping .

The Clarkson offices of Campus Planning, Facilities Management and Parking and Transportation will have input in the final selections and location of site furnishings.

- Provide ash urns near designated seating areas and outdoor smoking areas.

- Lighting styles must be consistent within each landscape character zone. For lighting recommendations, refer to Chapter 4, Division 26 – Electrical.

- Install roadway bollards whenever the need exists to prevent non-university vehicles from entering authorized areas or to prevent vehicular traffic onto sidewalks while still maintaining service and emergency access. When roadways need to be separated from normal vehicular traffic, use a collapsible traffic bollard operated by a standard hydrant wrench.

3.1.3.1.4.2 Fences and Gates

- Fencing, where required, shall conform to Clarkson's standards. Uncoated chain link, wood and PVC shall not be used. Permitted fencing is limited to five general types, to be applied per the chart below.

	Arch. Metal Fence	Split Rail Fence	Coated Chain Link Fence	Low Stone Wall	Pest Control Fence
Academic Zone	X			X	X
Athletic Zone			X		X
Campus Entryway				X	
Maintenance Zone			X		
Natural Zone		X			
Parking Zone		X			
Residential Zone				X	X

3.1.3.1.4.3 Exterior Signage

- All transportation-related signage shall conform to the MUTCD and NYS Supplement: https://www.dot.ny.gov/publications.
- All signage must comply with the Clarkson Signage Master Plan. Contact Clarkson's Environmental Graphics Designer to coordinate signage.

3.1.3.1.4.4 Retaining Walls

- Retaining walls, when constructed as an extension of the building, must use Masonry facing to match the building. Other retaining walls shall be modular stacking.
- Design site walls to fit within the context of nearby structures and the environment.
- Timber retaining walls are not permitted unless Clarkson grants specific authorization.
- Concrete retaining walls require prior Clarkson approval, especially as it relates to color pattern and overall design. Form liners shall be required at a minimum.

3.1.3.1.5 Landscaping

The following goals and objectives will be considered in the design of open space on any Clarkson University campus:

- Use open space to help link the campuses with a consistent visual character
- Enhance the appearance of the campus through the selection of consistent, aesthetically-pleasing, affordable and low-maintenance plantings, hardscape and site furnishings
- Enable planners and facilities management personnel to quickly select from a range of materials known to be compatible with the campus landscape
- Refer to character zones to determine the placement of specific groups of materials
- Apply principles of sustainability to the selection of materials

While elements of the landscape should have aesthetic continuity with regard to the style of paving, materials, and plantings, the design shall also be tailored to its specific zone of use. The majority of space within the Clarkson University campus system falls within one of four landscape character zones, or a combination of character zones, described below. Specific planting guidelines for each zone are included in 3.1.3.1.5.2 Plantings.

Academic Zone

The academic zones contain all educational buildings, as well as the cultural, recreational, and administration facilities. Landscapes within the academic zone tend to be formal and geometric. Plantings are typically used as accents for the buildings and hardscape as opposed to stand-alone designs. Because these landscapes represent the "face" of the university, it stands to reason that this zone should receive the most maintenance and exhibit a formal character.

Residential Zone

The Residential Zones contain vegetation patterns that are looser in their organization due to the fact that the building geometries and placements are not as rigid. However, the larger-scale and newer dormitories have begun to take on the feel of academic buildings. The Beacon Institute has a very limited residential component and Downtown Campuses do not contain residential zones.

Natural Zone (Clarkson Pond, RPAs, and Woodland Clusters)

Both the Hill and Beacon Institute Campuses have Natural Zones, which are overlays of woodland vegetation on top of the Academic and Residential Zones. They exist as small clumps of trees, riparian corridors, RPA's or woodland edges. The primary defining characteristic of natural areas is that they contain more undisturbed vegetation than built features.

Parking Zone

Parking zones exist solely for the purposes of parking vehicles.

3.1.3.1.5.1 Irrigation Systems

Irrigation is generally avoided on Clarkson University campuses. The planting guidelines, which call for hardy and drought-resistant species, are intended to reduce reliance on irrigation. When irrigation is necessary, sustainable practices such as rainwater cisterns or stormwater ponds are preferred. Refer to Section 3.4 – Environmental Standards for additional information regarding irrigation and stormwater management.

For guidelines related to new and replacement irrigation systems, refer to Chapter 4, Division 32 – Exterior Improvements.

3.1.3.1.5.2 Plantings

- New plantings must be selected to meet most of the following criteria:
  - Aesthetic quality consistent with the delineated campus character zones
  - Native to the NYS Coastal physiographic region
  - Hardy and drought-resistant

  - Limited fruit litter
  - Available in local or regional nurseries

- The majority of new plants must be native or cultivars of native plants. No more than 10% of new plants may be non-invasive exotics that are hardy, drought-tolerant and suitable for their specific site conditions. If non-native species are installed, ensure that they are non-invasive and hardy to the Hill USDA Hardiness Zone and can tolerate dry soil conditions.
- Minimize traditional turf lawn; use only as necessary for public gathering and recreation spaces.
- Consider permeable paving where pedestrians will utilize the area, or converting the area into a planting bed that is self-sustaining or requires minimal maintenance.
- Consider alternatives to traditional turf lawn, such as no-mow or low-growing turf.
- Utilize thick plantings of low shrubs, possibly supplemented with small protective fences, to encourage pedestrians to stay on the sidewalks.
- Ensure variety in plantings (textures, colors and scents). Avoid using the same species of plant in multiple locations to enhance visual interest and limit species-specific diseases.
- Avoid locating highly-scented trees or shrubs near seating areas as they may attract bees and insects.
- When new buildings are designed, retain as much natural vegetation and woodland as possible. Integrate wooded areas in between the buildings.
- Avoid placing plantings that are salt-sensitive adjacent to streets and sidewalks.

Academic Zone Planting Guidelines

- New plantings shall respond to the shape and form of adjacent buildings, retaining the formal geometries present in the zone.
- Accent plantings not associated with buildings shall be formal in arrangement and utilize rectilinear, radial, triangular, or other formal patterns.

Residential Zone Planting Guidelines

- Use plantings to make residential areas welcoming to students. Naturalistic, radial, curvilinear, and “organic” designs tend to be more peaceful and relaxing than geometric patterns. Group plants in threes or fours, but in no particular arrangement.
- Use a hierarchy of vegetation to reduce the scale of larger dormitory buildings. Begin with a tall shade tree, and then layer ornamental trees and shrubs to avoid students feeling as though the buildings were over-powering them. Avoid installing only low shrubs next to multi-story buildings.
- Provide shaded areas for students to utilize as outdoor studying, eating, or relaxing space. In these areas, avoid installing plants that have thorns or high levels of fruit litter (e.g. acorns or large seed pods) that would make sitting on the ground or a blanket uncomfortable.

Natural Zone Planting Guidelines

- Small clumps of woodland vegetation and "leftover" spaces adjacent to wooded areas can serve as seating or outdoor classroom areas. Install a limited number of benches or tables, or leave grassy spaces open for picnicking.
- Retain all existing natural zone plantings unless the stand of vegetation is threatened by disease or a large number of plants are dead or dying.
- Consider creating new natural zones on campus in open spaces that are not regularly used by students, faculty, staff, or visitors. In addition to creating more tree canopy for environmental and aesthetic reasons, new natural areas could present donor opportunities (e.g. named groves, listings of tree donors in University publications, Master Gardener community service hours for installation, etc.).

Parking Zone Planting Guidelines

- Install trees that are known to work well in urban settings.
- Ensure that new tree installations will not interfere with existing lighting.
- Avoid overplanting shrubs on planting islands and medians so that grounds crews will have a place to pile plowed snow. Design parking lot planting so that open ground remains to accept snow piles.
- Use evergreen plantings or densely-planted deciduous trees to screen parking lots from view. Stagger two planting rows for maximum screening.
- Ensure that new parking lots have interior planting islands and medians in which to plant trees. A standard practice is to have no more than ten or twenty spaces in a row without a planted island.
- While it is the goal of the university to achieve visual consistency among all campuses, the landscape design must be sensitive to its unique context. The difference in physical size may be the most obvious distinction, but other qualities set the campuses apart as well.

3.1.3.1.5.3 Hill Campus

Because the Hill campus is the most developed and largest of the three campuses, it has the most diverse spaces and vegetation. There are greater opportunities for a variety of formal planting arrangements, naturalistic groupings, and simple designs:

- Consider portions of the campus as arboretum-like spaces. Designate the Clarkson Pond area as a place to receive unique and memorial plantings. The space need not be a strict catalog of plants, but can serve as an attractive collection of interesting vegetation.
- Promote sculpture zones, where pieces of art could be displayed. These could be the arboretum-like spaces with interpretive signage or themed botanic gardens.

3.1.3.1.5.4 Beacon Institute Campus

The most notable landscape feature of the Beacon Institute Campus is the presence of woods and a wetland to the north of the campus, and it is the Clarkson's intent to preserve and showcase these natural features. To this end, in addition to the general planting guidelines, the following strategies apply:

- Keep plantings around drainages and waterways naturalistic and informal.
- Make use of the wetland and woods as a planting design concept. Have the woodland plants and natural aesthetic flow into the campus and then become more formal around the buildings. An alternate option is to keep plantings in the "front" of the buildings (along Clarkson Circle) formal and urban, while the rear of the buildings has a more natural aesthetic that blends with the woods and wetland.

3.1.3.1.5.5 Downtown Campus

The Downtown Campus has a unique urban character compared with the Hill so a somewhat different approach to landscape design is appropriate:

- Native plant selections are not as important on this campus.
- Select plant species that will grow in urban conditions (i.e. compacted, poor-quality soil and small spaces).
- Consider utilizing moveable planters to hold annuals, perennials or shrubs.

3.1.3.1.5.6 Landscape Buffers

Buffers are to be established at Clarkson Hill at the perimeters of the campus to screen adjacent uses and roads and within the Academic Zones on campus near university buildings to establish a forest ecosystem (i.e. limited reforestation). Buffers are to be provided at Clarkson Beacon Institute for both forest establishment and forest supplementation specific for their soil and microclimate. These buffers will provide a range of species composition, growth rate and succession for a typical native NYS forest aesthetic. All buffers shall require little or no maintenance, and shall not require permanent irrigation (except as needed during initial planting seasons to establish plant material). All existing dead or hazardous trees shall be removed prior to planting in order to preserve the existing vegetation that will remain.

3.1.3.2 Site Civil/Mechanical Utilities

The Design Team is responsible for coordinating with utility providers. Utility design, unless specifically addressed here, will conform to the design requirements of the utility that will ultimately have maintenance responsibility for that utility.

3.1.3.2.1 Water

3.1.3.2.1.1 Water Services - All Campuses

All domestic water services, including fire hydrants, shall conform to the local water supply agency. Below are the links to appropriate supplier/utility. It is the responsibility of the designer to notify Clarkson Land Development if the link does not work.

3.1.3.2.1.2 Downtown Campus: http://vi.potsdam.ny.us/content/Departments/View/9

3.1.3.2.1.3 Hill Campus: www.Hillva.gov/publicworks/pfm.asp

3.1.3.2.2 Sanitary Sewer

3.1.3.2.2.1 Sanitary Sewer - All Campuses

- All Sanitary Sewer mains 8" and larger shall conform to the local sewer collection agency. Below are the links to appropriate agencies. It is the responsibility of the designer to notify Clarkson Land Development if the link does not work.
- Sanitary Sewer laterals shall be in conformance with local requirements and VUSBC.
- Sewer laterals shall include a detectable marking tape if not laid in a straight line from cleanout at the building to the sewer manhole.
- The building cleanout shall be located outside of the building, approximately 5' from the outside wall, but in conformance with the Plumbing Code.
- Cleanout shall not be located within a sidewalk or within 5' of a building entrance or exit.
- All cleanouts shall be made of brass, set flush with the surface, in a concrete ring.

3.1.3.2.2.2 Downtown Campus: http://vi.potsdam.ny.us/content/Departments/View/5

3.1.3.2.2.3 Hill Campus: http://vi.potsdam.ny.us/content/Departments/View/5

3.1.3.2.3 Storm Sewer

3.1.3.2.3.1 Collection

At a minimum the design shall meet the requirements of the NYSDOT Drainage Manual (https://www.dot.ny.gov/doing-business) and Road and Bridge Standards. NYSDOT Manuals and Guides (https://www.dot.ny.gov/doing-business).

3.1.3.2.3.2 Storm Water Management/Best Management Practices

- All aspects of the Stormwater Management and Best Management Practices (SWM/BMP's) for any project must comply with the Clarkson MS4 permit and the University Master Plan, current version. At a minimum the SWM/BMP's will meet the requirements of the NYS Stormwater Management Handbook.
- The project site outfall (s) must be shown as adequate (by computations) down to already established storm structures (ponds).
- Drainage from roofs must:
  - Be connected to storm system (not day-lighted) unless it drains directly into a defined channel/swale.
  - Provide cleanout for roof drains at building and at change in direction, vertical or horizontal.

3.1.3.2.4 Fuel Distribution

3.1.3.2.4.1 Fuel Distribution – All Campuses

The designer will verify the availability of gas service to the site. If gas service is available to the site, the designer will verify the university's need for gas service to the facility. If gas service is needed, the designer will work with the utility provider to insure that the site layout will accommodate the extension of gas service lines and appurtenances to the facility. The servicing utility will be provided with all necessary site information to allow them to design their service lines and appurtenances to the site.

3.1.3.3 Site Electrical Utilities

3.1.3.3.1 Electrical Distribution

3.1.3.3.1.1 Primary Service – Hill East Campus

Clarkson's primary electrical distribution consists of 13.2kV - 3 phase underground electrical lines, fed from a 13.2kV substation and distributed to buildings in the campus via manholes and 15kV underground ductbanks.

- The infrastructure design of the primary electrical distribution shall be comprised of the following:
  - Design of new manholes in the vicinity of new building grounds.
  - Design of new 13.2kV underground ductbanks (conduits encased in concrete) from manhole to the building.
  - Design of service entrance ductbank and location of main electrical room.
  - Design of main single-ended substation consisting of 13.2kV loadbreak switch, dry type transformer, and 480/277V or 208/120V secondary switchgear all located in main electrical room.
- To accomplish the above, the Design Team shall submit information of project electrical loads and location of electrical service entrance to Clarkson's Facilities Management.
- Information related to the specific manhole to be connected to and available fault current shall be provided by Clarkson's Facilities Management.

3.1.3.3.1.2 Downtown Campus: https://www1.nationalgridus.com/StateLandingNY

3.1.3.3.1.3 Hill Campus: https://www1.nationalgridus.com/StateLandingNY

3.1.3.3.2 Site Lighting

- Lighting styles shall be consistent within each landscape character zone. For lighting recommendations, refer to Chapter 4, Division 26 – Electrical. The chart below designates the minimum and average recommended lighting levels for various outdoor spaces.

Exterior Space Location	Foot Candle Minimum	Foot Candle Average	Notes
Temporary Site Lighting	1	1.5	For security purposes, and only in areas required for the purpose.
Roadways	1.2	1.5	Where roadways are immediately adjacent to a walkway, the walkway lights can be combined with the roadway lights, so long as the lighting levels of the walkways are maintained at their minimum level as indicated herein.
Walkways			For pedestrian safety.
Crossing Streets	4	4.5	
Adjacent to Parking Lots	2	2.5	
Adjacent to Roads	1.8	2	
Interior of Campus	1.5	1.8	
Interior of Campus in Large Open Areas	1	1.2	
Plazas	5	5.5	
Landscape Areas Adjacent to Walkways	1.5	1.8	
Parking Lots	2	2.5	
Parking Decks	5	5	
Loading Docks	8	10	
Building Entrances	6	6.5	
Underpasses/Contained Areas	10	12	For pedestrian and general campus safety.
Heavily shadowed areas around buildings	3	5	For security purposes.
Sports/Recreation Fields	TBD	TBD	Based on NCAA guidelines, must conform to the above within 5 feet of the field edge.

3.1.3.3.3 Site Communications and Security

3.1.3.3.3.1 Communications

The Clarkson Campus is provided with communication manholes and handholes throughout the campus from which IT, A/V, and security utility cables are routed to each building's main Telecom room. Refer to Chapter 4, Division 27 and for additional information regarding communications.

- All cables shall run in underground ductbanks (PVC conduits in concrete encasement) from existing or new manholes or handholes to main Telecom room.
- Provide new manholes and handholes with cover locking means for systems security.
- Design service entrance to prevent water infiltration and conflicts with other utilities.
- Provide at least one IDF closet on each floor of the building with 2-4" conduits to main Telecom room. Conduits shall have 2 bends maximum.
- All communication work shall be coordinated with and approved by Clarkson OIT/NET.

3.1.3.3.3.2 IT

For additional information regarding IT systems, refer to the separate IT Design Guidelines.

- Provide IT drawings and spec Section 27 tailored to all infrastructure work for each project.
- Required shutdown of existing network systems must be scheduled during the Christmas holiday.
- Ensure that security is provided to all telecom rooms.
- Provide all IT equipment and A/C systems with emergency power.
- Provide record drawings to Clarkson OIT/NET.
- IT rooms must be separate from security rooms.
- The preferred phone system shall be VOIP.
- Show cable trays on all contractor coordinated drawings.
- Establish ADA Standards for phone and data and include in contract documents.
- Extend all conduits from wall jacks to the corridor.
- Include inside and outside wireless systems in the design.
- Provide all IT rooms with sprinklers.
- Design/include temporary IT systems in all renovation projects.

3.1.3.3.3.3 Security

- All doors inside shall have a key pass to meet the NYS state law.
- Card access system is preferred.
- Omni locks are being phased out on Clarkson campuses.
- Security closets shall have swipe card access.
- Provide wireless locks for low use spaces.
- Explore EVI contactless card technology for door systems.
- Standardize padlocks to secure outbuildings and athletic equipment.
- Standardize CCTV systems for security systems on campus.

3.2 INTERIOR SPACE STANDARDS

3.2.1 GENERAL

3.2.1.1 General

References:

- Clarkson Master Plans: http://clarkson.edu/facilities/masterplan_hill.php

Space planning for new and renovated university facilities shall generally follow the guidelines in. In addition to those outlined in the Design Manual, the following space guidelines shall be used. The Design Team shall document specific space allocations based on these guidelines and the requirements of the project in design during the Programming and Schematic Design phases for review and acceptance by Clarkson. These space allocations will become the basis for the development of the project design. Guidelines for specific space types can be found in Sections 3.2.2 through 3.2.15 of the Design Manual.

This section is organized by space use categories as defined by the Postsecondary Education Facilities Inventory and Classification Manual (FICM): 2006 Edition. For definitions of space use categories, refer to http://nces.ed.gov/pubs2006/2006160.pdf, Chapter 4.

Contact Facilities and Services Project Management for matters related to interior space planning design.

3.2.1.2 Facility Planning and Design

It is important that all facilities and spaces on all Clarkson University Campuses reflect the spirit of the university, as well as the future vision of the institution as defined in Clarkson's Master Plan. This applies not only to the planning and placement of new facilities, but also to the quality of their interior spaces. When beginning any new project, it is the responsibility of the Design Team to become familiar with the Master Plan and to incorporate these principles and guidelines, as appropriate, into their design.

Interior spaces should reflect the campus context and the desired image of the university. In planning all spaces on campus, it is a priority for Clarkson to create an environment that promotes learning and encourages collaboration. In designing successful interior spaces, the Design Team shall strive for the most efficient and effective use of space. Clarkson University places a high priority on the sustainability of its facilities and spaces, which shall remain a contributing factor throughout the design process.

3.2.1.3 Windows and Walls

3.2.1.3.1 General

- Design partitions to meet the applicable NC rating and/or the fire rating. All partitions shall extend a minimum of 6" above the ceiling, except where specifically noted otherwise.

3.2.1.3.2 Interior Signage

- See Signage Standards 3.7

3.2.1.4 Doors

3.2.1.4.1 General

- Vision panels and side lights are encouraged.
- Knock down frames are not acceptable.

3.2.1.5 Accessibility

3.2.1.5.1 General

- Drinking fountains located along a path of travel must be recessed when possible.
- A grab bar must be provided on at least one wall of each elevator cab.
- Interior and exterior signage marking permanent spaces must have both the name and number in raised letters and Braille in compliance with the applicable accessibility codes.

3.2.1.6 Furniture and Equipment

3.2.1.6.1 General

- Each assembly building shall be equipped with at least one Automated External Defibrillator (AED) as part of new construction contracts. The Environmental Health and Safety Office determines the location and type purchased. AED's must be mounted in a cabinet that is labeled and have a sign above the cabinet indicating the location of the AED. The Design Team shall coordinate with the Environmental Health and Safety Office in the selection of the make and model of the AED.
- Equipment shall be arranged to provide service clearances and maintenance access with a minimum disruption to workspace. The minimum width of an egress way in non-service or maintenance areas is 36 inches.
- Storage shelves shall be located in such a way that they do not permit the storage of items within 24 inches from the ceiling.
- Provide adequate space around equipment and furnishings. In general, 30" of free floor area is required for operations done while standing, and 36" of free floor area is required for seated operations, aisles, passageways, and doorways. These are minimums which should be increased depending on many variables including occupant traffic capacity, size of material used in an operation, and facility use.

3.2.1.7 Materials and Finishes

The Design Team in conjunction with the Clarkson design staff will select colors of interior finishes early during construction. The Design Team shall obtain submissions from the Contractor on all manufacturers and products that the Contractor intends to use on the project. Using the standard or special colors from these manufacturers, the Design Team shall prepare a color board indicating the various spaces and the color schemes for each space or series of spaces. These color boards shall be submitted to the Clarkson Project Manager, Interior Designer, and Planner for review and approval at a point early in the construction process and no later than the date that structural elements of the building are 50% complete. Upon approval of the colors, the Design Team shall develop a detailed listing for the Contractor indicating the colors selected for each material and location on the project.

It should be noted that Clarkson is required to use certain vendors for the purchase of furnishings, furniture, and systems modules.

3.2.1.7.1 General

The following guidelines apply to the selection of interior finishes for all space types throughout Clarkson's campuses:

- All paint, mastics, adhesives, sealants, and caulks must pass indoor air quality standards and be low VOC.
- All door frames shall have semi-gloss paint.
- All handrails, when required, shall have Direct to Metal (DTM) paint.
- For every paint color used, the Design Team shall provide one additional full can of paint per building for future maintenance purposes.

3.2.1.7.2 Wall Finishes

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3.2.1.7.3 Floor Finishes

- Avoid solid and light colored carpeting. Use flecked colors and shades that do not show dirt and stains as readily.
- All carpet shall be solution-dyed.
- All building entrances shall have walk-of mats installed in accordance with manufacturer's recommendations and in compliance with Chapter 4.

3.2.1.7.4 Ceiling Finishes

RESERVED

3.2.1.8 Building Systems

3.2.1.8.1 General

- Interior direct and structure born vibration from vibrating mechanical equipment and elevators can cause occupant complaints and concern for safety. The structural engineer and mechanical engineer for the project should work together to design the building systems to achieve the minimum vibration from mechanical and elevator equipment as recommended in Chapter 48 "Sound and Vibration Control" from the ASHRAE Applications Handbook as indicated for Human Comfort in Office areas unless otherwise indicated by Clarkson. Where critical vibration-sensitive laboratory or process equipment requires a more stringent vibration criteria, the design should be coordinated between the users and the Design Team to meet the specification requirements of the specific equipment.
- Vibration sources (mechanical and electrical equipment such as pumps, chillers, fans, emergency generators, and transformers) shall be located away from activities sensitive to vibration, such as laboratory instruments.

3.2.1.8.2 Plumbing

- Refer to Section 3.3.3 – Plumbing Systems.
- Equip all areas, rooms, or spaces where chemicals will be used or mixed with an emergency shower and eyewash unit. Refer to Chapter 3.3.3 of the Design Manual for additional information regarding plumbing systems, including emergency shower requirements.

3.2.1.8.3 Heating, Ventilating and Air Conditioning

- Refer to Section 3.3.1 – HVAC Systems.
- Provide HVAC system in accordance with applicable codes and design guidelines referenced in Chapter 3.3.1 of the Design Manual.

3.2.1.8.4 Electrical

- Refer to Section 3.3.2 – Electrical Design Criteria.
- Provide GFCI circuit protection for electrical outlets on countertops and within 6 feet of a water source. If countertop is used for laboratory equipment, consider a surface-mounted raceway with outlets.
- Electrical outlets shall meet electrical requirements of specific pieces of equipment to include amperage demands and plug configuration for voltage requirements.

3.2.1.8.5 Communications

- Equip each floor with a campus phone that is accessible to all building occupants and provide a sign to identify its location.

3.2.1.9 Acoustics

3.2.1.9.1 General

The acoustical quality of an environment relies on several factors which can be controlled through the design of a building or space. Sound Transmission Class, or “STC,” refers to the amount of sound insulation provided in the construction of a wall, floor or ceiling. A higher STC rating translates into greater sound isolation between spaces.

The Noise Criteria, or “NC,” describes the amount of mechanical background noise that is audible within a space. A higher NC means a greater level of background noise.

A third means of controlling the acoustical quality of a space is using interior finishes—as well as manipulating the shape of the room itself—to absorb sound. It is important that all factors contributing to the acoustical environment are considered throughout the design process. In addition, the following general guidelines shall apply:

- Specific criteria for NC and STC ratings are noted where applicable in subsequent sections. All spaces shall be designed in accordance with ASHRAE, ANSI/ASA, and best practices. Any recommendations in the Design Manual which are more stringent than these requirements shall be applied.

- Interior-source background noise from mechanical systems in the spaces shall be calculated using the sound from all relevant HVAC sources and paths. Where ever possible, the mechanical system design shall comply with all requirements in Chapter 48 “Sound and Vibration Control” from the ASHRAE Applications Handbook and, unless otherwise noted, shall be designed to achieve the Noise Criterion (NC) ratings for the various spaces recommended by the ASHRAE Applications Handbook. The values listed in the ASHRAE Applications Handbook are intended as the system design goal.

3.2.1.10 Security

RESERVED

3.2.2 CLASSROOMS

3.2.2.1 General

The Design Team must coordinate all classroom designs with the Office of Campus Planning and the Information Technology Unit including, but not limited to, the Division of Instructional Technology (OIT).

3.2.2.2 Facility Planning and Design

3.2.2.2.1 Classroom Concepts

The following classroom concepts are included for discussion between the Design Team and Clarkson University during the planning and design of non-lab teaching spaces. Various furniture configurations show a number of possibilities for classrooms of the same size to support a variety of instructional delivery types.

The diagrams included should be used as a reference when evaluating the space needs for new or renovated classrooms. It should be noted that the allocated square footage per student exceeds the guidelines for space planning in the CPSM. A greater square footage allocation for classrooms provides more flexibility in instructional delivery and the option for collaborative learning.

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Type	Seating/Surface	SF/student	Details/Notes
Lecture Hall	Fixed seating; sloped or tiered floor	18sf/stud	
Tiered Classroom	Movable seats, fixed tables; two rows per riser	25sf/stud	Modesty panels on table at front of riser; back table has double width to allow student collaboration.
Case Study	Tiered room, seats in a "U"/"C" shape	35sf/stud	Room has to be laid out to determine actual square footage.
Flexible Classroom	Movable tables, movable chairs; flat floor	40sf/stud	
MILS (Clarkson Innovative Learning Space)	Movable chairs; flat floor		Problem based learning/SCALEUP/New Clarkson Idea.
High Volume/Density Classroom	Flat floor, tables/chairs or movable tablets	25sf/stud	
Break-out Rooms			

3.2.2.2.2 Classroom Proportions

- The acceptable classroom proportion is a rectangle between 1:1 and 4:3 (Width : Length) or between 1:1 and 3:4 (Width : Length).

- Ceiling height and ceiling projector mounting height shall be coordinated to provide the desired image size.

- Any space with a ratio greater than 3:4 or 4:3 is unacceptable as a classroom space.

3.2.2.3 Windows and Walls

- Natural light is highly desired in classrooms, however, the placement of windows should be carefully coordinated to avoid distracting from instruction. Classrooms shall have blackout shades supplied on all windows.

3.2.2.4 Doors

- It is unacceptable to place classroom doors on the instructional wall; the ideal place for doors is on the wall opposite the instruction wall.

- It is acceptable to place classroom doors on side walls; however, they should be on the side of the room opposite the lectern.

3.2.2.5 Accessibility

- Classrooms shall be universally accessible for students, staff, and faculty.

- For classrooms—regardless of size—it is preferred that accessible seating be dispersed rather than clustered in a single location. Provide an accessible space for students at the top and bottom of each classroom. Exceptions may be approved by Clarkson depending on unique circumstances.

- Lectern placement and furniture must be compliant with the current ADA guidelines. In addition, the following guidelines shall apply:

    - A 60” minimum from instructor side of lectern to wall or obstruction behind the lectern is required.

    - If 12” of unobstructed knee clearance is available, then the lectern may be 48” from any obstruction or wall behind the lectern.

    - Lectern must have 36” knee width unobstructed underneath the lectern.

    - Lectern must be between 27”-34” in height. Preference is for 34” height.

    - Where the reach depth exceeds 20 inches (510 mm), the Lectern high forward reach shall be 44 inches (1120 mm) maximum and the reach depth shall be 25 inches

    - An ADA compliant path of travel to the lectern must be provided.

3.2.2.6 Furniture and Equipment

3.2.2.6.1 Classroom Specialties

- Classroom specialties such as whiteboards, projection screens, and seating vary significantly depending upon the ultimate use of the space. The Design Team shall work closely with Clarkson to identify the needs of each room.

- Projection screens in classrooms shall be coordinated with Campus Planning and the OIT.

- Provide wall protection in all classrooms to mitigate chair and table impacts.

3.2.2.6.2 Whiteboards

- Clarkson accepts three types of whiteboards: wall talkers; porcelain-on-steel surface; and white-board paint. The use of each shall be determined by Campus Planning and OIT in coordination with the Design Team.
- The writing surface shall span the entire teaching wall with a 48" height whiteboard. Additional whiteboard space may be required for a given classroom.
- Other types of whiteboards shall be full wall surface.
- Whiteboard walls shall be free of all devices (thermostats, receptacles, switches, strobes, horns, etc.).

3.2.2.6.3 Classroom Display Size and Placement (Projected and Direct View)

- Avoid locating projection screens near doors due to conflict with exit lights.
- The display shall either be a front screen projection or a direct view monitor for classrooms with technology.
- Rear projection is not preferred, but may be considered in specific projects in coordination with Learning Space Design in Clarkson's Division of Instructional Technology.
- The bottom of the displayed image shall be located at a min of 48" AFF and as appropriate for viewing.
- A minimum of a 3" separation shall be provided between the top of the display and the finished ceiling.
- The maximum display size for a classroom is a direct factor of the ceiling height of the classroom. This display size will dictate the nearest viewer (defined as the closest set of viewer eyes in front of the display) and the further viewer (defined as the furthest set of viewer eyes in front of the display).
- Front projection shall not be used in any space with a ceiling height lower than 102".

Finished Ceiling Ht. (FCH)	FCH – 48" – 3" = **Maximum Display Ht.**	1.6 x Display Ht. = **Maximum Display Width** (16:10)	Width of Screen = **Nearest Viewer**	Screen Ht. x 7 = **Furthest Viewer**
90 in.	39 in.	62.4 in.	62.4 in.	273 in.
96 in.	45 in.	72 in.	72 in.	315 in.
102 in.	51 in.	81.6 in.	81.6 in.	357 in.
108 in.	57 in.	91.2 in.	91.2 in.	399 in.
114 in.	63 in.	100.8 in.	100.8 in.	441 in.
120 in.	69 in.	110.4 in.	110.4 in.	483 in.
126 in.	75 in.	120 in.	120 in.	525 in.
132 in.	81 in..	129.6 in.	129.6 in	567 in.

Table of Display Maximums and Viewer Locations based on Ceiling Height (this chart is not for use to determine floor to floor or desired ceiling heights for new classroom spaces, only to show relative proportionality in selecting projection size).

- All students must be within proper sight lines of the screen. Sight lines are defined as any viewing angle within 45 degrees off the axis of the edge of the display.
- For any classroom with more than 150 seats, multiple displays may be necessary as determined by Clarkson for proper viewing. All students should be within the sight lines of both displays and within the nearest and furthest viewer range for both displays.
- When placing single displays it is expected that the display will be placed off center to allow maximum use of whiteboard space and displays simultaneously while preserving sight lines.
- Consider options other than traditional screens (e.g. whiteboards, etc) for projection display surfaces, as approved by the Clarkson.
- All classroom screens shall be motorized and provided with a low voltage wall switch to be located behind the instructor's lectern and low voltage connectivity to be controlled by a Crestron system via relays,
- Screens shall be ceiling recessed.
- Install screens so that the center of the screen does not fall on a ceiling grid line.
- Screens must be Matte White Material with a Gain of 1.0.
- Do not use tab tensioning for screens.
- Screen roller and other serviceable parts must be accessible from the classroom without making alterations to the ceiling grid.

3.2.2.6.4 Projector Infrastructure Placement

- Coordinate projector infrastructure with Project Management and OIT, based on the project, screen size and screen placement.

3.2.2.6.5 Ceiling Type

- Construct ceilings to allow for easy installation and maintenance of audio visual equipment and screens.
- Classrooms, in most cases, shall have drop ceilings with acoustical tile.
  - Gypsum wallboard (sheetrock) is unacceptable for classroom ceilings.

3.2.2.7 Materials and Finishes

RESERVED

3.2.2.8 Building Systems

3.2.2.8.1 General

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3.2.2.8.2 Plumbing

3.2.2.8.2.1 All Classrooms

- Refer to Section 3.3.3 – Plumbing Systems.

3.2.2.8.3 Heating, Ventilating and Air Conditioning

3.2.2.8.3.1 All Classrooms

- Refer to Section 3.3.1 – HVAC Systems.

3.2.2.8.4 Electrical

- Refer to Section 3.3.2 – Electrical Design Criteria for additional information.
- Single display classrooms (90% of classroom spaces) shall follow a defined lighting pattern. For classrooms larger than 150 seats or having multiple displays, the Design Team shall coordinate lighting design with Campus Planning and the OIT.
- Single display classrooms shall utilize a four zone lighting scheme. All zones shall have dimmable capacity.
  - Zone 1 is defined as the lighting above the instructor and lectern. The lighting design shall provide for on/off control of all fixtures in this zone on a single circuit.
  - Zone 2 is defined as the lighting above the screen or display location. The lighting design shall provide for on/off control of all fixtures in this zone on a single circuit.
- In rooms with projection, when Zone 2 is in an off state and all other lighting is in an on state, a 15:1 projected image systems contrast ratio will be achievable at screen location as measured by ANSI/INFOCOMM 3M-2011. It should be assumed that the projector output is 3600 lumens for the lighting design purposes. To achieve this ambient light at screen location will be ~5 foot-candles (~50 lux) or lower, however, this should be verified by the lighting designer.

- Zone 3 & Zone 4 are defined as the fixtures above the students. These fixtures should be double ballast fixtures. Zone 3 shall provide on/off control of the first ballast for all fixtures within the area on a single circuit. Zone 4 shall provide on/off control of the second ballast for all fixtures within the area on a single circuit.
- Provide lighting control for all circuits both at the instructor wall adjacent or behind the lectern and on the entry wall behind the door.
- Presets for each zone shall be determined by Campus Planning, the OIT, and the Provost Office representative.
- If there is an emergency or always-on fixture in the room, it shall be placed above the entry door furthest from the display.
- For an example of a single projection classroom lighting scheme, refer to detail 3.2-9.

3.2.2.8.5 Communications (IT/AV)

3.2.2.8.5.1 Lectern Location

- Requirements for the lectern include:
  - Single 20-amp individual branch circuit on same phase as projector/s
  - Duplex 5–20r receptacles

3.2.2.8.5.2 Projector Location

- Requirements for the projector include:
  - Single 20-amp individual branch circuit on same phase as lectern branch circuit
  - In rooms with 2-4 projectors, the individual branch circuit may be shared amongst projectors only.
  - Projector ceiling box enclosure shall be hard wired only.

3.2.2.8.5.3 Boxes and Conduit

- Requirements for ceiling box enclosures (typical of FSR CB-22p) include:
  - Plenum rated, 2’x2’ in size to fit into a ceiling tile grid
  - Two full rack units of space for low voltage equipment
  - External AC receptacle and a switch/circuit breaker on the ceiling surface
  - Five internal AC outlets ergonomically spaced to allow room for equipment power supply bricks inside the enclosure
  - A white rim access door that you insert a ceiling tile into
  - Projector Pole Mount (1½” NPT fitting to hold up to a 50 lbs)

- 1½" NPT fitting can be located in multiple positions to optimize projector placement
- Requirements for lectern floor box and AV conduit (example: FSR FL-500P-4) include:
  - Minimum 4" depth
  - Floor box cover shall allow for cables to pass through when closed
  - Floor box cover shall have the same finishing as flooring
  - If floor box is not in use, it should blend in with the rest of the floor
  - Single gang separation for duplex electrical outlet
  - Electrical shall have its own conduit
  - Single gang knockout for networking
  - Networking shall have its own conduit
  - At minimum a dual gang knockout for audiovisual cabling
  - With two 1¼" conduit enclosed from floor box to stubbed up above finished ceiling
  - Above the finished ceiling an audiovisual cable tray is to be installed from AV conduit stub out, from floor box, to projector ceiling box enclosure
  - For information regarding AV floor boxes and conduits, refer to details 3.2-8 and 3.2-10

3.2.2.8.6 Network & Telecom

- Provide 3 each: Network connections terminated to a standard wall plate type receptacle in each classroom floor box using dedicated networking conduit
- Provide 2 each: Network connections terminated into a surface mount jack housing placed in each classroom ceiling box (if there is a projector)
- Provide 2 each: Network connections terminated into a wall place behind each wall mounted large screen monitor in a manner coordinated with the AV installation (if there is a large screen monitor)
- Provide 1 each: Wall mounted digital telephone and required networking infrastructure including wall mount style telephone jack in each classroom located on the wall behind or adjacent to the lectern

3.2.2.9 Acoustics

References:

- Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools, Part 1: Permanent Schools
- For classrooms <50 student seats, follow ANSI/ASA S12.60-2010/Part 1

3.2.2.9.1 Videoconferencing or Lecture Capture

Videoconferencing or Lecture Capture (any seat count) and classroom (> 49 seats) require special attention and the services of an acoustical engineer. Initial guidance (needs to be verified by an acoustical engineer) for the following issues:

- High-reflectance materials near the instructor area that project sound.
- Sound-absorbing materials on ceilings and on the upper levels of walls in the rear.
- The following acoustical targets shall apply to any videoconferencing or lecture capture room:
    - Target 0.75 reverberation time (acceptable range, 0.6 to 1.2)
    - 50 STC Walls, ceilings, floors, movable or folding partitions
    - 40 STC Doors and windows near high noise areas
    - 28 STC Doors and windows near low noise areas

3.2.2.10 Security

- Specifications are to be provided by Clarkson's Physical Security Office.
- All classroom primary doors must have an electronic card swipe reader and strike plate.
- If a classroom has two doors that do not share the same hallway, then the secondary door must have an electronic swipe card reader and strike plate. If the two doors share the same hallway, then the secondary door must have only an electronic strike plate.

3.2.3 LABORATORY FACILITIES

3.2.3.1 General

Unless otherwise noted, the following guidelines apply to instructional science labs (including chemical, biology, animal, and special equipment laboratories), art studios, and scene shops.

3.2.3.2 Facility Planning and Design

The matrix below includes a suggested baseline for laboratory planning standards, and should be tested against actual equipment needs, workflow, and numbers of occupants on a project-by-project basis. The size requirements for laboratories can vary significantly. The matrix below represents guidelines for general classes in the noted areas. For advanced classes in these disciplines, the space requirement shall be developed for the specific used in coordination with Clarkson. Additional laboratory support and storage spaces may also be required.

	Space Type	SF/Seat
LABORATORY	Biology, General	52
	Chemistry, General	52
	Engineering, General	60
	Physics, General	41
	Geology, General	52
	Art and Architecture	60
	Research, Wet Lab	62
	Research, Dry Lab	40
LAB SUPPOR	Biology	13
	Chemistry	13

3.2.3.2.1 Lab Safety Requirements

3.2.3.2.1.1 All Laboratory Facilities

- All buildings that contain laboratories, art studios, or maintenance buildings where chemicals are used shall have an adequately sized and designed room for chemical storage and waste storage, as well as supplies. Refer to NFPA 30 – Flammable and Combustible Liquids Code.
- Refer to NFPA 45 – Standard on Fire Protection for Laboratories Using Chemicals.
- Design floors to support large pieces of laboratory equipment (i.e., mass spectrophotometers, freezers, etc.). In addition, vibration and stabilization may need to be considered for certain pieces of equipment (i.e., electron microscopes, etc.).
- All labs shall have hard floors, preferably chemical resistant (VCT and sheet vinyl are typically acceptable). For floors that are subject to extensive washing, refer to Animal Laboratories in Section 3.2.3.7 – Materials and Finishes.

- Decontamination stations such as sinks for hand washing and storage of clean clothes shall be designed into each laboratory, shop, studio or other such space. These facilities shall be located near exits leading to less hazardous areas.

- The most hazardous operations areas, such as chemical fume hoods, biological safety cabinets, and chemical storage areas must be located away from doors and exits in an area that is least susceptible to cross drafts, foot traffic, or sources of exhaust from other laboratory equipment. This is to improve safety and to minimize the chance that turbulence is created near the hood or cabinet.

- Sufficient areas convenient to all occupants must be provided to discourage eating and drinking in, and continuous occupancy of, potentially hazardous work areas.

- Typical labs are arranged to allow for a variety of student teams, from 2 to 8 people, depending on the course and discipline.

- For all instructional laboratories, provide sufficient space beneath the bench top to accommodate a person's legs and allow them to sit comfortably and erect while working at the bench top.

- Specific design requirements for microscope rooms depend on the type of microscope and the work to be performed. Vibration, ventilation, lighting, and utilities are important considerations.

- Fume Hoods

    - If fixed fume hoods, sinks, larger equipment and overhead storage can be located around the perimeter, a more flexible lab center will allow for a wider range of pedagogies and sub-disciplines over the life of the building. Coordinate with Clarkson to select the layout type appropriate for each laboratory.

    - Basic fume hoods for organic chemistry are typically 6'-0" wide; general chemical fume hoods for allow for two students to work in the hood .

    - Write up stations shall not be co-located with chemical storage areas.

3.2.3.2.1.2 Biology Laboratories

- All biological laboratories shall be provided access to a cold room within the same building as the laboratory.

3.2.3.2.1.3 Animal Laboratories

- If the University will use the animal space, the space must be designed to meet AAALAC standards.

- Penetration in floors, walls, and ceilings should be sealed, to include openings around ducts, doors, and door frames, to facilitate pest control and proper cleaning.

3.2.3.3 Windows and Walls

3.2.3.3.1 All Laboratory Facilities

- Presentation areas with sliding marker boards, projector screens, and A/V equipment shall be located on an interior wall to allow for exterior glazing.

- Glass to the corridor is desired to allow for light to penetrate into the building and to allow for views into the dynamic teaching lab environment. Interior glazing also contributes to a safer lab environment.
- Seal all gaps between the room and adjacent construction.

3.2.3.3.2 Biology Laboratories

- Windows in biological laboratories shall be non-operational.

3.2.3.3.3 Animal Laboratories

- External windows are not recommended.

3.2.3.4 Doors

3.2.3.4.1 All Laboratory Facilities

- Hazardous waste storage rooms shall have hard key doors only.
- Doors shall be self-closing and self-locking.
- Doors shall be of sufficient dimensions to accommodate equipment and may not be less than 48 inches wide.
- Vision panels must be provided in the active leaf of all laboratory doors.

3.2.3.4.2 Animal Laboratories

- For laboratories containing research animals, doors shall open inward (doors to cubicles inside an animal room may open outward or slide).
- Vision panels on doors may be tinted to prevent disruption of the animals' light/dark cycle.

3.2.3.5 Accessibility

3.2.3.5.1 All Laboratory Facilities

- Aisles shall have a minimum dimension of 5'-0" based on American Disabilities Act (ADA). This represents good laboratory practice for safe circulation zones in the lab.
- Each lab shall be designed to have at least one position that is ADA compliant. This will affect the design of at least one fume hood (where applicable) and sink.

3.2.3.6 Furniture and Equipment

3.2.3.6.1 Autoclaves

3.2.3.6.1.1 All Laboratory Facilities

- Autoclaves are industrial appliances that require overhead exhaust and floor drains. The size and model of autoclave should be determined by the specific function for the area and the anticipated frequency of use.
- Install a water softener in locations that have hard water to prevent calcium buildup from disrupting the function of the autoclave.

- Provide all biological laboratories with access to an autoclave within the same building as the laboratory.
- Provide autoclave rooms with sufficient ventilation to accommodate a high heat load of the equipment in the room.
- Provide autoclaves with a drip pan capable of holding 30% of the autoclaves operating capacity.
- Autoclave effluent shall discharge directly to sanitary sewer, and shall not discharge to a neutralization tank.

3.2.3.6.2 Special Equipment

3.2.3.6.2.1 All Laboratory Facilities

- Locate any labs with vibration-sensitive equipment (that would equal or exceed the vibration resistance needs of a 400X microscope) on the lowest floor where there is a concrete slab on grade, or utilize a vibration table if placed on an upper level.
- Equipment containing high strength magnets has specific design requirements that must be followed to shield the magnetic field, limit radiofrequency disturbance, and provide adequate ventilation for cryogenic liquids used to cool the magnet. Coordinate design of laboratories containing this equipment with EHS, the end user, the vendor, and a project engineer with appropriate knowledge and experience.
- Laboratories containing radioactive materials shall be equipped with appropriate mechanisms to secure radioactive materials inventory (lockable freezer) and waste (lockable waste containers).
- All laboratories, art studios and scene shops using or storing gas cylinders shall have cylinder storage mounts, racks, or floor stands for each cylinder to be used or stored. Mounts shall be located at a height that allows for the cylinder restraint to be placed 3/4 of the way up the cylinder. The design of cylinders shall comply with 29 CFR 1910.101.

3.2.3.6.3 Casework, Benches, and Furniture

3.2.3.6.3.1 All Laboratory Facilities

- Organizing lab casework on a three foot module will allow for easy changes and can be well served by an interchangeable inventory of casework.
- Ideally, labs shall be organized on a two directional grid to add flexibility to casework layouts
- Select easily cleanable materials and finishes for laboratory casework that are compatible with substances used for cleaning and disinfection. All wet lab benches shall be made of epoxy resin.
- Construct all bench tops of materials that are impervious to the chemicals and materials used in the laboratory. Ideally, bench tops should incorporate a lip to prevent runoff onto the floor.
- Provide a biosafety cabinet in any room where infectious materials will be used in a manner than can generate an aerosol, splash or splatter. The type of biosafety cabinet will be determined by an EHS risk assessment.

- Cold and warm rooms shall have stainless steel counters, legs, and sink and wire shelves.
- All chairs shall be constructed of synthetic non-fabric, non-porous materials.

3.2.3.7 Materials and Finishes

3.2.3.7.1 All Laboratory Facilities

3.2.3.7.1.1 Wall Finishes

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3.2.3.7.1.2 Floor Finishes

- All laboratory floors must be made of wipeable materials (no carpeting or rugs). VCT or similar material is acceptable.
- Waste storage rooms shall have recessed floors and be sealed with concrete.

3.2.3.7.1.3 Ceiling Finishes

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3.2.3.7.2 Animal Laboratories

- Walls, floors, and ceilings should be water resistant and designed to facilitate cleaning and housekeeping.

3.2.3.8 Building Systems

3.2.3.8.1 General

- Arrange light fixtures, air ducts, and utility pipes to minimize horizontal surfaces for cleaning.

3.2.3.8.2 Plumbing

3.2.3.8.2.1 All Laboratory Facilities

- Refer to Section 3.3.3 – Plumbing Systems.
- For information regarding compressed air piping, vacuum piping, gas piping, chemical waste systems and processed water systems for laboratories refer to Chapter 4, Sections 22 61 13, 22 62 13, 22 63 13, 22 66 00 and 22 67 00.
- Design plumbing systems to accommodate easy service isolation and maintenance while minimizing disruption to laboratory functions. Adequate fluid temperature, pressure, and volume should be delivered to required laboratory functions. Consider future capacity allowances in building designs.
- Consider building services needed by researchers (centralized bottled gases, compressed air, etc.) in the design. All effluent plumbing from laboratories shall be made of chemical-resistant materials and drain into a neutralization tank before discharge to sanity sewer.
- Provide a sink with pressurized running water near the exit door in all laboratories.

- An ANSI-approved shower and eyewash must be located within a 10 second walk in all spaces where chemicals are used or stored. The pathway to the emergency shower and eyewash shall be unobstructed (i.e. no doors without panic bars, no doors that do not swing open in the direction of travel). The installation of both a shower and eyewash in a mutual location is preferred by Clarkson.

- An ANSI-approved eyewash must be available in all spaces where eyes may be exposed to small particulates.

- Emergency shower and eyewash locations should be determined by an EHS risk assessment.

- The floor beneath emergency showers and eyewashes must not be carpeted.

- Do not install drains under emergency showers unless sensitive or extensive equipment/electronics exist below that may be adversely affected by the use of the emergency shower.

- Floor drains shall not be located inside laboratories unless required for indirect discharge from equipment.

3.2.3.8.3 Heating, Ventilating and Air Conditioning

3.2.3.8.3.1 All Laboratory Facilities

- Refer to Section 3.3.1 – HVAC Systems.

- Refer to Chapter 4, Section 23 07 00 HVAC Insulation for information regarding duct lining for laboratories and animal use areas.

- Ventilation systems shall comply with NFPA 45, latest edition.

- Design all laboratories to provide the required air changes indicated in Clarkson's Laboratory Ventilation Management Plan, unless one of the following conditions applies:

    - Space internal loads dictate greater airflows for cooling.

    - The total fume hood and containment device exhaust air requirements exceed 12 air changes per hour.

- The minimum occupied and unoccupied air change rate will be determined by EHS via risk assessment and is dependent on the type of work being performed in the laboratory.

- The minimum occupied and unoccupied fume hood face velocity set-point will be determined by EHS. Maximum fume hood design air flow rates shall be based on sash height and face velocity criteria determined by EHS.

- Where internal loads dictate airflows greater than 12 air changes per hour; use of chilled beams shall be evaluated in collaboration with Clarkson/EHS.

- Where the total fume hood and containment device exhaust air flow dictate greater than 12 air changes per hour, low flow fume hoods shall be evaluated in collaboration with Clarkson/EHS.

- All laboratory exhaust, including general exhaust and local exhaust ventilation (e.g., chemical fume hoods, biosafety cabinets, and snorkels) shall be single pass and vented to the outside of the building.

- All laboratory exhaust, including general exhaust and local exhaust ventilation (e.g., chemical fume hoods, ducted biosafety cabinets, and snorkels) should be manifolded if the chemicals used in the laboratories are compatible.

- "Co-Mingling" or mixing of general laboratory exhaust and exhaust directly from fume hoods and other containment devices is allowable as long as it is accomplished in compliance with applicable building and life safety codes and the chemical used are compatible.

- "Co-mingled" or combined fume hood and general room exhaust systems must be considered and designed as "hazardous exhaust systems" in accordance with International Mechanical Code, and other applicable building and life safety codes.

- Where fume hoods and general room exhaust streams are combined, the ductwork shall be fully welded type 316 stainless steel. The stainless steel ductwork shall be run from the point of collection (hood connection or room exhaust grille/inlet) to the main riser for that portion of the building. The main duct riser and associated downstream ductwork shall be constructed of stainless steel or anti-corrosion coated galvanized steel or other suitable materials approved by the Clarkson and the AHJ.

- Where general exhaust and fume hood exhaust systems are NOT combined, the fume hood exhaust ductwork shall be fully welded type 316 stainless steel and shall be considered a hazardous exhaust system.

- No heat recovery wheels (or any other technology which does not completely separate the exhaust and intake airstreams) will be considered for energy recovery building exhaust which handles fume hood exhaust, whether combined or not.

- Variable air volume control dampers controlling the exhaust flow from fume hoods and general room exhaust shall fail OPEN upon loss of control power or control air.

- Where exhaust is required to be filtered with HEPA filters, bag-in/bag-out containment type filter housings shall be utilized and shall include bubble tight dampers the inlet and outlet of the filter housing. The dampers housing shall be fully welded to the filter containment housing. The housing and damper material shall be stainless steel and shall be fully welded construction.

- For fume hood duct design and construction, see Chapter 4, Section 11 53 00.

- Vacuum pump systems shall have water resistant HEPA filters on the suction side with the exhaust to the outside of the facility. Vent vacuum system exhaust to the outside of the building, not recirculated to the mechanical room. A sampling port may be needed to sample exhaust. Design filter housing for easy replacement of the filter, with maximum protection for maintenance personnel.

- Fume Hoods

    - All chemical fume hoods shall meet all relevant design and testing protocols as required by ASHRAE 110. ASHRAE 110 testing shall be completed after the chemical fume hood is

installed, and testing certificates/reports delivered to EHS. ASHREA 110 testing shall be specified as part of the building construction contract.

- Design all wet laboratories to accommodate at least one chemical fume hood to allow for flexibility and university expansion.
- All chemical fume hoods shall have the following features: lighting, movable sash, chemical and fire resistant work surface, a raised lip or recessed work area. Provide at least 2 linear feet of work space per user.
- All chemical fume hoods shall have a face velocity of 80-120 feet per minute when the sash is opened 18".
- All chemical fume hoods shall have a monitor with a digital display of the average face velocity. The monitor shall be equipped with an audible and visual alarm. The monitor shall have a digital display showing the average face velocity.
- If volatile radioactive materials are to be used, provide a chemical fume hood capable of trapping volatile radioisotopes to prevent their release into the environment.
- If perchloric acid is to be used, a chemical fume hood shall be manufactured to meet ANSI/AIHA Z9.5-2003 and NFPA 45.
- Locate chemical fume hoods and biological safety cabinets in an appropriate location within the laboratory that is least susceptible to cross drafts, foot traffic, or sources of exhaust from other laboratory equipment. They may not be placed near doors or emergency exits. Chemical fume hoods shall not be located close to biological safety cabinets.
- A 12-14 inch clearance above biosafety cabinets may be required to provide for accurate air velocity measurement across the exhaust filter surface.

- Biological safety cabinet operation, as specified by NSF/ANSI Standard 49-2007, Annex F plus Addendum #1 shall be verified at the time of installation and, as a minimum, annually thereafter. Operational tests include Down flow Velocity Profile Test, Inflow Velocity Test, Airflow Smoke Patterns Test, HEPA Filter Leak Test, Cabinet Integrity Test (A1 cabinets only), Electrical Leakage and Ground Circuit Resistance and Polarity Tests, Lighting Intensity Test, Vibration Test, Noise Level Test, UV Lamp Test (if present).
- Ventilation systems must be designed to handle anticipated heat loads generated by specific pieces of equipment. This is especially critical for biological laboratories as incubators, freezers, and other pieces of equipment generate significant heat loads.
- Ventilation ductwork must be compatible with chemicals exhausted from the space.
- Local exhaust ventilation must be designed to effectively capture anticipated airborne contaminants as close to the generation point as possible. Appropriate testing must be completed after the local exhaust is installed, and testing certificates and reports (when appropriate) must be delivered to EHS. Testing shall be specified as part of the building construction contract. Dust collection systems are required for dust generating equipment, such as saws, to prevent a fire hazard.
- Prior approval by EHS is required for the use of canopy hoods.

- All exhaust in art studios and scene shops, including general exhaust and local exhaust ventilation (e.g., general ventilation, snorkels, and slot hoods) shall be single pass and vented to the outside of the building.

- All art studio and scene shop exhaust, including general exhaust and local exhaust ventilation, shall be manifolded if the chemicals used are compatible.

- For additional information regarding fume hood exhaust fans, refer to Section 3.3.1.4

3.2.3.8.3.2 Animal Laboratories

- Provide ventilation in accordance with the Guide for Care and Use of Laboratory Animals. Heat and humidity shall be adjustable to accommodate a range of animal species.

3.2.3.8.3.3 Darkrooms

- Furnish darkrooms where chemicals are used with local exhaust ventilation to control airborne levels of photographic process chemicals. This shall be in the form of a flanged slotted plenum running the length of and behind the work area where chemicals are used. A capture velocity of 50 linear feet per minute (LFM) must be provided at the front edge of the work area. The required exhaust flow rate to produce this capture velocity shall be calculated by the following formula:

- $Q = 2.6\ LVX$

  Where:

  Q = Volumetric flow rate in cubic feet per minute (CFM)

  L = Length of work area, in feet

  V = Desired capture velocity (in this case, 50 LFM)

  X = Distance from slot to front of work area, in feet

- Once the required flow rate is determined, the slot width shall be sized to provide a slot velocity of approximately 2000 feet per minute. The plenum shall be sized to provide a plenum velocity of approximately half the slot velocity. (Taken from the ACGIH Industrial Ventilation Manual, 22nd Edition.)

3.2.3.8.4 Electrical

3.2.3.8.4.1 All Laboratory Facilities

- Refer to Section 3.3.2 – Electrical Systems.

- Emergency generators shall be sized to provide adequate power for all exhaust fans serving combined fume hood and general room exhaust systems. Supply air handler outside air intake isolation damper actuators shall be served by the emergency power system and power OPEN to prevent excessive negative building pressurization upon loss of primary power source. Supply air handlers do not have to be included in emergency generator capacity. Where fume hood exhaust is separate from general room exhaust, only the fume hood exhaust fans need to be included in calculating the emergency generator capacity.

- Laboratory research requires high-quality lighting for close work, in terms of both brightness and uniformity. Position fixtures to provide uniform, shadow-free, and glare-free illumination of the laboratory bench top. Lighting shall be at least 70 foot-candles and may be as great as 120 foot-candles depending on the application.

- Post emergency lighting, either electric or photoilluminescent, at each exit in a laboratory. This lighting must provide at least an average of 1 foot candle of light and 0.1 foot-candle at floor level.

- Art studios and scene shops require high-quality lighting for close work, in terms of both brightness and uniformity. Position fixtures to provide uniform, shadow-free, and glare-free illumination of the work bench. Lighting shall be at least 30 (according to OSHA) foot-candles and may be as great as 50 foot-candles depending on the application.

3.2.3.8.5 Communications (IT/AV)

3.2.3.8.5.1 All Laboratory Facilities

- All laboratories shall be equipped with a phone.

3.2.3.9 Acoustics

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3.2.3.10 Security

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3.2.4 OFFICE FACILITIES

3.2.4.1 General

The guidelines in this section address offices and office support spaces.

Office and office support space standards are used to provide the Project Team with design guidelines for offices within new construction and/or renovation projects. Office space standards represent the general guidelines the Project Team should use when planning office spaces and represent maximum allowable assignable square feet for each employee category listed in the chart in section 3.2.4.2. It is understood that variations in space size may be needed to meet project specific programming needs, particularly for renovation projects in which the project program must be housed within an existing building envelope. Variations from these standards must be approved by the Associate Director, Space Management for each capital or non-capital project.

3.2.4.2 Facility Planning and Design

3.2.4.2.1 Faculty Offices

It is Clarkson University's objective to use space efficiently, and shared offices are encouraged where it is feasible.

Project Teams shall carefully analyze space plans to account and provide for spaces with shared use such as conference rooms, pantries, etc. A ratio of one shared use space for every 12 private offices is an appropriate assumption for planning.

The chart in this section includes the **maximum** assignable square feet (ASF) for each category of space. The minimum office size for an enclosed individual office is 90 ASF. Minimum cubicle or workstation size is determined by furniture design and layout. The ASF listed in the chart is intended to be a general guideline for these spaces, and it is understood that ASF may vary according to program needs within individual projects. Approval from the Associate Director of Space Management is needed for space that would exceed guideline ASF for each space category.

3.2.4.2.1.1 Full-Time Faculty

In most cases, full-time faculty are assigned private offices. In some cases, a department may utilize shared space for tenured, tenure-line, or term full-time faculty. The ASF for offices that will be shared by multiple faculty members will be adjusted to meet the total number of faculty who will be assigned to those spaces.

3.2.4.2.1.2 Part-Time/Adjunct Faculty

In all cases, part-time/adjunct faculty are assigned work space within a shared office or a hoteling workstation (inclusive of shared support space; i.e. conference, copy/print areas, etc.).

3.2.4.2.1.3 Classified Staff

Staff are assigned to workstations in either open common areas or within enclosed shared offices. An approved business use is required for private staff offices within a project program. Trade (shops/maintenance) staff are assigned shared drop-in stations.

3.2.4.2.1.4 Graduate Teaching/Research Assistants

Graduate assistants are provided shared workstations within a suite that includes workstations, a small 2-3 person meeting room, and collaboration areas. The number of workstations for each suite will be determined by the total number of GTA/GRAs assigned for each department and calculated by the percentage of occupancy for those spaces.

3.2.4.2.1.5 Collaboration Areas

Academic and research space programs should include ASF for open collaboration areas for faculty and faculty-student collaboration. These spaces should include whiteboard surfaces, power/data connections and flexible furniture.

	Employee Category	Type	Max ASF
FACULTY AND STAFF OFFICES	President	Private Office	350asf
	Vice President	Private Office	285asf
	Associate/Assistant Vice President	Private Office	180asf
	Provost	Private Office	285asf
	Associate/Assistant Provost	Private Office	180asf
	Dean	Private Office	250asf
	Associate/Assistant Dean	Private Office	150asf
	Chair/Director	Private Office	150asf
	Associate/Assistant Chair/Director	Private Office	140asf
	Instructional Faculty	Private Office	120asf
	Research Faculty*	Private Office	120asf
	Administrative/Professional Faculty	Private Office	120asf
	Graduate Teaching Assistant	Shared	35asf
	Graduate Research Assistant*	Shared	48asf
	Part-time/Adjunct Faculty	Shared	35asf
	Classified Staff	Workstation/Private Office	64 /100asf
	Wages Employee	Workstation/Shared Office	64 / 100asf
	Student Assistant	Workstation	20asf
SUPPORT SPACES	N/A	Waiting/Reception Area	250asf
	N/A	Storage Room	100asf
	N/A	Supply/Mail Room	120asf
	N/A	Pantry (shared – one per floor)	varies by program
	N/A	Copy/Work Room (shared-one per floor)	100asf
MEETING	N/A	Small Conference Room (4-10 seats)	26 asf/seat
	N/A	Medium Conference Room (10-20 seats)	28 asf/seat
	N/A	Large Conference Room (20+ seats)	34 asf/seat

*Additional space assigned for research faculty and graduate research assistant is determined by State Council of Higher Education in NYS (SCHEV) guidelines for ASF per $100,000 of annual research expenditures.

3.2.4.2.2 Conference Rooms

- For conference room configurations consult with Clarkson University for the appropriate configuration.

- Note that there will be variations for higher level furnishing levels where appropriate and indicated by the Planner.

3.2.4.3 Windows and Walls

3.2.4.3.1 All Office Facilities

- For executive level offices, confirm with the Planner the need for partitions above those indicated in Section 3.2.1.3.
- Partitions shall go to the underside of the deck above for all conference and private meeting rooms.
- Provide roller shades for offices; provide roller shades and blackout shades for conference rooms. All shades shall be manual except as specifically indicated in the project.
- Built-in millwork shall be provided on a case-by-case basis as required by the project.
- All operable windows shall have impervious sills and be fitted with screens.

3.2.4.4 Doors

3.2.4.4.1 All Office Facilities

- All doors for offices and conference rooms shall have a sidelight.
- All doors shall be solid core wood veneer.
- Provide a coat hook on the back of the door for each office.
- Provide a door stop for each door.

3.2.4.5 Accessibility

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3.2.4.6 Furniture and Equipment

3.2.4.6.1 All Office Facilities

The table below includes general information for conference room equipment and furnishings.

Room Size	Floor Power and Data Box	Projection Screen	Projector	Writing Surface	Furniture	Lighting
Small (4-10 seats)	1	Manual	Table Top	White Board*	Moveable Tables and Chairs	Dimmable at screen
Medium (10-20 seats)	2	Manual	Table Top	White Board*	Moveable Tables and Chairs	Dimmable at screen
Large (20+ seats)	2-3	Power	Ceiling Mounted	White Board*	Moveable Tables and Chairs Storage Credenza	On separate switches and dimmable

- For shared copy rooms, provide data and electrical support. Provide a minimum of one shared copy room per floor.
- Casegoods furniture is standard for all individual offices. Systems furniture shall be used for staff in open or shared office configurations.

3.2.4.7 Materials and Finishes

3.2.4.7.1 All Office Facilities

3.2.4.7.1.1 Wall Finishes

- Walls shall be painted drywall.
- Consider using an accent paint color in conference rooms.

3.2.4.7.1.2 Floor Finishes

- Provide a minimum 4” vinyl cove base in a dark color to coordinate with the floor finish. Provide broadloom carpet for office and small and medium conference spaces.
- Provide carpet tile for large conference rooms, open office areas, and circulation corridors in office areas.
- Provide VCT for copy/file/storage and pantry areas. Ceilings shall be 2’x2’ acoustic tile.

3.2.4.7.1.3 Ceiling Finishes

- GWB ceilings shall be used by exemption and as required by the project as an exception

3.2.4.8 Building Systems

3.2.4.8.1 General

3.2.4.8.2 Plumbing

3.2.4.8.2.1 All Office Facilities

- Refer to Section 3.3.3 – Plumbing Systems.
- The only plumbing provided in this space type is for pantry areas. Pantry areas are intended to be provided as a shared function for a floor.
- No dishwasher, disposal, or separate water station for coffee makers shall be provided in pantry areas.
- Refrigerators in pantry areas shall have ice makers.
- Provide a single bowl sink for pantry areas.

3.2.4.8.3 Heating, Ventilating and Air Conditioning

3.2.4.8.3.1 All Office Facilities

- Refer to Section 3.3.1 – HVAC Systems.
- Where possible, provide opportunities for natural ventilation without hampering and/or being in concert with the house ventilation system.
- Based on the economy of the overall system, to the maximum extent possible, provide limited user control of HVAC (minimum of 3 and a maximum of 5 offices), within a range of operation that can be centrally over-ridden IAW commonwealth standards.

3.2.4.8.4 Electrical

3.2.4.8.4.1 All Office Facilities

- Refer to Section 3.3.2 – Electrical Design Criteria for illumination level recommendations and additional information.
- Conference rooms shall have a multi-gang slide dimmer with one control device per zone.
- Lighting in offices shall consist of 2’x4’ recessed fluorescent or LED fixtures.
- Clarkson University has a preference for indirect and direct indirect lighting (as opposed to direct lighting) in office spaces.
- Lighting shall be controlled by wall or ceiling mounted occupancy sensors and wall mounted override switch.
- Receptacles (20A - 12SV) with isolated ground and 200% neutral shall be provided at each desk location. An additional outlet shall be provided at each desk location. In conference rooms each wall shall be provided with an electrical outlet adjacent to the lectern.

- Provide a ceiling mounted outlet for projectors and projection screens in large conference rooms.

3.2.4.8.5 Communications

3.2.4.8.5.1 All Office Facilities

- Provide a telephone/data outlet in each office at the desk area. Also provide a telephone/data/AV outlet at the blackboard/lectern area.
- Provide a floor outlet with elec/tel/data/AV capabilities at the center of the table in conference rooms.
- Refer to Chapter 3.3 for wireless requirements

3.2.4.9 Acoustics

Interior-source background noise from mechanical systems shall be calculated using the sound from all relevant HVAC sources and paths. Wherever possible, the mechanical system design shall comply with all requirements in Chapter 48 "Sound and Vibration Control" from the ASHRAE Applications Handbook and shall be designed to achieve the following Noise Criteron (NC) ratings in the spaces. The lower values listed below are intended as the system design goal and the higher values specify the performance of the total system installed and operating under actual field conditions. The higher values shall not be exceeded anywhere in the space.

	Maximum Design NC Rating	Maximum Field NC Measurement
Private Office	30	35
Shared Office	35	40
Open Plan Offices	35	40
Conference Rooms	30	35

3.2.4.10 Security

RESERVED

3.2.5 STUDY FACILITIES

3.2.5.1 General

This space use category includes study rooms, stacks, open-stack reading rooms, and library processing spaces.

3.2.5.2 Facility Planning and Design

RESERVED

3.2.5.3 Windows and Walls

RESERVED

3.2.5.4 Doors

RESERVED

3.2.5.5 Accessibility

RESERVED

3.2.5.6 Furniture and Equipment

RESERVED

3.2.5.7 Materials and Finishes

RESERVED

3.2.5.8 Building Systems

3.2.5.8.1 General

RESERVED

3.2.5.8.2 Plumbing

- Refer to Section 3.3.3 – Plumbing Systems.

3.2.5.8.3 Heating, Ventilating and Air Conditioning

- Refer to Section 3.3.1 – HVAC Systems.

3.2.5.8.4 Electrical

- Refer to Section 3.3.2 – Electrical Design Criteria.
- Lighting in study and library processing spaces shall consist of 2x4 recessed parabolic fixtures with 2-T5 lamps controlled with local wall switches.
- Lighting in stacks and open-stack reading rooms shall be 1x4 recessed with 2-T5 lamps controlled by multiple local switches at room/entrance.
- 20A - 125A electrical duplex outlets shall be provide in study and open-stack reading rooms for portable laptop use by students at each desk location.

- Emergency lighting and exit lighting must be provide in large study and open-stack reading rooms to meet local fire codes.
- See Section 3.3.2 for recommended illumination levels.

3.2.5.8.5 Communications

- Tele/data wall or floor outlets shall be provided at each student desk in study and open-stack reading rooms.

3.2.5.9 Acoustics

RESERVED

3.2.5.10 Security

RESERVED

3.2.6 SPECIAL USE FACILITIES

3.2.6.1 General

This space use category includes military training rooms, athletic and physical education spaces, media production rooms, clinics, demonstration areas, field buildings, animal quarters, greenhouses, and other room categories that are sufficiently specialized in their primary activity or function to merit a unique room code.

3.2.6.1.1 Recreation Facilities

- Recreation facilities should be warm, inviting, and friendly. Colors and large areas of glazing are often used to create an inviting atmosphere.

3.2.6.2 Facility Planning and Design

3.2.6.2.1 Recreation Facilities

- Requirements for gymnasiums and aquatic facilities shall be dictated by the appropriate National Governing Body (NGB).
- Where feasible, locate columns at the perimeter and corridor wall. Design large activity spaces such as rooms for strength training and conditioning, group fitness, martial arts, and gymnasiums to be free of columns for maximum flexibility and functionality.
- For basketball courts, the space between the outside line of the court and perimeter walls may be a minimum of 3’-0”, but a greater distance of between 3’-0” and 10’-0” is preferred. Provide padding on walls less than 10’-0” from courts.
- Provide an uninterrupted ceiling height of 20’-0” for multi-purpose rooms and weight rooms to allow hanging heavy kick bags in multiple locations. A minimum ceiling height of 14’-0” is permitted if a greater ceiling height is not feasible.
- Open ceilings are preferred in gymnasiums and multi-purpose rooms.
- Provide adjacent storage areas in lieu of the outdated “goody box” storage solution for racquetball courts..
- Provide adequate storage rooms that are easily accessible to the spaces they support.
- Locate housekeeping closets in close proximity to service areas to reduce travel and labor time.
- Locate equipment checkout and membership services outside of access control.
- Provide unisex toilets and family changing rooms.

3.2.6.3 Windows and Walls

3.2.6.3.1 Recreation Facilities

- Walls behind basketball backboards and soccer goals must be solid enough to withstand direct hits by balls and other objects.
- Walls used for medicine ball exercises shall be reinforced and covered with an appropriate surface.

- The bottom 18” of weight room walls shall be protected with a hard surface to prevent damage and discoloration. Carpet or the same floor surface in a dark color may be used, preferably with sound absorption properties.

- Racquetball courts are also used for vollyball and must be designed to withstand high impact.

- Select exterior glazing with a maximum UV rating. Exterior glazing on the east and west face of the building shall be fitted with electronic curtains.

3.2.6.4 Doors

3.2.6.4.1 Recreation Facilities

- Areas used for high activity and/or with flying objects must have doors that are not alarmed or have the alarm feature protected.

- Emergency egress doors within access control shall have panic hardware with a minimum 15 second delay before opening once activated.

3.2.6.5 Accessibility

RESERVED

3.2.6.6 Furniture and Equipment

3.2.6.6.1 Recreation Facilities

- Provide space to accommodate large fans in weight, cardio and multi-purpose rooms. In the case that the ceiling height is restrictive, fans may be located on the floor in a corner.

- Provide at least one mirrored wall in weight rooms and multi-purpose rooms, and mirrors on columns where it is feasible.

- Provide a stretch bar mounted to one wall in dance rooms.

- When nets are used to divide a gymnasium, maintain visual access to allow supervision across the space. The weight of the net may be enhanced with vinyl on the bottom portion, however, the height of the vinyl shall be a maximum of 4’-0”. Provide maximum flexibility with sectioned nets. Areas at the corners must remain open.

- Utilize walk-off mats at facility entrances to prevent dirt and water trailing.

3.2.6.7 Materials and Finishes

3.2.6.7.1 Recreation Facilities

3.2.6.7.1.1 Wall Finishes

RESERVED

3.2.6.7.1.2 Floor Finishes

- Use suspended wood floors for gymnasiums, with special consideration for shock absorption. Consider the logistics of future maintenance to allow for the repair of minor damages without replacing the entire floor.

- For wet spaces such as pool decks and locker rooms, use 2" tile or smaller on the floors. Provide maximum slip resistance.

- Clarkson prefers modular carpet tiles (opposed to broadloom or wall-to-wall carpet) due to ease of repair and replacement.

3.2.6.7.1.3 Ceiling Finishes

RESERVED

3.2.6.8 Building Systems

3.2.6.8.1 Plumbing

3.2.6.8.1.1 All Special Use Facilities

- Refer to Section 3.3.3 – Plumbing Systems.

3.2.6.8.1.2 Recreation Facilities

- Hot, cold water and drains are important. Often they are available in locker rooms and in predesigned athletic training rooms. The ability to adapt other spaces in proximity to activity/ locker room spaces is often a costly adaptation.

- Aquatic systems shall be connected to proper wastewater disposal systems and be provided with appropriate wastewater backwater valves and have appropriate domestic water backflow preventers.

- Hose bibs shall be installed at various locations where they are beneficial.

- Chemical delivery systems shall be adequately protected, yet accessible to qualified staff. Pre-design access to repair and replace these systems.

3.2.6.8.2 Heating, Ventilating and Air Conditioning (HVAC)

3.2.6.8.2.1 All Special Use Facilities

- Refer to Section 3.3.1 – HVAC Systems.

3.2.6.8.2.2 Recreation Facilities

- Indoor aquatic centers produce large quantities of chlorine laden water vapor through the process of surface evaporation. Design the HVAC system to provide adequate dehumidification year round to remove the vapor as liquid waste water. This waste water shall be properly disposed of per the applicable plumbing code or recycled and reused in the aquatics systems. A proper air change rate and air supply/return configuration shall be provided to adequately remove all harmful water vapors that could condense on building surfaces and designed to control the chloramine levels at the water surface.

3.2.6.8.3 Electrical

3.2.6.8.3.1 All Special Use Facilities

- Refer to Section 3.3.2 – Electrical Design Criteria.

- Normal lighting for these areas shall consist of a mixture of 2x4, 2x2 compact fluorescent, sconces, and pendant decorative fixtures to meet the program requirements and as designed and specified by the interior designer and/or lighting consultant of the projects.
- Illumination levels shall be maintained in accordance with associated tables in Section 3.3.2 of this manual.
- Lighting in these areas shall be controlled by lighting relay panels overridden by local switches.
- Audiovisual fire alarm devices shall be provided in all of these areas as required by NFPA and local codes.
- Emergency and exit lighting shall be provided in accordance with national and local fire codes.
- Provide protection for fire alarms, fire suppression devices, clocks, scoreboards, lights and sprinkler heads in high activity areas.

3.2.6.8.3.2 Recreation Facilities

- Provide lights with motion sensors in racquetball courts where it is feasible.
- Additional electrical capacity is needed in gymnasiums as these spaces are often multipurpose and the need for five 20 amp breakers in addition to existing power is costly.
- Weight rooms and cardio spaces often need 220 Volt dedicated circuits to accommodate the equipment, data, televisions etc.
- Provide security cameras at access and egress points, and at locations where financial transactions will occur. Cameras may also be desired for educational purposes.

3.2.6.8.4 Communications

3.2.6.8.4.1 All Special Use Facilities

- Tel/data/AV outlets wall mounted or floor mounted shall be provided as required by the furniture layout in training rooms, physical education spaces, production rooms, clinics, and demonstration areas.

3.2.6.9 Acoustics

3.2.6.9.1 Recreation Facilities

- Acoustical products may be employed to mitigate sound issues.

3.2.6.10 Security

RESERVED

3.2.7 GENERAL USE FACILITIES

3.2.7.1 General

In addition to food service and convenience, this space use category includes assembly rooms, exhibition space, lounges, merchandising facilities, recreational facilities, meeting rooms, and child and adult care rooms.

3.2.7.2 Facility Planning and Design

3.2.7.2.1 Food Service and Convenience

- A minimum of 17sf/seat is required for dining facilities.
- Space must be allocated for disposal of food waste.
- Additional space must be allocated for pre-chilling food and beverage products in convenience stores.

3.2.7.3 Windows and Walls

3.2.7.3.1 Food Service and Convenience

- Walls of servery shall have minimum 24” high cement board with 12” high waterproofing for mold remediation.

3.2.7.4 Doors

RESERVED

3.2.7.5 Accessibility

RESERVED

3.2.7.6 Furniture and Equipment

3.2.7.6.1 Food Service and Convenience

- All coolers and freezers will be on back-up generator where applicable.
- Chairs must be stackable for easier storage.

3.2.7.7 Materials and Finishes

3.2.7.7.1 Food Service and Convenience

3.2.7.7.1.1 Wall Finishes

RESERVED

3.2.7.7.1.2 Floor Finishes

- Carpet tiles are preferred to standard carpet due to easier repair and maintenance.
- Quarry tile with grout must be used in kitchens; tile must be sealed to prevent grease absorption.

3.2.7.7.1.3 Ceiling Finishes

RESERVED

3.2.7.8 Building Systems

3.2.7.8.1 General

RESERVED

3.2.7.8.2 Plumbing

3.2.7.8.2.1 All General Use Facilities

- Refer to Section 3.3.3 – Plumbing Systems.

3.2.7.8.2.2 Food Service and Convenience

- Grease traps must be accessible.
- For specific requirements related to plumbing for food service areas and kitchens, refer to Section 3.3.3 – Plumbing Systems.

3.2.7.8.3 Heating, Ventilating and Air Conditioning

3.2.7.8.3.1 All General Use Facilities

- Refer to Section 3.3.1 – HVAC Systems.

3.2.7.8.3.2 Food Service and Convenience

- Each kitchen hood shall be provided with a dedicated exhaust fan.
- All Type 1 kitchen hoods will be provided with wet-chemical suppression systems.
- For information regarding steam and condensate piping for kitchen equipment, refer to Section 3.3.1

3.2.7.8.4 Electrical

3.2.7.8.4.1 All General Use Facilities

- Refer to Section 3.3.2 – Electrical Design Criteria.
- Normal lighting for these areas shall consist of a mixture of 2x4, 2x2 compact fluorescent, sconces, and pendant decorative fixtures to meet the program requirements and as designed and specified by the interior designer and/or lighting consultant of the projects.
- Illumination levels shall be maintained in accordance with associated tables in Section 3.3.2 of this manual.
- Lighting in these areas shall be controlled by lighting relay panels overridden by local switches.
- Audiovisual fire alarm devices shall be provided in all of these areas as required by NFPA and local codes.
- Emergency and exit lighting shall be provided in accordance with national and local fire codes.

3.2.7.8.4.2 Food Service and Convenience

- Adequate lighting must be provided directly over food.

3.2.7.8.5 Communications

3.2.7.8.5.1 General

- Wall mounted or floor mounted tel/data/AV outlets shall be provided as required by the furniture layout and program requirements in assembly rooms, exhibition spaces, lounges, merchandizing facilities, recreational facilities, meeting rooms, and child and adult care rooms.

3.2.7.9 Acoustics

RESERVED

3.2.7.10 Security

RESERVED

3.2.8 SUPPORT FACILITIES

3.2.8.1 General

This space use category includes computing facilities, shops, central storage areas, hazardous waste and chemical storage rooms, mailrooms, vehicle storage areas, and central service space.

3.2.8.2 Facility Planning and Design

3.2.8.2.1 IT, AV and Security Rooms

- Provide separate rooms for IT and Security; IT and Security functions and equipment shall not be combined in a shared space
- Provide one IT room on each floor.
- Do not use suspended ceilings for IT and Network Equipment rooms; Clarkson University prefers sealed concrete above.
- Avoid excess, unused space; utilize walls for storage or other purposes.

3.2.8.2.2 Hazardous Waste and Hazardous Substance Bulk/Stock Storage

- Design all chemical and waste storage areas with recessed flooring (e.g., sunken slab) and a sloped entrance ramp to contain any material spills within the room footprint.
- All chemical storage rooms shall be completely sealed from the environment and adjacent spaces, except for doorways and ventilation areas to contain spilled material and avoid gases, vapors, or fumes from escape.

3.2.8.2.3 Chemical Storage

- Provide sufficient space to physically separate incompatible materials.
- A means of securing regulated materials such as controlled substances or radioactive materials shall be available when applicable.
- Locate chemical storage cabinets as remote as possible from exit doors. Chemical storage cabinets shall not be located in corridors.

3.2.8.3 Windows and Walls

RESERVED

3.2.8.4 Doors

3.2.8.4.1 Hazardous Waste and Hazardous Substance Bulk/Stock Storage

- Doors shall be self-closing.
- Doors shall be of sufficient dimensions to accommodate equipment and may not be less than 48 inches wide.
- Doors shall swing in the direction of egress.

3.2.8.4.2 Chemical Storage

- Chemical storage and hazardous waste storage areas shall be keyed to EHS' waste room key; contact EHS for further instruction. Supply duplicate keys for chemical storage areas and cabinets to EHS.

3.2.8.5 Accessibility

RESERVED

3.2.8.6 Furniture and Equipment

3.2.8.6.1 Hazardous Waste and Hazardous Substance Bulk/Stock Storage

- All waste rooms and rooms where hazardous substances are used or stored with bench tops shall use bench tops constructed of materials that are impervious to the chemicals and materials used or stored in this space. Ideally, bench tops should incorporate a lip to prevent run-off onto the floor.

- All spaces using or storing gas cylinders shall have cylinder storage mounts, racks, or floor stands for each cylinder to be used or stored. Locate mounts at a height that allows for the chain to be placed 3/4 of the way up the cylinder. The design of cylinders shall comply with 29 CFR 1910.101.

3.2.8.6.2 Chemical Storage

- If chemicals are stored in a refrigerator, the refrigerator shall be intrinsically safe, designed in accordance with UL standards, and labeled "No Food or Drink."

- All chemical storage cabinets shall be constructed of a chemical resistant material, must be listed as UL or FM certified, and should be ventilated and manifolded to single pass local exhaust systems. If ventilated and manifolded to single pass local exhaust systems, exhaust shall be removed from the bottom of the cabinet. The exterior of the storage cabinet shall be appropriately labeled.

- Chemical storage cabinets shall be mounted per the manufacturer's instructions, and the integrity of the cabinet may not be compromised by its mounting method.

- Flammable storage cabinets shall be present in locations that store greater than 10 gallons total of flammable liquids.

- Flammable storage cabinets shall not be vented and all openings or vents must be sealed. Flammable storage cabinets shall be located in each chemical storage or waste room, and meet applicable fire safety requirements (minimum requirements: listed as UL or FM certified). The exterior of the storage cabinet must be appropriately labeled, and located as remote as possible from the exit doors, and shall not be located in corridors. The cabinet shall be mounted per the manufacturer's instructions, and the integrity of the cabinet may not be compromised by its mounting method.

3.2.8.7 Materials and Finishes

RESERVED

3.2.8.8 Building Systems

3.2.8.8.1 General

RESERVED

3.2.8.8.2 Plumbing

3.2.8.8.2.1 All Support Facilities

- Refer to Section 3.3.3 – Plumbing Systems.

3.2.8.8.2.2 Hazardous Waste and Hazardous Substance Bulk/Stock Storage

- All chemical storage and waste rooms shall have a sink with pressurized warm and cold running water. Locate sinks near the exit door.
- Drains shall not be present.
- Locate an ANSI approved emergency shower and eyewash within the chemical or waste storage room. The emergency shower shall not have a floor drain and the area beneath the shower shall not be carpeted.

3.2.8.8.3 Heating, Ventilating and Air Conditioning

3.2.8.8.3.1 All Support Facilities

- Refer to Section 3.3.1 – HVAC Systems.

3.2.8.8.3.2 IT, AV and Security Rooms

- A dedicated cooling system connected to the emergency power system shall be provided for all telecom rooms; cooling for these spaces is required at all times (24 hrs per day/7 days per week).

3.2.8.8.3.3 Mailrooms

- Mailrooms shall be provided with an HVAC system which shall maintain the mailroom under negative pressure relative to all adjacent spaces. All mailroom supply air shall be 100% exhausted. Variable volume air systems shall be provided with a pressure independent control system to maintain proper tracking between supply and exhaust air.

3.2.8.8.4 Electrical

3.2.8.8.4.1 All Support Facilities

- Refer to Section 3.3.2 – Electrical Design Criteria.
- Normal lighting in these areas shall consist of explosion proof fixtures, 2x4, 2x2, or compact fluorescent fixtures, to meet the program requirements.
- Illumination levels shall be maintained in accordance with associated tables in Chapter 3 of this manual.
- Lighting in these areas shall be controlled by lighting relay panels overridden by local switches.
- Audiovisual fire alarm devices shall be provided.

3.2.8.8.4.2 Hazardous Waste and Hazardous Substance Bulk/Stock Storage

- All lighting shall be intrinsically safe, explosion-proof fixtures. At least 30 foot-candles must be provided for these spaces.

- Emergency lighting, either electric or photoilluminescent, shall be posted at each exit in a laboratory. This lighting must provide at least an average of 1 foot candle of light and 0.1 foot-candle at floor level.

3.2.8.8.5 Communications

3.2.8.8.5.1 All Support Facilities

- Tel/data/AV outlets, wall mounted or floor mounted, shall be provided as required by the millwork layout in computing facilities, shops, and central service space.

3.2.8.8.5.2 Hazardous Waste and Hazardous Substance Bulk/Stock Storage

- Equip chemical storage and waste rooms with an intrinsically safe phone.

3.2.8.9 Acoustics

RESERVED

3.2.8.10 Security

RESERVED

3.2.9 HEALTH CARE FACILITIES

3.2.9.1 General

This space use category includes spaces that are used to provide patient care for humans and animals.

3.2.9.2 Facility Planning and Design

RESERVED

3.2.9.3 Windows and Walls

RESERVED

3.2.9.4 Doors

RESERVED

3.2.9.5 Accessibility

RESERVED

3.2.9.6 Furniture and Equipment

RESERVED

3.2.9.7 Materials and Finishes

RESERVED

3.2.9.8 Building Systems

3.2.9.8.1 General

RESERVED

3.2.9.8.2 Plumbing

- Refer to Section 3.3.3 – Plumbing Systems

3.2.9.8.3 Heating, Ventilating and Air Conditioning

- Refer to Section 3.3.1 – HVAC Systems.

3.2.9.8.4 Electrical

- Refer to Section 3.3.2 – Electrical Design Criteria.
- Lighting in this area shall consist of 2x4 or 2x2 recessed fluorescent fixtures with acrylic lens and 2-T5 lamps. See Section 3.3.2 of this manual for recommended illumination levels.
- Light controls in human health care areas shall be wall mounted manual switches at room entrance. In animal health care areas shall be 24/7 automatically controlled via a programmable lighting control system.
- Electrical outlets, 20A -125V duplex, shall be provided on each wall of these areas, as well as, GFI outlets at countertop locations for various portable medical devices.

- Fire alarm, smoke detector, and audiovisual devices shall be provided in each of these health care areas to meet NFPA codes.

3.2.9.8.5 Communications

- Tel/data/AV wall outlets shall be provided adjacent to human patient areas in each of these health care areas and related procedure rooms.

3.2.9.9 Acoustics

RESERVED

3.2.9.10 Security

RESERVED

3.2.10 RESIDENTIAL FACILITIES

3.2.10.1 General

The following section includes guidelines for housing facilities for students.

Clarkson desires future flexibility in terms of floor plan re-arrangement. Structural approaches in order of preference therefore are:

- Columns only – at the perimeter and corridor wall
- Load-bearing corridor walls and perimeter columns

Schemes with interior structural walls are not permitted unless it is demonstrated that more flexible approaches are not feasible for structural or economic reasons.

3.2.10.2 Facility Planning and Design

Spatial planning guidelines for specific room categories are listed below. For additional information regarding interior construction, interior finishes, building services (including lighting), equipment and furnishings, and acoustics, refer to the subsequent sections.

	Space Type	SF	Notes
RESIDENTIAL UNITS	General	NA	Ceiling height in sleeping area shall be a minimum of 9'-4". At dropped ceilings or bulkheads the ceiling height may be a minimum of 8'-6". Provide a minimum clearance of 3" between each piece of furniture or from the furniture to the wall. Furniture sizes will be identified in the building program. With the exception of triples, rooms must be sized to accommodate furniture without requiring beds and/or chests to be bunked. Refer to Part 5 – Standard Details for conceptual unit plans
	Standard Single Room	130 asf	Provide ADA compliant singles as required by code. Must accommodate a twin bed, chest, desk and chair. Minimum finished width: 8'-8".
	Ensuite Single Room	200 asf	Provide ADA compliant Ensuite Single Rooms as required by code with ADA compliant bath distributed within the building. Minimum finished width: 8'-8".
	Double Room	210 asf	Provide ADA compliant doubles as required by code. Must accommodate 2 twin beds, 2 chests, 2 desks, 2 chairs. Minimum finished width: 11'-8".
	Triple Room	270 asf	Provide ADA compliant triples as required by code; Mason requires a minimum of one ADA compliant triple. Must accommodate 1 twin bed, 1 twin bunk, 3 chests, 3 desks, 3 chairs.

	Space Type	SF	Notes
RESIDENTIAL SHARED & SUPPORT	Group Living Room	625 asf	Provide serving counter to accommodate microwave and wiring for installation of a wall-mounted flat screen TV. Must accommodate lounge seating, tables and chairs. Should be adjacent to elevators and centrally located. Large windows with campus views are desirable. Corridor wall should incorporate glass panels for views in and out. Ceiling height shall be a min. of 9'-4" and bulkheads a minimum of 8'-6."
	Study Room	200 asf	Must accommodate a study table and chairs, and lounge seating. Assumes 20sf/occupant. Should be adjacent to the community or communities it serves. Large windows with campus views are desirable. Corridor wall shall incorporate glass panels for views in and out of the room. Ceiling height shall be a min. 9'-4" and bulkheads a min. of 8'-6."
	Trash/ Recycling	80 asf	Two trash rooms with recycling bins shall be provided on each typ. floor. Each trash room shall accommodate 3 large recycling bins—1 for paper and 2 for comingled material. Locate trash/recycling rooms near the Housing Admin. Closets and bathroom cores. Provide space for recycling bins per Mason.
	Entry Lobby/ Lounge	900 asf	Provide entry vestibule with walkoff mat. Design lobby to encourage student interaction. Must accommodate lounge seating and amenities to serve building residents as well as visitors. Provide secure access to elevators, stairs and ground floor community.
	Housing Office	120 asf	Does not need to be adjacent to the lobby. Does not function as a security or information desk.
	Housing Admin.	120-350 asf	Support space for Housing Staff. Does not need to be adjacent to Housing Office.
	Laundry		Provide space and connections for 1 W/D per 30 residents. Provide space for folding tables. Provide glass to corridor. W/D provided by Owner.
	Vending	80 asf	Must accommodate 3 vending machines @ 42" wide.
	Multi-Purpose Rm	1,000 asf	Provide access to entry lobby. Equipment: ceiling projector, projection screen, white boards.
	Kitchen	120 asf	Provide lockable ADA compliant kitchen accessed from Multi-Purpose Room. Provide stove with self-cleaning oven, microwave, double sink with garbage disposal, refrigerator/freezer, commercial ice machine, SS countertop, base and wall solid wood cabinets.
	Multi-Purp. Rm Storage	200 asf	Provide storage for folding tables and stacking chairs.
RESIDENT	Staff Apartment	750 asf	One-bedroom ADA compliant apartment for housing manager. Incl. living/dining room, bedroom, bathroom, kitchen, laundry room and storage closet. Kitchen to include stove with self-cleaning oven, microwave,

	Space Type	SF	Notes
			dishwasher, double sink with garbage disposal, refrigerator/freezer with ice maker, solid surface countertop, base and wall solid wood cabinets. W/D provided by owner.
	Main Trash/ Recycling	120 asf	Convenient to service elevator, ground floor shared spaces and service entry. Size and requirements to be coordinated with the Mason Recycling and Waste Management group.
	Hall Bathrooms	390 sf	Provide 2 bathroom cores per typical floor with 2 bathrooms in each core. Provide 1 core on the ground floor if design includes a ground floor community. Separate toilet rooms are required to serve public areas on the ground floor. Locate bathroom cores to be as convenient as possible to the community or communities they serve. Provide fixtures as required by code or in a ratio of no more than 6 beds per fixture type, whichever is greater. All bathrooms must be unisex to provide maximum flexibility in room assignments. All bathrooms shall be accessible. Layout to be compartmentalized with wet shower area separate from Lavatories/WC's. Provide floor drain in open area of each compartment. Daylight desired.
	Housing Admin.	60 sf	Provide 1 Housing Admin. room adjacent to each bathroom core. Provide mop sink and wall mounted shelving for housekeeping supplies.
	Network Engineer	80 sf	Number of rooms required is determined by a max. distance of 300’ from the room to the furthest data outlet location.
	Elec. Closet	80 sf	Provide 1 per floor.
	Residential Corridors	TBD	Shall be designed as required by code and a min. of 5'-8" wide. Corridors shall implement offsets or other strategies to minimize apparent length. Recesses, special lighting and finish accents are encouraged at room entries. Variation in corridor width to foster student interaction is desirable. Daylight shall be visible at ends of corridors. Accent flooring shall be used at elevator lobby. Ceiling height shall be as high as possible to accommodate building systems with a minimum of 8’-6” at bulkheads.. Provide corner protection.
	Stairs	TBD	Provide a stair adjacent to elevator lobby to encourage non-elevator vertical circulation. Provide daylight in stairs.
	Sprinkler Room	TBD	Dedicated room with direct access to outside.
	Housing Security	TBD	Access control/security equipment.
	Network Engineer	TBD	Dedicated room with direct access to outside.

	Space Type	SF	Notes
RESIDENTIAL SHARED & SUPP.	Main Mechanical Room	TBD	Provide space for air handlers, heat exchangers, hot water, energy monitoring equip., etc.
	Main Electric Room	TBD	
	Public Toilets	TBD	Provide fixtures as required by code to serve ground floor shared and support spaces.

Note: Balconies are prohibited in the design of residential facilities.

3.2.10.3 Windows and Walls

3.2.10.3.1 General

RESERVED

3.2.10.3.2 Bedroom Units

- Bedroom windows:
  - Use clear, low-E glass.
  - Provide a minimum 18 square foot rough opening.
  - Provide a minimum operable panel as required by code.
  - Provide bug screens at all operable windows.
  - Use an impervious material such as solid surfacing or slate for interior window sills; painted wood is not acceptable.
  - Provide window treatment for each window.

3.2.10.4 Doors

- All interior doors in residential buildings must be solid core wood veneer with a steel hollow metal frame.

3.2.10.5 Accessibility

- Public rooms and hall bathrooms in all residential facility projects, in addition to the units that must be fully accessible per ADAAG, must be accessible to permit unassisted visitation.

3.2.10.6 Furniture and Equipment

3.2.10.6.1 All Residential Facilities

- Furniture will be procured separately by Clarkson when applicable and installed prior to substantial completion.
- Furniture sizes will be identified in the building program.

3.2.10.6.2 Staff Apartment

- Provide full size, fully equipped kitchens including appliances.
- Provide a washer/dryer in the unit; a stacked washer/dryer is acceptable if able to retrofit with ADA compliant single unit.

3.2.10.6.3 Bedroom Units

- Provide a closet with a minimum width of 36” of hanging space for each occupant. Hanging rods in non-ADA units must be 65”-68” above the finished floor. Provide two fixed shelves above the rod.

3.2.10.6.4 Toilet Rooms and Kitchens

- Solid surface counter tops are required. Plastic laminate is not acceptable.
- Provide integral or undermount lavatory bowls.
- Provide a mirror with a minimum width of 24” centered on each lavatory. The top of the mirror is to be mounted at 7’-0” AFF minimum, with the bottom of the mirror tight to the backsplash or as required by ADA.
- Provide one 24” towel bar and one robe hook per student in suite style toilet rooms.

3.2.10.7 Materials and Finishes

3.2.10.7.1 All Residential Facilities

- Abuse resistant gypsum board, painted, must be used throughout unless otherwise noted.
- Special accent finishes or colors may be used to define special areas, including:
  - Entry Lobby/Lounge
  - Group Living Rooms
  - Multi-purpose Rooms and Multi-purpose storage
  - Residential corridors
  - Study Rooms

3.2.10.7.2 Bedroom Units and Staff Apartments

3.2.10.7.2.1 Wall Finishes

- Gypsum board, painted, must be used for all residential units with ensuite ADA toilets.

3.2.10.7.2.2 Floor Finishes

- Tile (VCT) is the preferred flooring for all residential areas including bedrooms and living areas, unless otherwise specified by Clarkson.

- All accent flooring and/or carpet, (if used) for entry lobby/lounge areas, study rooms, and residential corridors must have a resilient base.

3.2.10.7.2.3 Ceiling Finishes

- Textured semi-gloss paint on underside of deck with caulk joints and gypsum board, painted as required to hide building systems, must be used for all residential units and staff apartments.

3.2.10.7.3 Public Areas

3.2.10.7.3.1 Wall Finishes

RESERVED

3.2.10.7.3.2 Floor Finishes

- Tile (VCT) is the preferred flooring for all residential areas including bedrooms and living areas, unless otherwise specified by Clarkson.

- All accent flooring and/or carpet, (if used) for entry lobby/lounge areas, study rooms, and residential corridors must have a resilient base.

3.2.10.7.3.3 Ceiling Finishes

- Gypsum board, painted, combined with acoustic ceiling tile must be used for public areas such as group living rooms, multi-purpose rooms, residential corridors, study rooms and vending areas.

- Accent ceiling must be used in the lobby/lounge area.

3.2.10.7.4 Service and Support Areas

3.2.10.7.4.1 Wall Finishes

RESERVED

3.2.10.7.4.2 Floor Finishes

- Concrete, sealed, with resilient base, must be used for all mechanical and janitorial areas, as well as stairs and trash/recycling rooms.

- Resilient flooring with resilient base must be used for all security rooms, kitchens, laundry rooms, network engineer rooms and vending rooms.

3.2.10.7.4.3 Ceiling Finishes

- Unfinished ceilings may be used for mechanical and security rooms, housing administration areas, stairs and trash/recycling rooms.

- Gypsum board, painted, must be used for all kitchens and laundry rooms.

- Suspended acoustic ceiling tile must be used for multi-purpose room storage areas and housing offices.

3.2.10.7.5 Toilet Rooms

3.2.10.7.5.1 Wall Finishes

RESERVED

3.2.10.7.5.2 Floor Finishes

- Ceramic tile flooring must be used for all toilet rooms.

3.2.10.7.5.3 Ceiling Finishes

- Gypsum board, painted, must be used for all toilet rooms.

3.2.10.8 Building Systems

3.2.10.8.1 General

RESERVED

3.2.10.8.2 Plumbing

3.2.10.8.2.1 All Residential Facilities

- Refer to Section 3.3.3 – Plumbing Systems.

3.2.10.8.3 Heating, Ventilating and Air Conditioning

3.2.10.8.3.1 All Residential Facilities

- Refer to Section 3.3.2 – HVAC systems.

3.2.10.8.3.2 Bedroom Units

- Each bedroom shall be heated with baseboard or in floor hydronic heat.
- Provide an individual thermostat in each bedroom or suite as defined by a hall entry.

3.2.10.8.4 Electrical

3.2.10.8.4.1 All Residential Facilities

- Refer to Section 3.3.2 – Electrical Design Criteria.

3.2.10.8.4.2 Bedroom Units

- Provide all units with self-contained smoke detector by the bed and outside the bedroom area. Each dorm must have an audio-visual device within the suite.
- Provide ceiling mounted vandal resistant light fixtures in each bedroom unit that provide light levels as required by code. Toilet room light fixtures may be either wall mounted or ceiling mounted.
- Lighting controls must have an occupancy sensor. Provide bedrooms with a manual override.

- Provide recessed down lights at the bedroom entry. Surface mounted fixtures (exposed conduit not permitted) are acceptable in the remainder of the room.
- Provide compact fluorescent lights in toilets and kitchenettes.

3.2.10.8.4.3 Public Areas

- Provide a mixture of 2x4, 2x2, and compact fluorescent fixtures.
- For Hall and Lounge areas, use 2x4 recessed or surface mounted fluorescent fixtures controlled by manual switches at the entrance door to the space.
- Provide emergency and exit lighting at all egress corridors and lobbies of the facility, connected to the buildings' emergency system.
- Provide all public areas with audio/visual devices and smoke detectors.

3.2.10.8.5 Communications

3.2.10.8.5.1 All Residential Facilities

- In addition to any Code requirements, the following loads must be connected to an emergency generator(s) via an automatic transfer switch(es):
  - All life safety systems
  - Access control system
  - Telecommunications system

3.2.10.8.5.2 Bedroom Units

- All units shall be equipped with tel/data/TV outlet as required by Clarkson.
- Provide one Coax cable outlet in each bedroom and each living room where required.
- Provide each bedroom with a minimum of two duplex outlets and one data connection for each bed. Locate outlets on opposite walls in rooms with more than one occupant.

3.2.10.8.5.3 Public Areas

- Provide recessed power/data box for TV in common areas with a power outlet below for game consoles.

3.2.10.9 Acoustics

- Provide a minimum acoustic separation of 50 STC at unit demising walls, corridors, study rooms, bathrooms and common areas.

3.2.10.10 Security

RESERVED

3.2.13 BUILDING SERVICE AREAS

3.2.13.1 General

The guidelines in this section address spaces used to support cleaning and public hygiene functions, including custodial and janitor closets, public restrooms, and trash rooms.

3.2.13.2 Facility Planning and Design

3.2.13.2.1 Toilet Rooms

- For additional information regarding plumbing fixtures, refer to Chapter 4, Section 22 40 00.

3.2.13.2.2 Waste and Recycling

- Locations for recycling containers shall be built into the design, not placed as an afterthought.

3.2.13.2.3 Housekeeping

- Provide a sufficient number of electrical outlets in corridors; extension cords for cleaning equipment are typically 100’ or less.
- Janitor’s closets must be provided; these rooms shall be ventilated and provided with drains
- Provide a minimum of 150sf for storage space for paper, chemicals, and equipment.

3.2.13.3 Windows and Walls

RESERVED

3.2.13.4 Doors

RESERVED

3.2.13.5 Accessibility

3.2.13.5.1 Toilet Rooms

- Toilet rooms shall not have vestibules.
- Locate accessible paper towel dispensers adjacent to the accessible lavatories.
- In the case that only one urinal is provided, is must be accessible.
- Install grab bars at 35” above the finished floor to allow better placement of the toilet tissue dispenser.
- Provide a pull handle on the inside of accessible toilet stall doors.
- Door hardware for all stalls shall be either a slide bolt latch or throw latch.
- Doors must open outwards.

3.2.13.6 Furniture and Equipment

3.2.13.6.1 Toilet Rooms

- Toilet partitions shall be ceiling-hung.
- Mirror-mounted soap dispensers are preferred.
- Countertop soap dispensers are prohibited.
- Provide wall space for paper towel dispensers.
- Paper towel dispensers are preferred to hand dryers; if using hand dryers, two units must be provided

3.2.13.7 Materials and Finishes

3.2.13.7.1 Toilet Rooms

- All wet walls shall be tiled.
- Carpet versus tile in terms of upkeep; grouting is more intense to clean.
- Glue and grout is an issue that can't come out, sheet goods or VCT over this, recessed grouting.
- For grouting, select a color that will not easily show dirt.

3.2.13.8 Building Services

3.2.13.8.1 General

3.2.13.8.2 Plumbing

3.2.13.8.2.1 All Building Service Areas

- Refer to Section 3.3.3 – Plumbing Systems.

3.2.13.8.2.2 Toilet Rooms

- Waterless urinals are prohibited due to maintenance and vandalism issues

3.2.13.8.3 Heating, Ventilating and Air Conditioning

- Refer to Section 3.3.1 – HVAC Systems.

3.2.13.8.3.1 Toilet Rooms

- Air conditioning at night is an issue for cleaning crew; humidity control.

3.2.13.8.4 Electrical

3.2.13.8.4.1 All Building Service Areas

- Refer to Section 3.3.2 – Electrical Design Criteria.

3.2.13.8.4.2 Toilet Rooms

- Toilet lighting shall consist of fluorescent down lights and cove lighting at the perimeters controlled by occupancy sensors and wall override switches.
- Emergency lights shall also be provided in toilets to maintain 1 foot-candle minimum.
- Janitor and trash rooms shall have strip fluorescent lighting controlled by wall occupancy sensor/override switches.
- Toilet areas shall be provided with audio-visual fire alarm devices per NFPA code.

3.2.13.8.5 Communications

- Not required in these areas.

3.2.13.9 Acoustics

RESERVED

3.2.13.10 Security

RESERVED

3.2.14 MECHANICAL AREAS

3.2.14.1 General

This space use category includes non-assignable spaces for mechanical equipment and utilities.

- Locate all floor mounted equipment on concrete housekeeping pads with a minimum height of 4 inches.
- Provide a minimum of 6'-8" vertical clearance to ensure headroom for maintenance workers.
- Locate all gas and oil fired equipment in rooms that are physically separated from air handling equipment and refrigeration equipment.
- Provide a gray colored epoxy coating or equivalent waterproof, chemical resistant sealant for all flooring of mechanical, plumbing, and electrical rooms.
- If not accessible by elevator, provide mechanical penthouses with stair access as a minimum.
- Provide rooms with permanent means to allow egress and ingress of equipment and/ or major components without cutting of building walls and/or floors. Temporary removal of permanent louvers or wall knock out panels is an acceptable means to allow egress and ingress of major equipment such as chillers, boilers and large air handling units.
- Provide all utility entrance pits (Power, Hot Water and/or chilled water) with guard rails, chain and an access ladder. Utility entrance pits shall be sized to accommodate utilities and safe access to utility piping valves.

3.2.14.2 Facility Planning and Design

3.2.14.2.1 Main Electrical Room

- Main Service Equipment located inside a building shall be within a space designated as the Main Electrical Room. The Main Electrical Room will have at least two points of exit, with a double door on a minimum of one opening. The Main Electrical Room shall have direct access to the corridor(s). All doors shall swing in the path of egress. See Section 13 48 00 for the acoustical considerations including the partition walls sound insulation ratings.
- Within the design of the Main Electrical Room, consideration shall be taken to maintain proper clearances of all equipment for maintenance. The minimum clearance for most equipment shall be 4'-0" in front. Provide additional clearance for equipment containing heavy maintenance parts.
- Size electrical rooms to include 20% usable space to allow addition of future electrical equipment.
- Along with the design of the Main Electrical Room, provide a path for which to remove and replace large equipment. All equipment, regardless of size and lifespan, shall be assumed to require replacement at least once in the life of the building.

3.2.14.2.2 Emergency Electrical Room

- In specific building requirements, a separate main electrical space may be included to house only emergency (both life safety and standby) equipment such as transfer switches, panels, and transformers. This space shall conform to the requirements of the Main Electrical Room.

3.2.14.2.3 Secondary Distribution Electrical Rooms:

- Provide separate electrical and telecom closets. Custodial closets shall not be used to house electrical or telecom equipment.
- Provide each floor with a minimum of two secondary distribution electrical rooms containing 480/277V and 120/208V equipment. One electrical room may be provided per floor if centrally located and approved by Facilities Management Services.
- Locate electrical rooms at a maximum of 150'-0" from the furthest point of distribution.
- All secondary distribution electrical rooms shall be provided as enclosed spaces. All doors shall swing in the path of egress regardless of the size or location of the room. Lockable closets or lockable fences may be acceptable in certain applications. Panels may be located outside of the electrical room, including corridors, in special applications such as laboratory spaces or retrofit projects as deemed acceptable by Facilities Management Services.
- Design electrical rooms to provide the minimum code required clearance for all equipment. Size electrical rooms to include 20% usable space to allow addition of future electrical equipment. Room partition walls and floor/ceiling assembly shall provide sound insulation as required by Section 13 48 00.
- Electrical equipment shall not be located in non-designated spaces such as janitor's closets and storage rooms. Electrical equipment shall be located in designated electrical spaces deemed as such by Mason Facilities Management Services.

3.2.14.2.4 Mechanical Equipment Rooms:

- Provide manufacturer's and code required minimum clearances for all fuel fired equipment.
- Provide adequate clearances for air handling equipment filter pull, fan replacement and any other maintenance or repair of equipment.
- Provide adequate clearances for refrigeration equipment tube pull, compressor replacement and any other maintenance or repair of equipment.
- Follow manufacturer's recommendations for minimum service clearances.
- Provisions shall be given to pathways to allow removal and replacement of large equipment.
- Mount all equipment on a concrete housekeeping pad.

3.2.14.2.5 Plumbing Equipment Rooms:

- Take considerations to maintain proper clearances of all equipment for maintenance. The minimum clearance for most equipment shall be 36 inches in front. Equipment containing heavy maintenance parts shall be provided with additional clearance. Follow manufacturer recommendation for specific clearance requirements for equipment.
- Provide the path for which to remove and replace large equipment. All equipment, regardless of size and lifespan, shall be assumed to require replacement at least once in the life of the building.

3.2.14.3 Windows and Walls
RESERVED

3.2.14.4 Doors
RESERVED

3.2.14.5 Accessibility
RESERVED

3.2.14.6 Furniture and Equipment
RESERVED

3.2.14.7 Materials and Finishes
RESERVED

3.2.14.8 Building Systems
3.2.14.8.1 General

RESERVED

3.2.14.8.2 Plumbing

3.2.14.8.2.1 All Mechanical Areas

- Refer to Section 3.3.3 – Plumbing Systems.
- Provide areas housing chemical water treatment tanks and feed equipment with countertop sink for water treatment testing, a hose bib adjacent to chemical feed tanks for chemical mixing and an emergency eye wash.
- Provide rooms with sufficient quantity and location of floor drains for the following service:
  - Cooling coil condensate drainage
  - Humidifier drainage
  - Pump seal drainage
  - Automatic air vent drainage
  - Safety relief valve drainage
  - Utility entrance pits
  - Heat exchanger manual drains
  - Piping system low point manual drains
- Locate floor drains no more than 30 inches from equipment drain connections in order to prevent tripping hazards resulting from piping located at floor level.

- Provide mechanical and plumbing equipment rooms with at least one hose bib connection with integral vacuum breaker and threaded hose connection.

3.2.14.8.3 Heating, Ventilating and Air Conditioning

3.2.14.8.3.1 All Mechanical Areas

- Refer to 3.3.1 – HVAC Systems.
- Provide ventilation and/or air conditioning in these areas to maintain cooling temperature set-point under all operating conditions. Consider all sources of heat gain including the following:
  - Building envelope
  - Motors
  - Electrical equipment
  - High temperature piping heat dissipation/radiation
  - Heating and steam generating equipment heat dissipation/radiation
- Provide dedicated combustion air intake/supply systems for gas and oil fired equipment that are not direct vented.
- Provide heating in these areas to maintain heating temperature set-point under all operating conditions.
- Design systems to accommodate specific equipment environmental requirements unless directed otherwise by Mason.
- Provide MERV 7 minimum filtration on air conditioning and ventilation systems serving these areas where mechanical ventilation/forced air are utilized. Do not provide filtration where natural ventilation is utilized.

3.2.14.8.4 Fire Protection

- Refer to Section 3.3.4 – Fire Suppression Systems.
- Fire alarm smoke detectors shall be provided in these areas per NFPA requirements.

3.2.14.8.5 Electrical

- Refer to Section 3.3.2 – Electrical Design Criteria.
- Each room (mechanical, electrical or plumbing) and other equipment type spaces such as elevator machine rooms, shall be provided with a minimum of (1) normal duplex receptacle and (1) emergency duplex receptacle.
- Locate electrical outlets to accommodate cleaning and vacuuming of the space.
- Lighting shall include at least (1) emergency fixture. Larger rooms shall include a minimum of (2) emergency fixtures.

- Strip fluorescent 4 feet long with 2-T5 lamps shall be designed in these areas for an average 20 foot-candle illumination. These fixtures shall be controlled by occupancy sensors along with a wall mounted override switch.

3.2.14.8.6 Communications

- Communication outlets (tel, data, AV) are not required in these spaces.

3.2.14.9 Acoustics

RESERVED

3.2.14.10 Security

RESERVED

3.2.15 RETAIL SUBTENANT SPACES

3.2.15.1 General

- In addition to the design guidelines, the Subtenant must comply with the Rules and Regulations for Subtenants set forth by Clarkson University.

3.2.15.2 Facility Planning and Design

- No toilet facilities for retail Subtenants are provided. All required toilet facilities for retail spaces are to be provided by the Subtenant.

3.2.15.3 Windows and Walls

- All proposed interior construction is to be reviewed and approved by the Sublandlord and/or its agent before construction may begin.

- Interior Signage

    - All signage must conform to the building standard guidelines. Subtenant signage must be limited to the space occupied by the Subtenant demising walls. Individual Subtenant signs are limited in size by the building provided sign box attached to the sign rail and must conform to the design guidelines for this location.

    - All signage, both interior and exterior, must be reviewed and approved by the Sublandlord and/or its agent before construction may begin.

3.2.15.4 Doors

RESERVED

3.2.15.5 Accessibility

RESERVED

3.2.15.6 Furniture and Equipment

- All equipment and furnishings are by Subtenant.

3.2.15.7 Materials and Finishes

- All architectural finishes and improvements are by Subtenant.

- Window coverings proposed by the Subtenant must be reviewed by the Sublandlord prior to installation.

3.2.15.8 Building Systems

3.2.15.8.1 General

3.2.15.8.1.1 Retail Space Utility Metering

- All retail space shall be sub-metered for the purpose of energy monitoring, tracking energy costs, billing, and shall be connected to the existing campus EMS system. The following utility meters, or Clarkson approved equivalent, shall be installed.

    - DEM 2000 for tracking electrical use

- Onicon ultrasonic flow meters for both chilled water and hot water for heating and cooling
- Onicon ultrasonic flow meter for domestic cold water
- Onicon gas meter (if applicable) for natural gas consumption

- All utility meters will be purchased and installed by the contractor, unless directed otherwise by Clarkson University. Pipe sizes and other information relating to the installation of the meter will be the responsibility of the mechanical engineer. The contractor will also install the conduit and communication wire from each utility meter back to the building automation panel. With Clarkson approval, the contractor can hire Siemens to set up the meters and connect them to the campus EMS system. If the University's Energy Management is used, the project will be charged back for all expenses associated with the labor, material, and use of manufacturer's representative to set up the meters and connect them to the EMS system. Whoever the contractor chooses to do the set up once the meters are installed will terminate the communication wires in the BAS panel.
- Once the utility meters are installed, the Onicon representative needs to set up the internal parameters of the meter to correctly pass the appropriate data to the EMS system.
- Graphics will be created for each meter and appropriate points assigned to the graphics. Each meter shall have a link to the facility they are installed in on the Facility front page graphic.

3.2.15.8.2 Plumbing

- Refer to Section 3.3.3 – Plumbing Systems.
- Domestic water service is provided to the building. Clarkson Facilities Management will provide subtenant with a T4002 Onicon cold water turbine meter with pulse output or other preapproved device acceptable to the Sublandlord.
- No hot water heater is supplied to the Subtenant space. An electric or gas-fired hot water heater is to be provided by the Subtenant at Subtenant cost.
- A sanitary waste line is located within the Subtenant shell space for connection by the Subtenant.
- A grease waste line is located within the Subtenant shell space below the concrete slab for connection by the Subtenant.
- Natural Gas service is provided to the building. Subtenant will be provided an Onicon Inc., F-5100 Series Thermal Mass Flow Meter or other device approved by Facilities Management.

3.2.15.8.3 Heating, Ventilating and Air Conditioning

- Refer to Section 3.3.1 – HVAC Systems.
- Temporary heating is provided within the shell of the space.
- Engineering, ductwork and other mechanical equipment are to be provided by Subtenant at Subtenant cost.

3.2.15.8.4 Electrical

- Refer to Section 3.3.2 – Electrical Design Criteria.
- Temporary lighting is provided within the shell of the space.
- Electrical service for Subtenant spaces is provided via a retail service trough located within the main electrical room. A disconnect at the retail trough is to be provided by the Subtenant at Subtenant cost. Subtenant will be provided a Siemens, Digital Energy Monitor, Electrical Series 2000 submeter or other Facilities Management approved device.

3.2.15.8.5 Communications

3.2.15.9 Acoustics

RESERVED

3.2.15.10 Security

RESERVED

3.6 ACCESSIBILITY STANDARDS

3.6.1 BARRIER FREE DESIGN

3.6.1.1 General

References:

- NYS Code, Chapter 11
- Rehabilitation Act of 1973, Section 504, and supporting Regulations
- Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way, July 26, 2011, US Access Board: http://www.access-board.gov/prowac/nprm.htm
- 2010 ADA Standards for Accessible Design: http://www.ada.gov/regs2010/2010ADAStandards/2010ADAstandards.htm

The following section includes guidelines for accessibility throughout all Clarkson campuses.

- New construction and renovations shall be in compliance with the current version of the Design Manual. In addition to the referenced standards within the Design Manual, compliance is required with the following codes, regulations and standards listed above. In addition, any standard in 3.5.1 of the Design Manual that is more stringent (i.e., more favorable to persons with a disability) than a mandate in the code shall be followed.
- Facilities must be accessible at the completion of construction. Adaptable facilities do not meet the Clarkson's requirements for accessibility unless they are proven to the Clarkson Office of Equity and Diversity Services to be made immediately accessible on demand.
- Accessibility must be integrated into the design of new and renovated facilities, rather than applied as an afterthought. Where possible, accessibility features should be architecturally inconspicuous. For example, rather than providing stairs at the main entrance and a ramp at a secondary entrance, the main entrance should be fully accessible.
- For accessibility guidelines related to specific space types (classrooms, toilet rooms, etc.), refer to Sections 3.2.1 through 3.2.15 in the Design Manual.

3.6.1.2 Circulation

3.6.1.2.1 Walkways

Pedestrian networks throughout the campus must be capable of conveying persons of all ability levels between desired destinations. While every segment of every path need not be accessible, each corridor must provide a continuously accessible route. All accessible routes must meet ADA standards. A map of accessible routes on the Hill Campus can be obtained from the university.

The guidelines in this section must be followed in the design of accessible pedestrian pathways:

- A maximum 2% cross slope shall be designed on all walkways. All walkway designs must include sufficient spot elevations to ensure positive drainage away from walkways, paths and curb ramps.
- A chain barrier is required where any walkway ends at a roadway where a crosswalk is not provided. Chain barriers may be in combination with railings and should guide pedestrians to a safe crossing area of that roadway.
- Provide edge protection on accessible paths when downward slope of adjacent grade exceeds 4:1. Clarkson will review on a case-by-case basis.
- Path barriers must be 42” high.

3.6.1.2.2 Stairs

- Contrasted nosing is required for stairs.
- All stairs shall have handrails on both sides.
- The Architect is responsible for designing accessible connections between new and existing buildings; stairs should be avoided when possible.
- Steps with a single riser are prohibited.

3.6.1.2.3 Ramps

- Exterior walkways shall not have a slope greater than 1:20 in the direction of travel. If this is not possible due to site topography, a ramp may be provided.
- Use ramps only when necessary.

3.6.1.2.4 Crosswalks

- Locate curb cuts at the end of each curb return, rather than in the middle of the return.
- Diagonal curb cuts at intersections are prohibited.
- Curb cuts shall be painted red and shall have detectable warnings covering the lower 2’-0” of the ramp measuring from the street, extending the entire width of the transition. Detectable warning strips shall be perpendicular to the path of travel.
- If a curb cut is present on one side of the street, there shall be a responding curb cut on the opposite side of the street.
- Where feasible, orthogonal pedestrian crossings are preferred.
- Alternate style for curbless transitions/areas that are not crosswalks.

3.6.1.2.5 Parking

- Provide required accessible parking within 250’ of the primary entrance. The number of accessible parking spaces to be provided for various facility types is listed below:

- Residential Facilities
- Assembly Building
- Academic and Office Buildings

- With regard to special events, the following requirements apply:
  - Provide signage to designate additional ADA parking (beyond the required number of reserved ADA spaces) when it is needed for special events.
  - Need to provide for cross slope and stall width. This will be clarified by the university during the initial design phase.

3.6.1.3 Doors and Hardware

- All lever hardware shall have an end return.
- Power operated doors shall be hardwired. Include the location and dimensions of activators (push plates) and stub outs for power operated doors on the architectural drawings. Mount activators 36” above the grade or floor and a minimum of 48” from any portion of the door in the open position. The push plate shall be a minimum of 4-1/2” diameter and located within an appropriate proximity to the door (as approved by Clarkson).
- Where vestibules are provided, the power operated door must activate the doors on both sides of the vestibule. A push plate shall also be located inside the vestibule.
- Provide at least one power operated door per building at the primary entrance. If the entrance closest to accessible parking is not the primary entrance, provide an additional power operated door at that entrance.
- Provide one power operated entrance along any ADA path located near a building. Need to address the vestibule air break to accommodate those that need to be accessible.
- Provide a power operator or magnetic hold open on fire doors heavier than five pounds that are on the accessible path of travel.

3.3 BUILDING SYSTEMS

3.3.1 HVAC SYSTEMS

3.3.1.1 Overview

The HVAC Design Standards described herein define the minimum design requirements and procedures that the consultant shall adhere to. The HVAC design standards are organized as follows:

- Design Guidelines and Standards
- System Selection Analysis
- Design Criteria
- Commissioning

3.3.1.2 Design Guidelines

Compliance with state and local codes is mandatory by law. It is the consultant's responsibility to provide a design that is in full compliance with the latest applicable codes and the local authority having jurisdiction (AHJ). The design guidelines included herein are intended to supplement all code and AHJ requirements. Where applicable code and the referenced design guidelines are in conflict, the consultant shall submit a written explanation describing the differences between the applicable codes and the referenced guidelines to Clarkson for review. The Design Guidelines Section is intended to provide guidelines which Clarkson recognizes and accepts to be applicable to all projects. The Standards and Guidelines listed herein apply to all projects.

Published Standards and Guidelines recognized by Clarkson to be applicable are listed below.

- American Institute of Architects
  - Guideline for the Design and Construction of Healthcare Facilities - Latest Edition
- ASHRAE Handbooks (All) - Latest Editions
- ASHRAE Standards - Latest Editions
  - Standard 15 - Safety Standard for Refrigeration Systems
  - Standard 55 - Thermal Environmental Conditions for Human Occupancy
  - Std. 62.1 - Ventilation for Acceptable Indoor Air Quality
  - Std. 62.2 - Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
  - Std. 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings
  - Std. 90.2 - Energy Efficient Design of Low-Rise Residential Buildings
  - Std. 154 - Ventilation for Commercial Cooling Operations
  - Std. 169 - Weather Data for Building Design Standards

  - Std. 170 - Ventilation for Healthcare Facilities
  - Std. 183 - Peak Cooling and Heating Load Calculations in Buildings Except Low-Rise Residential Buildings
  - Std. 189.1 - Standard for the Design of High-Performance, Green Buildings Except Low-Rise Residential Buildings
- ASHRAE Guidelines - Latest Editions
  - Gdl. 0 - The Commissioning Process
  - Gdl. 13 - Specifying Direct Digital Control Systems
- American National Standards Institute - Latest Editions
  - ANSI/AIHA Z9.5 - Laboratory Ventilation Standard
- National Fire Protection Association (Latest Editions)
  - NFPA 45: Standard on Fire Protection for Laboratories Using Chemical
  - NFPA 90A: Standard for the Installation of Air Conditioning and Ventilating Systems
  - NFPA 90B: Standard for the Installation of Warm Air Heating and Air Conditioning Sytems
- SMACNA (Latest Editions)
  - HVAC Duct Construction Standards - Metal and Flexible
  - Rectangular Industrial Duct Construction Standards
  - Round Industrial Duct Construction Standards

3.3.1.3 System Selection Analysis

3.3.1.3.1 Overview

- The consultant will be responsible for an evaluation of applicable HVAC system options. The evaluation shall be based on both a qualitative and quantitative analysis. A minimum of three (3) systems shall be analyzed and the consultant shall provide a written summary of the analysis results including recommendations.

3.3.1.3.2 Qualitative Analysis

- The qualitative analysis shall be a comparison of each applicable HVAC system option based on qualitative evaluation criteria. The evaluation criteria shall include, but shall not be limited to the following:
  - Constructability: Impact on construction schedule, ongoing facilities operations, and overall project phasing requirements shall be considered.
  - Flexibility: The ability of systems to be modified to serve likely future changes in space usage without rework of central systems or main distribution.

- Maintainability: The ease at which system components can be accessed and serviced. As an example, utilization of above ceiling hydronic heat pumps would not rank high in this category because of the multiple compressors, fans, filters, and condensate drain pans located above the ceiling which access for regular maintenance.
- Comfort Control: The ability of the system to satisfy environmental requirements including temperature, humidity and space noise criteria.

3.3.1.3.3 Quantitative Analysis

- The life cycle costs for each HVAC system option shall be determined and used as the basis of quantitative comparison. Life cycle costs shall include the following system costs:
  - First Cost
  - Annual Energy Cost
  - Annual Maintenance Cost
  - Life Cycle Replacement Costs
- All life cycle costs shall be performed in accordance with NIST handbook 135 - "Life Cycle Costing Manual for Energy Management Program."
- First costs and replacement costs shall be determined using R.S. Means Cost Works (latest edition) or third party cost estimate.
- Annual energy costs shall be determined by one of the following energy modeling methods:
  - Modified Bin-Hair Method using preliminary HVAC loads
  - Software simulation using an approved load and energy simulation program
- Utility costs shall be based on the applicable utility rates and shall include all utility charges. Where records of historical energy costs and usage are maintained by the campus or facility; average and all inclusive rates may be used when justified by the historical data.
- Annual maintenance cost shall be estimated using the latest edition of ASHRAE Handbook, HVAC Applications, Chapter 36.

3.3.1.4 Design Criteria

3.3.1.4.1 Overview

- Design criteria described herein are mandatory. The design criteria address minimum system design and performance requirements.

3.3.1.4.1.1 Design Conditions

Outdoor Design Conditions

Location	Winter	Summer
Downtown	-15°F DB	91°F DB/77°F WB
Hill	-15°F DB	91°F DB/77°F WB
Beacon Institute	5°F DB	93°F DB/77°F WB
Trudeau Institute	-15°F DB	93°F DB/77°F WB
Pier 32	10°F DB	95°F DB/77°F WB

For evaporative cooling, use 78°F WB.

Indoor Design Conditions

Space Type	Winter	Summer
Classrooms	70°F DB	76°F DB, 50% ORH
Offices	70°F DB	76°F DB, 50% ORH
Laboratories	70°F DB	76°F DB, 50% ORH
Assembly	70°F DB	76°F DB, 55% ORH
Commercial Type Kitchen	68°F DB	78°F DB
Residential	70°F DB	76°F DB, 50% ORH

For space types not listed above, indoor design conditions shall be as directed by Clarkson.

3.3.1.4.1.2 Sizing Criteria

Hydronic Piping Systems

Location	Maximum Velocity (FPS)	Maximum Friction Rate (FT WC/100FT)	Remarks
Below Grade	12	3.3	
Above Grade - Ultimate Spaces and Mechanical Rooms	12	3.3	
Above Grade - Above Ceilings and in Wall Chases	10	3.3	
Terminal and Coil Run-outs	10	3.3	

Ductwork

System		Building Location	Maximum Friction Rate (In.WC/100 FT)	Maximum Velocity (FPM)	Remarks
Type	Location				
VAV	Primary supply	Above Ceilings and In Wall Chases	0.25	1,500	
VAV	Primary supply	Shafts and Mechanical Rooms	0.25	1,800	
VAV	Secondary supply	All	0.08	1,200	Runouts to terminal boxes/valves less than 10' may e same size as terminal inlet.
`CVSZ	Supply	Above ceilings and In Wall Chases	0.08	1,200	
CVSZ	Supply	Shafts and Mechanical Rooms	0.10	1,400	
All	Return	Above ceilings and In Wall Chases	0.08	1,200	
All	Return	Shafts and Mechanical Rooms	0.10	1,400	
CVSZ	Exhaust	All	0.08	1,200	
VAV	Primary Exhaust	Above ceilings and In Wall Chases	0.25	1,500	
VAV	Primary Exhaust	Shafts and Mechanical Rooms	0.25	1,800	
VAV	Secondary Exhaust	All	0.10	1,200	

- The maximum friction rates and velocities listed above are maximum allowable and are based on the following general assumptions:
    - Typical classroom or office application with noise requirement no less than NC 35-40
    - Rectangular ductwork with aspect rations no greater than 4:1
    - Ductwork design provides adequate straight run between fittings and at fan connections to provide uniform velocity profiles and negligible system affect

- Piping design provides adequate straight run between fittings and at pump connection to provide uniform velocity profiles

- The consultant is responsible for the acoustic performance of all systems and shall be responsible for determining appropriate distribution system velocities based on the specific acoustical requirements of each space.

3.3.1.4.2 Heating Systems

- The primary heating source for the facility shall be determined as part of the System Selection Analysis.
  - Hot water generation using condensing type boilers.
  - Hot water generation using fire tube boilers.
  - Geothermal heat pump system
  - Air to air heat pumps will only be used after a life cost analysis has been performed.
  - Electric boilers are not acceptable. Use of electric heat for supplemental heat in hydronic heat pump systems is not acceptable.

3.3.1.4.3 Heating, Ventilating, and Air Conditioning (HVAC)

- Refer to the CPSM.
- All control transformers for thermostats, baseboards, or other individualized equipment will be located in nearby machine rooms unless expressly permitted by Clarkson University.
- All equipment shall be designed and installed with sufficient clearances to insure proper maintenance access to the equipment and its components. Equipment shall be provided with adequate clearances to allow ease of regular maintenance activities such as filter replacement, removal and replacement of strainers, draining equipment, filter changes, lubrication, belt replacement adjustment, testing, inspection, etc. Adequate clearances and provisions within the facility shall be provided to all replacement of major components such as heat exchanger tubes, coils, fans, compressor and motors without removal of other equipment or system components. It is the Design Team's responsibility to identify access space and service clearance requirements in the contract documents.
- Equipment such as VAVs, terminal air units, cabinet heaters, valves, etc. placed in ceilings, crawl spaces, or other limited access areas shall have sufficient access for periodic maintenance. Care will be taken not to place equipment where control or power panel access is restricted preventing maintenance with reasonable ease. All equipment, controls, and devices installed behind an inaccessible finished surface shall be provided with a suitable access door. It is the Design Team's responsibility to identify, in the contract documents, the minimum size of all access doors and ensure that access to those doors is not blocked by conduit, wire trays, ductwork, etc.
- During renovations new equipment, conduit, piping, ductwork, or other materials will not be installed where it impedes or hinders the regular maintenance of existing equipment and peripheries; junction boxes, controls, valves, piping, etc.

- All equipment will be labeled with the panel and breaker number from which it is supplied electrical power.

- Air handlers and other equipment requiring periodic cleaning or filling shall be provided with a domestic water hose bib in the same mechanical room, or within fifty feet if not located in a mechanical room.

- Equipment that may require periodic draining of hot or chilled water located above an occupied or otherwise sensitive space (i.e. data closet, electrical room) will have a permanent drain line installed to Clarkson's sewer system. Glycol or any other environmentally hazardous material will be drained to holding tanks.

- Specifications prepared by the engineer shall include requirements for the Contractor to maintain a marked up set of Contract Drawings ("Red-Lines") which indicate all changes in construction and installation due to field conditions, coordination between trade, concealed conditions or other deviations from the Contract Documents. The engineer shall incorporate all changes indicated in the Contractor's "Red-Lines" and produce the As-Built Drawings for the project incorporating all marked-up information. The engineer shall submit As-Built Drawings in the format and media defined in Chapter 4, Section 01 78 39 of Division 01.

- The engineer shall field verify HVAC system performance in existing buildings prior to completion of the schematic design phase of all renovation projects. Performance verification shall include the following:

Air Handling Units:

1. Air Flow: Supply, return, outside air, and relief.

2. Fans: RPM, brake HP, Volts, Amps.

3. Unit Pressure Map: Measure static pressure at unit discharge and across each unit component.

    - HVAC Risers: Measure total airflow and static pressure at all floor branch take-offs.

    - Floors and Spaces within the Area of Work: Measure airflow of all supply, return, and exhaust air devices.

    - Fans: Measure airflow, inlet static pressure, outlet static pressure, RPM, brake HP, Volts, Amps.

    - Measure airflow and pressure at all necessary locations in order to establish existing system performance.

- All HVAC performance measurements shall be recorded and submitted to Clarkson prior to completion of the schematic design. The report shall include a deficiency list, identifying all observed performance deficiencies. Performance measurements shall be performed by a qualified TAB Technician using instrumentation which has been calibrated within six months.

3.3.1.4.4 Cooling Systems

- Where building chilled water capacity and associated distribution is adequate to serving the cooling load of any renovations or additions, the chilled water system shall be utilized as the primary cooling

source. The consultant will not be responsible for evaluating the adequacy of the chilled water generation capacity or distribution for individual projects. Clarkson will be responsible for determining adequacy of chilled water generation and distribution based on cooling loads determined by the consultant.

- Where chilled water capacity and associated distribution is not of adequate capacity to serve the cooling load, the primary cooling source shall be determined as part of the System Selection Analysis.

3.3.1.4.5 Humidification Systems

- In general, Clarkson does not humidify its buildings for comfort. Humidification shall be provided to preserve materials such as wooden musical instruments, library collections, archives, artwork, etc. Humidification shall be provided for spaces and areas defined by Clarkson and its users as requiring winter humidity control.
- Where humidification is required, one of the following methods shall be employed:
    - Non-fired steam generator using high temperature hot water, medium temperature hot water or steam as primary heating medium.
    - Gas fired steam generator.
    - Gas fired packaged humidifier.
    - Electric steam generator.
    - Electric cartridge type humidifier.
- Electric type humidifiers (cartridge type) exceeding 75 pounds per hour (PPH) capacity or 30 amps shall not be allowed. Electric steam generators exceeding 500 PPH capacity or 200 amps shall not be allowed.

3.3.1.4.6 Dehumidification Systems

- Dehumidification equipment and controls shall be provided for spaces and areas defined by Clarkson and its users as requiring strict humidity control.

3.3.1.4.7 Airside Heat Recovery

- 100% exhaust air heat recovery shall be utilized with the following systems:
    - Laboratory general exhaust
    - Chilled Beam and DOAS system general exhaust
    - Air handling unit zones with 35% or greater exhaust/relief
- Heat recovery systems shall be in accordance with applicable codes and the AHJ.

3.3.1.4.8 Airside Economizer

- All air handling units shall be provided with economizer and/or enthalpy optimization controls. All air handling unit outdoor air intakes and outdoor air ductwork shall be sized for 100% outdoor air with a

velocity no greater than 1200 fpm and a friction rate no greater than 0.08 inches wc/100 feet. Design of systems for minimum outdoor air (i.e. no economizers) is not allowed unless specifically approved or directed by Clarkson in writing. The consultant shall submit a written variance request to Clarkson with justification for the variance request.

3.3.1.4.9 Expansion Compensation

- Avoid using expansion compensators on Hot Water Systems. Use expansion loops and z-bends to maintain acceptable piping stress levels. Where there is inadequate space for loops and z-bends, bellows type can be used if approved by Clarkson.
- Do not use bellows type expansion joints on High Temperature Hot Water piping systems. Flanged, slip type expansion joints are preferred for High Temperature Hot Water piping systems.

3.3.1.4.10 General-Duty Valves for HVAC Piping

- Include sufficient zone isolation/shut off valves in heated water, chilled water, steam and other service piping to allow maintenance of equipment and replacement of terminal equipment without shutting down entire building or floor.
- Install valves above the floor on all piping that penetrate the floor from below.
- Install valves on all branch piping take-offs.
- Install valves on all lines at locations such that each floor can be isolated without affecting service to other floors. Example: Install valves at pipe riser horizontal branch take-offs at each floor.
- Chain-wheel operators for valves above 7’-0” shall be located in a place where they will not interfere with normal access and shall be restrained at wall or column if necessary.
- OS&Y gate valves shall be used on all piping 2-1/2” and above, unless Clarkson provides written direction/acceptance of another valve for a specific application.
- Drain valves shall be installed in accessible locations at all low points in the piping system to permit drainage and servicing.

3.3.1.4.11 Fuel Burning Equipment

- The Design Team shall be responsible for preparation and follow-up correspondence for all permitting required for fuel burning equipment.

3.3.1.4.12 Hangars and Supports for HVAC, Piping, and Equipment

- The design shall provide foundations, supports, and means of attachment to the structure for all equipment, fixtures, and piping. Hangers shall be spaced sufficiently to prevent sagging and allow for additional stresses.
- Use of the appropriate beam clamps, brackets, and expansion shields for supporting and securing equipment, fixtures, and piping.

- Wall clamps and brackets used for support of piping and equipment from concrete or solid masonry shall be secured with self-drilling concrete fasteners. Clamps and brackets on hollow masonry block construction shall be supported with toggle bolts.

- Horizontal, parallel, and adjacent piping shall be supported by gang hangers with appropriately sized hanger rods (3/8" minimum) and clamps to match the pipe.

- Hangers supporting insulated piping will be sized to fit over the insulation.

- Supports and clamps in contact with copper pipe shall be copper plated.

- Hanger spacing for copper pipe shall be as follows:

Pipe Size	Hanger Spacing
1"	6'-0"
1-1/2"	8'-0"
2"	9'-0"
3"	10'-0"
4"	12'-0"

- Seismic requirements must be considered as required.

3.3.1.4.13 Facility Fuel Piping

- Fuel oil systems shall be designed for No. 2 fuel oil and diesel fuel.

- Gas fuel systems shall be natural gas, connected to the local or campus natural gas utility, unless otherwise approved by Clarkson in writing. Refer to Section 3.3.3 " Plumbing Systems" for additional requirements.

3.3.1.4.14 HVAC Piping and Pumps

- Definitions:

- Hot water - Hot Water Systems operating with a maximum temperature below 250°F and a maximum system pressure of 160 psi.

- Dual Temperature Water - A system which utilizes one piping system to distribute heating and cooling water. These systems operate within the pressure and temperature limits of Low Temperature Hot Water systems. The typical winter design supply temperatures are 100°F to 180°F and the typical summer supply water temperatures are 40°F to 450°F.

- Chilled Water - A system which distributes cold water. Typical design supply temperatures are 40°F to 58°F depending on the application. Antifreeze solution may be used in lieu of water to prevent freezing.

- All new hydronic piping systems shall be specified to be cleaned and flushed by Clarkson's term water treatment contractor.

- All Hot Water and Chill Water piping will have valves at all low points to enable complete draining of the system.

- All Hot Water and Chill Water will be vented at highpoints and any downturn in the system, vents will be installed with ball valves.

- The use of dielectric unions between dissimilar piping materials is prohibited without prior Clarkson approval. Bridging materials, such as brass between copper and black iron, are to be used in place of the dielectric union.

3.3.1.4.15 Hydronic Piping and Pumps

- Encase all key crocks for chilled water building isolation in a 1′ x 1′ x 6″ concrete pad.

- Do not run piping above telecommunication racks.

- Do not run piping or locate pumps above electrical panels, control panels, or other electrical components or systems. If doing so is unavoidable then provide protection, waterproof shields, roofing, etc.

- All Hydronic Piping will have valves at all low points to enable complete draining of the system.

- All Hydronic Piping will be vented at highpoints and any downturn in the system, vents will be installed with ball valves.

3.3.1.4.16 Hydronic Piping

- Below Grade Piping:

- Clarkson Chilled Water systems are designed at 42°F with a 14°F delta.

    - CHW distribution system (campus loop, Hill Campus):

        - Provide a 2-way flow control valve on the building main, located in the main mechanical room.

        - All components, including piping, valves, flanges and fittings must be manufactured in either Canada or the United States. The system must be designed to minimize system low points to the maximum extent possible. Any deviations from the Clarkson University Utility Master Plan Update (current edition) in piping system sizes or design must be approved in writing by Clarkson Facilities.

        - Valves: At each branch line or building takeoff provide a three valve combination on both supply and return lines which allow back feed capability. Valves shall be OS&Y type gate valves with flanged connections. Triple duty valves are not acceptable. Provide two way flow control valves on the building main, located in the main mechanical room of the building(s) being served.

        - Drains and Vents: At CHW system low points, provide drains (on both supply and return lines) to discharge to the sanitary sewer. Drains to be 1" pipe size for 6" CHW lines; 2" pipe size for lines above 6". At CHW system high points, provide 3/4" vents. All drains and vents to be valved with a ball valve with valve box. Valve boxes located in other than paved areas shall be encased in a 20"x 20" x 6" thick concrete pad.

- Insulation. Use manufacturer supplied pre-insulated pipe kit for piping joints and fittings. All raw ends shall be sealed.
- Dual temperature systems are prohibited except with express permission from Clarkson.
- Clarkson prefers diaphragm-type compression tanks.
- Flexible connection shall be installed at pumps only when directed by Clarkson or when acoustic consultant recommendations are accepted by Clarkson.
- Do not use butterfly valves for throttling hydronic systems.

3.3.1.4.17 HVAC Pumps

- Consult with Clarkson about pump selection philosophy. Limit speed to 1750 RPM. Any pumps handling.
- For small flows and low heads, in-line circulators may be used, this application is limited to coil freeze protection pumps, heating zone pumps. Typical limits are 80 GPM at 30 feet TDH.
- Utilize vertical in-line pumps or close coupled end suction pumps for smaller capacity primary, secondary, tertiary pumping systems. Typical limits are 80 GPM at 70 feet TDH.
- Utilize base mounted separately-coupled end suction pumps for medium capacity primary, secondary, and tertiary pumping systems. Typical limits are 900 GPM at 120 feet.
- Utilize double suction horizontal spit case pumps for larger capacity primary, secondary, and tertiary pumping systems.
- Vertical pumps may be used in lieu of base mounted separately-coupled end suction pumps where space is limited. Clarkson must approve use of vertical pumps.
- Vertical split case pumps may be used in lieu of horizontal split case pumps where space is limited. Clarkson must approve use of vertical split case pumps.
- Base-mounted, separately coupled double-suction, horizontal split-case type pumps shall be used for connections 4" and larger. Only consider vertical pumps where space is at a premium and with the approval of Clarkson.
- Selection should be made for high efficiency. Consideration of life cycle cost study of variable speed pumping should be made.
- Use mechanical seals when choice is available. Use cyclone separator type seal waste cleaning device on all pumps that can be equipped with it (generally on all double suction pumps).
- Piping design provides adequate straight run between fittings and at pump connections to provide uniform velocity profiles.
- Do not use vibration isolators or flexible connectors on pumps located on slabs on grade. Provide vibration isolation, flexible pipe connectors, and inertia base for all pumps located above occupied spaces.

- Pump suction diffuser shall be installed at the inlet side of the pump and shall have flanged outlet with grooved inlet connections. Ductile iron body with removable stainless steel frame and perforated sheet diffuser with 5/32″ or 3/16″ diameter holes, 20 mesh stainless steel start-up pre-filter and base support boss. Victaulic Series 731 and W731.

3.3.1.4.18 Steam and Condensate Piping

- Steam system shall be designed for low pressure (15 psig or less) unless otherwise approved by the university. All kitchen equipment (dishwasher, steam tables, etc.) should be operated at less than this pressure. Autoclaves, sterilizers and cage washers should be capable of operating at less than 15 psig steam. If this is not possible, the use of an electric steam generator that can be separately metered (electrically) shall be considered.
- Steam for user-required humidification shall be generated by unitary humidifiers.
- Use bimetallic element traps only with Clarkson approval.
- Hot Water for coil and terminal is preferred heating medium. Do not utilize steam heating coils or terminals unless directed in writing by Clarkson
- Adjust class of safety valves for pressure and temperature used in each system.
- Sizing of reducing valves shall be clearly shown on the Drawings for all equipment.
- Pipe discharge from safety valves shall be terminated at a safe height and location to prevent personnel harm.

3.3.1.4.19 HVAC Fans

3.3.1.4.19.1 Air Handling Unit Fans

- Air foil type or backward inclined fan blades shall be used for all centrifugal fans. Use of forward curved fans is not allowed without written approval from Clarkson.
- Fan bearing shall be grease lubricated with extended lube lines.
- Fans shall be selected based on greatest efficiency.
- Housed centrifugal fans may be belt drive however direct drive fans are preferred where applicable. Unhoused centrifugal fans (plenum fans, plug fans) shall be direct drive. Where unhoused fans are utilized use of multiple fans in parallel duty is encouraged.

3.3.1.4.19.2 In-Line Fans

- In-line fans for return air duty shall be vane axial type. Tube axial fans for air handling systems which require fan tracking is not allowed because current fan inlet airflow measurement technology cannot be applied to tube axial fans.
- Provide thrust restraints on all axial inline fans to prevent fan movement and excessive compression/tension in fan flex connector.

3.3.1.4.19.3 Exhaust/Relief Fans

- Exhaust/relief fans shall be located at terminus of system such that there is no positively pressurized exhaust ductwork within the building envelope.
- Direct drive fans are to be used for exhaust fans unless otherwise approved by Clarkson.
- Direct drive fans shall be provided with manually operated factory speed dial to be used for balancing in the field or be manufactured to the specified requirements.
- Provide low leakage type two-position control dampers where exhaust duct penetrates the building envelope and interlock with the fan operation to close when the fan is de-energized.
- Exhaust fans shall be located on the roof, or in an adequately ventilated fan loft. Exhaust motors shall be located to allow access for maintenance.

3.3.1.4.19.4 Smoke Evacuation Fans: Shall be listed for smoke evacuation duty.

3.3.1.4.19.5 Fume Hood Exhaust Fans:

- Direct drive fans are to be used for fume hood exhaust unless otherwise approved by Clarkson.
- Utilize either single width/single inlet housed centrifugal or strobic type.
- The exhaust stack termination height shall be based on the required effective stack height determined by an air dispersion model.
- Fans and duct systems for hoods are to be sized and designed to provide an average hood face velocity of 80-100 LFM, as measured at the face, with the sash wide open. Deviations in this value shall not be greater than 20% at any point across the hood face. To assure this standard, the designer must work closely with the duct installer to determine the effects of duct routing on motor sizing.
- Do not use dampers on laboratory fume hood fans unless specifically approved by Clarkson.
- Utilize direct drive fans for applications requiring variable fan speed control. Variable frequency drives shall not be the primary means for initial fan balancing.
- Drains shall be provided in fan scrolls, especially when the fan may receive storm water in its ordinary course of duty. This applies to most of the fume hood exhaust fans that use Clarkson's preferred vertical discharge stackhead.

3.3.1.4.20 Air Terminal Units

3.3.1.4.20.1 Location

- All terminal units shall be located and oriented in accessible locations for routine and emergency maintenance and meet minimum manufacturer service clearances.
- Terminal units shall be placed in typical unoccupied areas (i.e. corridors) in lieu of directly overhead occupied areas where possible.
- Terminal units shall be located so that they can be accessed from an 8 foot ladder for maintenance.

3.3.1.4.20.2 Application

- Fan powered parallel supply air terminal units shall be used to serve perimeter zones and areas with exterior walls.
- Single duct supply air terminal units shall be used for all other spaces.
- Provide reheat coils on all units serving perimeter zones and areas with exterior walls and/or roofs. All reheat coils must be sized to provide reheat with 100 degree water.
- Provide reheat coils on all units serving conference rooms and other high occupancy spaces.

3.3.1.4.21 Air Cleaning Devices

3.3.1.4.21.1 General

- Every supply air system shall be provided with a filter bank. Every air terminal unit shall have filters if it is fan powered.
- Filters shall be pleated type and shall be designed for a maximum 400 feet per minute face velocity unless directed otherwise by Clarkson.
- Filters shall meet the requirements of International Mechanical Code, latest edition to provide suitable indoor air quality.

3.3.1.4.21.2 Filter Efficiency Requirements

- Supply air system filters shall be provided in accordance with ASHRAE 52.76 to meet these minimum efficiencies:
    1. Classrooms, lecture halls, and auditoriums: 60% (MERV 11)
    2. General Office Space: 60% (MERV11)
    3. Laboratories: 85% (MERV 13)
    4. Clean rooms: Based on room classification
    5. Healthcare: Based on the latest edition of the AIA Guidelines for the Design and Construction of Healthcare Facilities
- Provide higher efficiencies when directed by Clarkson.
- All other supply air systems that require specialized air filtration shall meet criteria given by the university.
- All supply air systems shall have 35% efficient (MERV 7) pre -filters.

3.3.1.4.22 Breechings, Chimneys, and Stacks

- Terminations of chimneys and stacks shall be "open" (without weathercap) so that an upward velocity is possible, without sideward flue gas movement. Without exception they will be designed so that

velocity of gases will clear any surrounding roofs, building and especially outside air openings. A velocity control device may be necessary at the outlet of the stack.

- Clarkson may require an analysis of effluent flume shape and dispersion by a specialist in air wake analysis. Specialist shall be approved by Clarkson. Such analysis is typical for all discharge stacks such as laboratory fume hood or other laboratory discharges.

3.3.1.4.23 Heating Boilers

- New boilers will be high efficiency (+90%) condensing Hot Water Boilers. Shell and Tube boilers may be used at sizes above 50 horsepower.
- Hot Water boilers will be capable of modulating HW output temperatures from 80°F to 200°F.
- New boilers will use factory supplied efficiency programming and features (outdoor reset with outdoor air sensor, lead/lag, and other efficiency settings) where applicable. BMS systems will be designed to provide Start/Stop signal and monitor boiler operation; status, HW supply temp, HW return temp, HW flow status, etc. as determined by Clarkson.
- Steam Boilers are only allowed with permission from Clarkson and shall operate at pressures 15 psig or less.
- Do not use electric boilers.
- Develop water treatment system specification and design in collaboration with Clarkson.

3.3.1.4.24 Heating Boiler Feedwater Equipment

- Consult Clarkson's engineers concerning feedwater equipment.

3.3.1.4.25 Heat Exchangers for HVAC

- Steam to HW or HW to HW exchangers will be sized to produce up to200°F with steam or 200°F water.

3.3.1.4.26 Packaged Cooling Towers

- Induced draft cooling towers shall be utilized for process and building cooling loads. Type of cooling tower (counter-flow verses cross-flow) shall be evaluated by the engineer based on the following:
    - Noise
    - Building Esthetics (Height)
    - Maintainability
    - Efficiency
- Use of forced draft cooling towers is not permitted without review approval by Clarkson.
- Winterizing requirements shall be discussed with Clarkson. The appropriate design shall be reviewed prior to such application.

- Fan motors shall be variable speed, controlled and sequenced to obtain the condenser water temperatures needed.
- Provide automatic control valves on cooling tower inlet and outlet where multiple cooling towers are manifolded to common supply and return piping.
- Provide equalizer pipe connecting all cooling tower basins to maintain equal basin water levels under all potential operating conditions. Equalizer pipe shall be appropriately sized to maintain equal basin levels under all operating conditions.

3.3.1.4.27 Air Handling Units

- Utilize indoor modular air handling units wherever possible. All units hall be double wall construction.
- Modular air handling units shall not exceed 35,000 CFM capacity.
- Air tunnels and fans in custom air handling units shall not exceed 35,000 CFM capacity.
- All fans shall be non-overloading type (backward inclined or airfoil blades).
- Air handling units located on the roof shall be provided with heated pipe enclosures/vestibules which include adequate space for control valves. Locating control valves above the ceiling in occupied spaces is prohibited unless approved by Clarkson.
- Fan wall systems shall be considered. Where applied on variable volume systems, a minimum of two variable frequency drives shall be provided for the fan wall.
- All air handlers feeding common ductwork need isolation dampers on supply and return ducts at the unit.
- Provide return air fans whenever return static pressure at peak design air flow will exceed 0.50 inches water column. Return fans are required for all units utilizing air side economizer/enthalpy optimization controls. Return fans may be integral or external to air handling units.
- Relief Fan configurations are not acceptable. Return Fans shall be utilized in all applications except where approved in writing by Clarkson.
- Provide fan inlet airflow measuring stations on centrifugal and vaneaxial fans. Where tubeaxial return fans, other in-line return fans are utilized; provide return air flow measuring stations in the ductwork. The engineer shall design the ductwork to allow for the manufacturers recommended inlet and outlet straight run at all airflow measuring stations.
- Provide outdoor air flow measuring stations, specifically design for outdoor air flow measurement.
- Do not use electric heat without specific permission of Clarkson.
- Properly locate face and bypass dampers on 100% outside air systems so that no coil will receive a low temperature blast of cold air when bypassed, or provide a properly sized pumped water protective system.
- All hot water pre-heat coils shall be provided with freeze protection pumps unless Clarkson allows the pumps to be deleted.

- Humidifiers should be used only with Clarkson approval. Use canister type steam generator with proper distributing grid if approval is obtained.

- Condensation drain pans shall be stainless steel. Secondary drain pans are required in suspended applications and will require either overflow safety switch or be piped to floor drain with appropriate signage. Drain piping to include cleanout plug.

- All drains shall be properly trapped. Units shall be elevated to allow for proper trap height.

- Unit utilizing steam coils shall be elevated to allow proper steam trap elevation.

- Air Handling Units will be placed so access doors can swing fully open. Access doors on negative pressure casings shall open outward. Access doors on positive pressure casings shall open outward, unless otherwise specified by Clarkson, and be supplied with a safety chain to prevent injury.

- All access doors and panels will be clearly labeled with both mechanical (filters, belts, electrical) and hazard (arc-flash, injury) information.

- Provide differential pressure indicator (manometer) for all serviceable filters and locate the indicator where it can be readily observed. Mark on the indicator the “clean” and “replace filter” points.

- Constant volume AHU's should utilize a VFD for energy cost savings. Since most of the AHU's for this application are over sized, instead of using a pulley size reduction to achieve the required CFM a VFD should be used. A 20% turn down results in a 50% reduction in rated H.P. size of the motor.

- Cooling coils used in constant volume systems shall be sized for no more than 450 feet per minute face velocity. Cooling coils used in variable volume systems shall be sized for no more than 500 feet per minute face velocity.

- Heating coils shall be sized for no more than 650 feet per minute face velocity.

- The maximum airflow for an individual coil shall be 17,500 CFM.

- All coils shall be completely drainable at each row. Drainage of coil shall be accomplished by opening vent valves and opening the drain valve with hose connection; no other means shall be required. Copper tubes with aluminum fins are satisfactory. CHW temperature delta should be 14°F with an entering temperature of 42°F. For 100% outside air applications, a higher delta T may be used with Clarkson permission.

3.3.1.4.28 Outdoor Intake Locations

- The lowest elevation of an outdoor air intake shall be no less 2 floor levels above grade. Outdoor air intakes shall not be provided via areaways unless approved by Clarkson. As a general rule, outdoor air intakes shall be located no less than 25’-0” from building exhaust outlets and plumbing vents. Air dispersion studies shall be performed where there is a potential for entrainment of hazardous exhaust/fumes/emissions into the building outside air intake(s). The results of the air dispersion study will determine acceptable outdoor air intake locations, exhaust locations, vent locations and/or additional filtration requirements to eliminate both gaseous and particulate contaminants from entering the building outside air intake(s).

3.3.1.4.29 Mailrooms

- Refer to Section 3.2.8 – Support Facilities for mailroom ventilation system requirements.

3.3.1.4.30 Laboratory Ventilation Systems

- Refer to Section 3.2.3 – Laboratory Facilities for laboratory ventilation system requirements.
- For fume hood duct design and construction, see Chapter 4, Section 11 53 00.

3.3.1.4.31 Type 1 Kitchen Hoods

- Refer to Section 3.2.7 – General Use Facilities for kitchen ventilation system requirements.

3.3.1.5 Miscellaneous

3.3.1.5.1 Renovations

- Renovations performed in an area that do not include modifications to the HVAC system will be analyzed to determine if such modifications are required to meet the new requirements of the space.
- When renovations (including adding separate areas to adjacent buildings) require the addition of equipment, Design Teams, Contractors, and Subcontractors will consult with Clarkson University Facilities Department to determine equipment type, name or number, and other designators to comply with the University's naming conventions.

3.3.1.5.2 Equipment Manuals

- Copies of all equipment manuals, both user and maintenance, will be left in a document storage compartment (provided by Clarkson) at the piece of equipment or in the associated machine room.
- Copies of all equipment literature will be left with both the project manager and the Clarkson University Engineering Department.
- Copies of the Mechanical Maintenance drawings will be left with equipment manuals in equipment rooms.

3.3.1.5.5 Results

- All results from analysis, testing, and studies of the HVAC components, systems, or other related items shall be submitted to the Clarkson University Engineering Department. These include water testing, balancing result, system analysis for renovations, air dispersion studies, or any other analysis, test, or study directly or indirectly related to the project.

3.3.1.5.10 Brand Reference

- For specific equipment brands preferred by Clarkson University reference **Division 23 - Heating Ventilating and Air Conditioning- 23 00 10** of Construction Products and Activities. These preferences supersede any brands which may be mentioned later in the document.

3.3.2 ELECTRICAL DESIGN CRITERIA

3.3.2.1 General Design Criteria

3.3.2.1.1 Installation Design Requirements

- In atriums or other multi-story open areas, accessibility and maintenance shall be a consideration when mounting lights.
- Ensure maintenance and accessibility provisions for servicing and replacement of equipment.
- Provide adequate working area around equipment for service.
- There must be permanent access to the roof if any equipment needing service is mounted on the roof as well as appropriate fall protection when required.
- Access doors to crawl spaces shall be located as close as possible to electrical equipment under floor.
- Renovations involving relocation of equipment further from the disconnect will require new feeder lines, splices are not allowed without the express permission of Clarkson's Facilities Representative.
- All control transformers for thermostats, baseboards, or other individualized equipment will be located in nearby machine rooms unless expressly permitted by Clarkson University.
- As-built for any and all control systems will be provided will with closeout documents.
- When renovations (including adding separate areas to adjacent buildings) require the addition of equipment, Design Teams, Contractors, and Subcontractors will consult with Clarkson University Facilities Department to determine equipment type, name or number, and other designators to comply with the University's naming conventions.

3.3.2.1.2 Demolition Requirements

- In demolition associated with renovations all wire shall be removed back to the panelboard and all accessible conduits shall be removed.

3.3.2.1.3 Evaluation or Commissioning

- List of items or systems requiring testing, evaluation, verification, or commissioning:
  - Commissioning report: The entire emergency systems, UPS systems and lighting control systems shall fall under the scope of the Commissioning process and be subject to the protocols listed in the independent Commissioning guidelines.
  - Operations and Maintenance Manuals: shall be provided as required by the independent Close-out Guidelines.

3.3.2.2 Power Distribution System

3.3.2.2.1 Power System Overview

3.3.2.2.1.1 Utilization Voltages

Primary Voltages:

	13.27kV, 3 Phase, 3 Wire

Secondary Voltages:

Normal	480Y/277V, 3 Phase, 4 Wire
	208Y/120V, 3 Phase, 4 Wire
Emergency/Standby	480Y/277V, 3 Phase, 4 Wire
	208Y/120V, 3 Phase, 4 Wire

Branch Circuits:

General Use Receptacles	120V
Special Purpose Receptacles	208V, 1 phase and 208V, 3 phase
Fluorescent Lighting	277V
Special Purpose Incandescent Lighting	120V
Motors 1/3 HP and smaller	120V
Motors 1/2 HP and larger	208V, 1 phase, 208V 3phase, and 480V, 3 phase

3.3.2.2.1.2 Primary Service

- Information related to available fault current and feeder information is provided per project by Facilities Management Services.
- Required information from the project team includes projected loads as well as the location of service entrance equipment.
- Information related to the specific feeder(s) routings will be specified by Clarkson Facilities Management Services.

3.3.2.2.1.3 Electrical Metering

- Provide digital electric meters for all new buildings and existing renovations as directed.
- Electric Metering will be integrated into the active Building Management System.
- Meter Location: Meters shall be located on the substation mains and/or the main service to each facility and/or the distribution main. The addition of meters on branch distribution equipment will be determined on a project basis by Facilities Management Services.

3.3.2.2.1.4 Primary Feeder Equipment and Distribution Equipment

- Manholes and Handholes
    - Facilities Management Services will identify connection location(s) and designated manholes(s) or handhole(s) for each project. Facilities Management Services will also provide details and fault current information for each manhole or handhole as available.

3.3.2.2.1.5 Medium Voltage Feeders

- 33% spare capacity shall be included for each feeder. Conduits shall not be more than two-thirds filled.
- For every conduit provided for the project, an equal number of spare conduits shall be provided from the manhole to the Main Electrical Room. Conduits shall be a minimum of 5". Wire size shall be a maximum of 500 MCM.

3.3.2.2.1.6 Grounding

- Grounding will be implemented as specified by all existing codes.

3.3.2.2.1.7 Medium Voltage Termination

- Conductor terminations may be cold or heat shrink type termination kits rated 15kV, 95kV BIL with current rating same as the cable. Splice kits are not acceptable unless approved by Clarkson Electrical FAS.

3.3.2.2.1.8 Power Shut Off Notification

- 14-day written notification is required prior to any power shut down. Written approval will be given by Facilities Management services including the approved date and time of shut down.

3.3.2.2.2 Normal Power Distribution Equipment

3.3.2.2.2.1 Substations

- Design engineer will provide the final trip setting for the Main Breakers prior to equipment start-up.
- Buildings and their equipment shall be served by unit substations where applicable as required for the load. Generally, substations shall be single ended type, and the secondary or building distribution system voltage shall be as follows:
    - 480Y/277 volt 3 phase 4 wire 60 HZ for buildings with large power loads utilizing 277 volt for most lighting and small 480 to 120/208 volt transformer for receptacles, lighting and small equipment loads as required.
    - 208Y/120 volt 3 phase 4 wire 60 HZ for buildings with small power loads that can be readily served by this voltage.
- Substation shall be exterior or interior as directed by Clarkson Facilities Management Division.

- Substations shall consist of a medium voltage load break primary switch, power transformer and main secondary low voltage switchboard.

- Secondary switchboard main breaker will be set to trip on its lowest setting during construction and will be adjusted to calculated load required set points during commissioning.

3.3.2.2.2.2 Primary Feeders

- All primary feeders shall consist of conduit and copper wire.

3.3.2.2.2.3 Secondary Distribution Transformers

- Secondary distribution transformers and all downstream transformers shall be of explosion resistant, fire-resistant, air insulated, dry type construction, cooled by the natural circulation of air through the windings. Only copper windings shall be specified.

3.3.2.2.2.4 Distribution and Branch Circuit Panelboards

- Panelboards that are not located in the same room as their distribution breaker shall have a main breaker provided in the panel. Exceptions may be made for panels located on the same floor as their distribution breaker, determined on case by case basis.

3.3.2.2.2.5 Variable Frequency Controllers

- See Chapter 4 of the Design Manual.

3.3.2.2.2.6 Secondary Feeders

- All secondary feeders shall consist of conduit and copper wire.

3.3.2.2.2.7 Branch Circuits

- Ratings and Size: Branch circuits shall be at minimum #12AWG.

- Acceptable Conduit Types:

    - Conduit shall be specified as Electrical Metallic Tubing (EMT) or Intermediate Metal Conduit (IMC).

    - Flexible metal conduit (FMC) is acceptable for up to 6 foot max for final terminations to motor loads and light fixtures.

- Conduit Size and Fill

    - A minimum of ¾" conduit shall be specified. A minimum of ½"conduit is acceptable for distribution to receptacles.

    - No more than 9 conductors (3-phase, 3 neutral and 3 ground) shall be installed in a common conduit.

    - Usage

- Branch circuits shall be comprised of like usage.
- Electrical wiring system shall be designed and installed with as much flexibility as practical and reasonable.
- Other branch circuits shall have a maximum of 6-8 receptacles per circuit to allow for future receptacles.
- Receptacles (and light fixtures) shall be circuited such that the room or area has a diversity of circuits. For example, all outlets in one office shall not be on the same circuit. The failure of one circuit should not take down an entire area.
- Corridor outlets shall be on a separate circuit with only other corridor outlets.

- J-boxes for Branch Circuits
  - At least one j-box shall be provided for the receptacle branch circuits feeding each room. Branch circuits shall enter the room, connect to the j-box and then continue to the appropriate receptacles. If the circuit continues to an adjacent room, the connection shall be j-box to j-box.
  - Label all J-boxes with originating panel and breaker number.
- Commercial Cooking Systems
  - All electrical shunts and other associated shut off devices shall be labeled.

3.3.2.2.2.8 Wiring Devices

- Plate Colors and Labeling
  - Plate material shall be specified by Clarkson FAS. Plate colors typically are specified by the architect. White shall be the default color. For receptacles with special power requirements, plate colors shall match receptacle colors.
  - All device plates shall be labeled with originating panel and circuit numbers. The preferred labeling method is black lettering on clear ½" labeling tape.
- Projects that include pre-wired workstations are also required to have each receptacle labeled with panel and circuit number. A note shall indicate as such on both the electrical drawings as well as the furniture plans.
- Receptacle Colors:
  - The receptacle color will be specified by Clarkson FAS.
  - Emergency and UPS receptacles will have a visual indicator and plate color as specified by Clarkson FAS, for specific equipment see; Chapter 4 DIV 26 00 10.
  - Receptacles with isolated ground will be specified by Clarkson FAS.
- Receptacle Orientation

- All receptacles shall be orientated with the ground up.
- For receptacles located in wire mold, receptacle orientation shall be specified by the engineer on the documents. All receptacles included in the wire mold shall face the same direction.

- GFCI
  - Along with code required locations, all Janitors Closets shall be provided with GFCI outlets.

3.3.2.2.3 Emergency and Standby Power

3.3.2.2.3.1 Terminology

- At Clarkson, the term "emergency system" refers to the entire system supported by a generator.
- The Emergency System, as defined by Article 700, is more commonly referred to as the Life Safety System.
- The Legally Required Standby Systems (Article 701) and the Optional Standby Systems (Article 702) are more commonly referred to as the Standby System.
- Regardless of terminology, all code requirements for the generator systems are to be met.

3.3.2.2.3.2 Acceptable Power Sources

- Order of Preference for Sources
  - The preferred method of providing emergency (life safety) power to a building is via generator.
  - In cases where it is not physically feasible to include a generator, a central inverter type battery system is acceptable.
  - In cases where a central inverter type battery system is not feasible, individual local batteries will be permitted.
  - For projects in existing buildings, the method being employed in the building shall be followed unless otherwise directed by Facilities Management Services.
- Generators
  - For existing buildings, where a life safety generator is available, all code required life safety devices shall be fed by the generator.
  - Generators shall be sized with a 30% spare capacity.
  - Generator Distribution Board: In the cases where one generator feeds multiple transfer switches, a distribution board with circuit breakers shall be provided.

- Emergency generators shall be natural gas fuel.
- Provide load bank for generators to use when cycling for maintenance. At a minimum, provide a connection for a portable load bank.
- Consider emergency generator exhaust path in relation to make-up air and building openings.
- Provide grounding system for generator per NEC.
- Generator shall provide operational status to the Fire Alarm Annunciator.

- Generator Communication: Provisions shall be made to have monitoring contacts from the generator status panel to communicate with the University BMS System.
- Automatic Transfer Switch: Automatic transfer switches shall be provided for the connection of generators. At least two ATS shall be provided to support both emergency (life safety) and standby loads. One ATS may be provided if only emergency (life safety) load is to be supported as determined by Clarkson FAS. ATS shall be designed by the engineer. See preferred vendor list 26-00-10
- Commissioning: Generator and transfer switches shall be commissioned.
- Battery Backup
  - Battery backup for life safety lights and exit signs may be acceptable in instances where a generator is not available or not feasible.
  - Central inverter systems with battery backup shall be provided when a generator system is not feasible. Batteries shall provide a minimum of 90 minutes per code. An automatic battery charging means shall be provided per code.
  - Individual battery systems shall be a last resort.
- UPS Systems
  - Refer to Clarkson University Office of Information Technology for specific requirements concerning UPS Systems.

3.3.2.2.3.3 Systems on Generator Power

- Required Systems: All buildings shall be provided with a generator. All required systems shall be provided emergency power (whether life safety, legally required standby or optional standby power) to meet code requirements.
- Other Systems: The following systems shall be provided generator power on the proper code branch where available.
  - All access control and/or security devices shall be provided with emergency power.

- All building management system (BMS) devices shall be provided with emergency power.
- Elevator(s) shall be provided with generator power in some applications.
- At least (1) emergency outlet shall be provided in each electrical room, mechanical room, elevator machine room and other machine rooms.
- At least (1) emergency light fixture shall be provided in each electrical room, mechanical room, elevator machine room and other machine rooms.
- All domestic water booster pumps.

3.3.2.2.3.4 Roll Up Generators

- Where the building conditions and the Facilities Management Services require roll up generator provisions, the following shall be met:
    - An adequately sized breaker, meant to accommodate the critical loads in a building, shall be provided within the main switchgear. A separate section with key interlocks can be provided, or a remote disconnect can be provided to allow for the safe and efficient connections of a temporary generator. Options on where the breaker is located and how connections are made will be determined on a project by project basis by Facilities Management Services.
    - For New Buildings - Without a Generator: For a new building, where a permanent generator has not been specified, roll up generator provisions shall be provided, as directed by Clarkson.
    - For New Buildings - With a Life Safety Generator: For a new building, where a permanent life safety emergency generator has been specified, roll up generator provisions shall be provided, as directed by Clarkson.
    - For New Buildings - With a Life Safety & Standby Generator: For a new building, where a permanent generator has been provided for both life safety power and standby power, roll up generator provisions are not required.
    - For Existing Buildings - Adding a Life Safety Generator: For an existing building, where a project involves the addition of a life safety emergency generator, roll up generator provisions should be considered. In buildings where provisions can be included without major modifications to existing switchgear and excessive cost to the project, roll up provisions shall be provided. All other buildings shall be reviewed on a case by case basis.
    - For Existing Buildings - Adding a Standby Generator: For an existing building, where a project involves the addition of a stand by generator in addition to a life safety generator or to replace an existing generator, roll up provisions are not required.

3.3.2.2.3.5 Fire Pumps

- Concrete encased cable or MI cable is acceptable for feeding the fire pump.
- When the fire pump is provided with generator power, a separate ATS shall be specified as per code.

3.3.2.3 Lighting System Criteria

3.3.2.3.1 Lighting System Overview

- New buildings, other than residential, shall have lighting provided at 277V where available.
- Existing buildings may have lighting provided at either 120V or 277V depending on the age of the facility.

3.3.2.3.1.1 Normal Lighting Distribution Equipment

- Branch Circuits:
    - Branch circuits shall be at minimum #12AWG.
    - Conduit shall be specified as Electrical Metallic Tubing (EMT) or Intermediate Metal Conduit (IMC).
    - Flexible metal conduit (FMC) is acceptable for up to 6 foot max for final terminations to light fixtures.
- Conduit Size and Fill:
    - A minimum of 3/4" conduit shall be specified.
    - No more than 7 conductors (3-phase, 3 neutral and 1 ground) shall be installed in a common conduit.
    - 20% spare capacity shall be left on each circuit for future lights.
- Usage: Light fixtures shall be circuited such that the room or area has a diversity of circuits where feasible. It is preferred that all lights in one office not be on the same circuit where multiple circuits exist in the area in order to minimize the failure of one circuit taking down an entire area.
- J-boxes for Branch Circuits: At least one j-box shall be provided for the lighting branch circuits feeding each room. Branch circuits shall enter the room, connect to the j-box and then continue to the appropriate light fixtures. If the circuit continues to an adjacent room, the connection shall be j-box to j-box.
- Label all J-boxes with originating panel and breaker number.

3.3.2.3.1.2 Lighting Fixtures

- All fixtures will require approval from appropriate Clarkson FAS Maintenance personnel. Refer to Chapter 4 DIV 26 00 10 for specific electrical equipment standards.

- Clarkson requires the use of light emitting diode (LED) lighted exit signs with diffused lenses. Only red lettered exit signs will be used.

- Fluorescent fixtures of the static recessed type shall be used for most hung ceiling applications. They shall be 2' x 4', 1' x 4', or 2' x 2' based on ceiling grid, size of room or area, and architectural arrangement. Generally lenses shall be plastic injection molded prismatic type of 100% virgin acrylic. In areas requiring low brightness, numerous CRT's, or similar equipment, parabolic type louvered fixture shall be used. Commercial fluorescent fixtures shall be used where applicable for surface or stem mounted fixture shall be metal with hinged shielding lens of 100% virgin acrylic prismatic type. Industrial type fluorescent fixtures with bulb protection shall be used in mechanical equipment rooms, storage and receiving areas and similar spaces.

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- Fixtures shall be specified with cost and availability in mind.

- Fixtures shall have standard parts and be easily maintained.

- Cut sheets of all planned fixtures should be submitted with the project plans and specifications.

- Lenses: Lenses shall conform to the spaces they are being applied with the approval of Clarkson FAS.

- Light fixtures shall be selected to permit the use of lamps that are on State contract, readily available from multiple manufacturers and are in typical use at the University.

- No lighting fixtures shall be specified for which the manufacturer will require a minimum order for the purchase of replacements. Non-catalog and custom lighting fixtures are to be economically justified and avoided whenever possible.

- Ballasts shall be warranted for 60 months from date of manufacture and shall have harmonic distortion of less than 15%. Ballasts shall be of the parallel lamp connection design such that lamps remain fully lit if any of the companion lamps fail.

- For Exit Light specifications refer to Chapter 4 DIV 26 00 10 for specific equipment standards.

- Typical locations for occupancy sensors include small rooms such as individual restrooms, one person offices, and small storage rooms like closets, supply rooms or recycling rooms, areas of rescue assistance and conference room and classrooms. Wall switches also be provided in conference rooms and classrooms such that lights may be controlled by switches when space is occupied.

- Locate light fixture schedule on drawings. Schedule shall contain a description fixture, not simply a model number.

- Use of fluorescent dimming systems is discouraged. When approved, the ballasts shall have a dimming range of 100% to 1%.

- Provide multi-level lighting capability for all classrooms.

- Specify standard lamps not requiring special order or premium price. The following illumination levels are recommended by Clarkson. Illumination levels referenced are maintained levels measured at a 30" height from the floor or at an actual work surface and represent an average level for the area.

Lighting Levels

Area/Room Name	Maintained Foot Candles
Offices & Secretarial Areas	30 - 35
Laboratories	30 (Ambient) 75 - 80 (Task + Ambient)
Study Areas & Classrooms	30 - 75
Conference Rooms & Meeting Rooms	30 40
Lecture Hall Auditorium/Multi Purpose	35 - 50
Corridors & Stairwells	5 - 10 (at Floor)
Reception/Lobby, Lounge	25 - 30
Mechanical, Electrical Rooms	20
Telephone & Elevator Machine Rooms	20
Receiving Areas	25
Storage Areas	25
Rest & Locker Rooms	25 ~ 30
Critical work areas such as tissue labs, culture plate areas, instrument room, etc.	90 - 100 (Task/Ambient)

- Stairwells in buildings shall have sufficient fixtures so that loss of one lamp or ballast will not leave the area dark. Please use wall mounted fixtures in stairwells that can be serviced from a 6' ladder.

- Lighting fixtures in garages shall be sealed and watertight.

3.3.2.3.1.3 Lighting Power Density

- Refer to ASHRAE 90.1 (edition reference in latest energy code) for minimum lighting power densities.

3.3.2.3.1.4 Lighting Control

- Occupancy sensors shall be utilized for interior lighting as approved by Clarkson FAS.

- Motion Sensors shall not be used where a safety hazard may be present.

- Motion sensors shall not be connected to EMS.
- The use of multiple switching shall be evaluated for each space and condition.
- All exterior and security lighting shall be powered from one location in the building.
- Contractor shall provide the initial lighting control setup.
- Daylighting:
    - For continuous occupied space automatic controls that constantly adjust the electric lighting in response to the available daylight shall be used where applicable.
    - Fluorescent dimming ballasts with 0-10V control will be used to dim the lights to within 10 percent.

3.3.2.3.1.5 Emergency Lighting

- Emergency and exit lighting shall be provided in each building to meet IBC and NFPA codes. These lights shall be connected to buildings emergency power source.
- Emergency lighting, either electric or photoilluminescent, must be posted at each stairwell door and building exit. SFPC 1011.1.
- Emergency lighting shall be provided as required by code; including toilet areas, outdoors at all egress doors, mechanical/main electrical room and in laboratory areas.
- Emergency system wiring shall be in separate conduits, and its distribution through separate panelboards and motor control centers, etc. as required for a complete system to serve exit lights, safety lighting in corridors and stairwells, in general assembly areas, and mechanical equipment rooms and electrical rooms for essential loads, for security systems, fire alarm, and as required.

3.3.2.3.1.6 Switching and Dimming

- Switching Requirements
    - All switching shall be bi-level (a, b).
    - Location: Switches shall be located on the wall opposite the side of the door swing. Switch leg “a” shall be the closest switch to the door.
- Dimming
    - Refer to DIV 26 00 10 for specific dimming equipment standards.
- Back of House Locations
    - Back of house locations, including storage rooms and the like, shall be provided with a digital time switch where applicable and as permitted by Clarkson FAS.
- Exceptions: Certain exceptions and substitutions may be made on a case by case basis by Clarkson FAS. For example, color temperature of a bulb may be adjusted to match existing

fixtures in an area. All exceptions will be made at the discretion of Clarkson. Cut sheets or documentation shall be provided where necessary in order to approve substitutions and exceptions.

- General Requirements
    - Incandescent bulbs, even in limited quantity are not energy efficient and should not be specified.
    - Bulbs longer than 4' are only used with approval by Clarkson FAS.
    - U lamps are only used with approval by Clarkson FAS.
    - Biax lamps above 42 watts are only used with approval by Clarkson FAS.

3.3.2.4 Documentation

3.3.2.4.1 Standards and Code Requirements

- All equipment shall be UL listed, shall be provided with proper identification related to the UL listing, as well as appropriate listing documentation.
- All equipment and electrical spaces shall meet the minimum code requirements including all applicable local codes and amendments.

3.3.2.4.2 Code References

- All drawing sets shall include code references to the specific code being applied including International Building Code (IBC), International Energy Conservation Code (IECC) the NYS Statewide Code, National Electrical Code (NEC) and any local Code Amendments. This reference shall be made in the E-000 sheet.

3.3.2.4.3 Single Line (One-Line) Diagram Requirements:

- Single line diagrams for any project will be incorporated into Clarkson's full set of line diagrams. The full set, or portions thereof, will be signed out and updated, all changes will be clearly marked.
- Single line diagrams shall be of the most accurate and descriptive nature allowed by the available information. Site surveys and earlier drawings shall be used as references to ensure that the single line being depicted is as up-to-date as possible.
- Projects that include multiple story buildings, regardless if the project scope includes only one floor*, shall have a "riser" style single line diagram. The single line shall be broken up into floors and the equipment, both existing and new, shall be shown on the appropriate floor.
- The basement (or lowest level of the building) shall be shown on the bottom of the sheet. The roof (or highest level of the building) shall be shown on the top of the sheet. Floor delineations shall be in the form of horizontal lines labeled with Clarkson's recognized floor name.
- Projects that include single story buildings or areas may have a "flow" type single line diagram.

- Projects including multiple electrical rooms on one floor shall have single line diagrams that indicate the room number of each electrical room the gear is located in for quick reference.
    - Exceptions may be made by Facilities Management Services in the case of smaller TI projects that do not require the installation of major pieces of equipment. In these cases, determined on a project by project basis, the existing single line may be used and amended as necessary.
- All Single Line Diagram sheets shall include the following information:
    - All connected building equipment, including panels, generators, switchboards, utility equipment, mechanical gear, etc.
    - Names, locations and ratings of all gear
    - Feeder schedule for equipment included in scope of work
    - Feeder schedules that do not fit on the single line, due to the amount of equipment being shown, shall be located on an adjacent sheet. The single line sheet shall make reference to the adjacent sheet with the feeder schedule. Sheet notes shall be provided as necessary.
    - Arc Flash study results and ratings.
- Single Line Diagram sheet numbering:
    - Single line diagrams shall be located in the 700 series sheet numbers, regardless of how many sheets are in the set.
    - Normal single line diagrams shall be first in the series. Emergency single line diagrams shall come next in the series.
    - For smaller projects, single line diagrams may be combined with panel schedules to minimize the page usage, with Clarkson FAS approval. In such cases, the combined single line/panel schedule sheet shall still be located in the 700 series sheet numbers.

3.3.2.4.4 Load Summary

- The load summary can be in the form of panel schedules or a table. The load summary shall include all equipment loads being fed into the main switchgear. Existing equipment may require metering to determine connected load.

3.3.2.4.5 Scope of work

- The equipment related to the scope of work of the project shall be highlighted or some other way indicated as included in the project. All building equipment shall be shown as reference and may be indicated as such.

3.3.2.4.6 Equipment Support

- Support and anchor all equipment and conduit.
- Provide fittings for seismic expansion and deflection.

- Provide vibration isolation and seismic anchorage.

3.3.2.4.7 Schedule Requirements

3.3.2.4.7.1 Panel Schedules

- All electrical drawing sets shall include panel schedules. These sheets shall include any and all panels affected by the project scope, regardless of whether the gear is directly or indirectly affected.
- Any panel being referenced by a home run in the floor plans shall have an individual panel schedule and a load summary.
- Panel schedules shall indicate where the panel is located, especially in the cases of large projects with several Electrical Rooms.
- Reference boxes should be included on each sheet in the drawing set that includes panel schedules. The reference box should indicate where on the page each panel schedule is located for quick reference.

3.3.2.4.7.2 Light Fixture Schedule

- A light fixture schedule shall be provided for all projects and shall be included in the electrical drawing set. The light fixture schedule shall be in table form including all of the pertinent information necessary for the sub-contractor. Information should include length, ballast type, wattage, manufacturer and location. See below example light fixture schedule:

Type	Description	Manufacturer and Catalog No.	Lamps		Input Watts	Volts	Comments
			Qty.	Description			

3.3.2.4.8 Circuiting and Identification Requirements

- Each home run shall indicate the corresponding panel name and the circuit number(s).

- Lighting plans and/or reflected ceiling plans shall show the respective lighting panel in its proper location in each electrical room to provide clear indication of home run destination.

3.3.2.4.9 Special criteria/requirements

3.3.2.4.9.1 Equipment Naming and Numbering

- For a full Equipment Name used for electrical panels in GIS or TMA refer to Chapter 2 Design Procedures, 2.2.5 Equipment Naming.
- Electrical Panel numbers will be created using the following conventions (See Categories below for the selection options in each);

  - Switchboards/Distribution Boards/Panels Naming Convention
    Panels shall be named based on the following criteria –
    (Emergency) Type Voltage (Area) Floor Alpha
    Example 1: a standard 120/208V, panel located on the south side of the second floor
    LS2A
    Example 2: a 480V emergency standby distribution board located on the north side of the second floor
    EDBHN2

  - ATS Naming Convention
    ATS shall be named based on the following criteria –
    (Emergency) A Voltage (Area) Floor (Alpha)
    Example 1: an emergency stand by 480V ATS in the second floor
    EAH2
    Example 2: the first of two normal 480V ATS on the roof
    AHBA

  - Transformer Naming Convention
    Transformers shall be named based on the following criteria–
    (Emergency) T (Area) Floor (Alpha)
    Example 1: a life safety transformer in the south area of the third floor
    ELTS3
    Example 2: the first of two normal transformers on the fourth floor
    T4A

  - New or Renovated Buildings: For new buildings and completely renovated buildings, panels shall be named in relation to the floor the panel is located on and the type of power the panel is providing. See Conventions section above for additional information.

  - Existing Buildings: For existing buildings, panels shall be named in coordination with existing panels. If no pattern is evident in the existing building for panel naming. See Conventions section above for additional information. Verify there is no existing panel with the same name as the new panel in existing buildings.

  Specialty Areas: Coordinate with Facilities Management Services for naming convention for specialty areas.
  Categories

Emergency	
EL	Emergency-Life Safety (as defined by NEC Article 700)
ER	Legally Required Stand by (as defined by NEC Article 701)
E	Optional Stand by (as defined by NEC Article 702)

Type	
U	Unit Substation
DB	Distribution Board
G	Generator

Voltage	
H	480 or 480/277
L	208/120V

Area	
N	North
S	South
E	East
W	West
	*Segments A, B, C, D are also acceptable

Floor	
B	Basement
1	First
2	Second
3	Third
R	Roof
M	Mezzanine

Alpha	
A	Panel
AA	Sub panel to A
*Alpha category is sequential. The second panel follows with B and so on.	

- o

3.3.2.4.10 Lighting Floor Plan Fixture Labeling

- On the electrical lighting floor plans and/or reflected ceiling plans, each light fixture shall have the following information:
  - o Fixture type – in capital letters

- Circuit Number – including panel and circuit
- Switch leg (where applicable) – in lowercase letters

3.3.2.4.11 Coordination

- Light fixtures shall be coordinated with location of equipment, especially in back of house spaces. Coordination of light locations shall not be left to the contractor or "with field conditions."

3.3.2.4.12 Field Verifications

- Expectations: Where existing building is involved, the engineer is expected to visit the project site once initiated to confirm the existing conditions, including but not limited to project space, electrical rooms, existing panels, etc. Drawings shall accurately reflect current existing conditions.

3.3.2.4.13 Electrical Coordination Study

- The electrical design will include a short circuit and coordination study to identify overcurrent protection devices which will provide a selectively coordinated system for the emergency systems in the building. The design will also include a preliminary arch flash hazard analysis to identify potential arc flash hazards and to develop strategies to mitigate the hazards. The study shall be submitted to Clarkson for review.
- In order to provide a baseline database for operation and maintenance of the building, the project specifications will require the following studies to be performed by the installing contractor. All electrical studies will be performed by a registered professional engineer and submitted for review and approval by the electrical engineer and Owner prior to releasing any equipment and shall include the following:
  - Short circuit: Study shall be conducted at all busses in the system. Study shall be performed for both utility, generator and transition mode. Study shall assume full contribution from all motor loads. A full report shall be provided showing fault currents in all configurations and associated X/R ratio.
  - Coordination: Study circuit: Study shall provide all settings for programmable trip units and adjustable breakers. Study shall include copies of all TC curves used and graphic and test data indicating proper coordination.
  - Arc Flash: Study shall indicate working distance for all panels. Study shall include all labeling required per NFPA 70E. Labels will be required in electronic format and installation of labels will be included as a requirement of the specification.
  - Clarkson's one line diagrams will be updated to include all of the above.

3.3.2.4.14 Estimated Load Summary

- Use tables below to calculate the normal and standby building loads:

Building Electrical Load Summary					
Loads	**KW**	**KVA**	**Load Growth**	**SUB-TOTAL @ Demand**	
				KW	**KVA**
Lighting					
General Power					
Manuf.					
Mechanical					
Elevator					
Other					
TOTALS					
BLDG SF =					
Expansion=				**W/sf**	**kVA/sf**
Total SF =					

Standby Power Load Summary					
Loads	**KW**	**KVA**	**Load Growth**	**SUB-TOTAL @ Demand**	
				KW	**KVA**
Emergency					
Legally Required					
Optional Standby					
Fire Pump					
Elevators					
TOTALS					
BLDG SF =					
				W/sf	**kVA/sf**
TI Total SF =					

3.3.2.5 Fire Alarm System

- Refer to DIV 28 31 11 for specific information concerning Fire Alarm Systems.
- A non-coded digital addressable fire alarm system shall be designed for each existing and new building to meet the NFPA and local codes. The fire alarm system shall be connected to building's emergency power source where applicable.
- The preferred system is NOTIFIER.
- Per 2009 NYS Statewide Fire Prevention Code 908.1 for H-use buildings, install a digital voice fire alarm system that uses standard smoke detectors and manual pull stations.
- All new construction shall be equipped with fire alarm system that includes a building wide Public Announcement system. The microphone shall be placed in a locked cabinet in the lobby, fire control room, or other space accessible to building management and first responders. When an emergency occurs, building management must have access to the system microphone to make announcements.
- The digital voice fire alarm public announcement system shall be capable of interconnecting with a remote receiver. The receiver would be used to make building or campus-wide announcements from a central transmitter. SFPC 907.6

- Fire alarm smoke detectors provide in dorm rooms should be supervisory only.
- All fire alarm devices shall be provided with copper stranded wire, maximum size #12AWG. All wiring for fire alarm devices shall be in conduit.
- All system wiring and cable must be in conduit.
- The design documents shall include requirements for demolition and remove the old/un-used system and system components. Abandoning old, un-used and inactive systems and system components is not allowed.
- Fire detection equipment that is located on a pitched roof must have the appropriate tie-offs and guide rails to facilitate a safe ascent to and descent from the equipment.
- Clarkson inspectors will perform system testing prior to performance of specified third party inspection and testing.

3.3.2.5.1 Fire Alarm Plans:

- A full Fire Alarm System design is required as part of the design documents.
- Plans shall be complete and in accordance with BCOM requirements for submittal/approval.
- Devices powered with 120V (or greater) shall be shown on electrical power floor plans with circuit designations for coordination.
- Fire alarm devices shall be shown on dedicated Fire Alarm plan and shall not be mixed with power plans.
- Provide a fire alarm operations matrix; Clarkson will provide an example matrix upon request.

3.3.2.6 Lightning Protection

- Each building shall be considered individually to determine the necessity for lightning protection. The building location, height, proximity and height of surrounding facilities, etc. shall be analyzed in determining the need for this protection. If lightning protection is to be provided, it shall be designed and specified to comply with NFPA #780 “Lightning Protection Code” and the completed system and its installation must have U.L. master label.

3.3.4 FIRE SUPPRESSION SYSTEMS

- All fire suppression systems shall be designed and installed in accordance with the building code, referenced NFPA standards and FM Global criteria. Refer to Part 4 for specific design criteria.
- No glycol or antifreeze based fire suppression systems should be used in any part of the building. A dry pipe sprinkler system can take the place of an antifreeze system and be much more reliable.
- External drains that are fitted with a hose connection shall be 2-1/2 in national standard thread.
- Steel pipe should be used for all installations. BlazeMaster CPVC piping may be used with permission from Clarkson and only when installed by a Clarkson approved “Blazemaster Installer”.
- When installed the Post Indicator Valve (PIV) should be at least ten feet from any drivable surface or protected by reinforced bollards. The building name/address numbers must posted on the PIV.
- All Type I (grease or oil laden) hoods should be protected by a wet-chemical suppression system where applicable.
- Fire suppression equipment that is located on a pitched roof must have the appropriate tie-offs and guide rails to facilitate a safe ascent to and descent from the equipment.

3.4 ENVIRONMENTAL STANDARDS

3.4.1 GENERAL

Clarkson expects its Design Teams to employ the industry's best management practices and recommend innovative technologies, balanced with those that are time honored and proven.

Clarkson University signed the American College and University Presidents' Climate Commitment, an initiative to promote sustainable development among institutions of higher education. As Clarkson takes steps towards its target of climate neutrality by 2050, it aims to educate its community in the process by integrating sustainability into its curricular and co-curricular activities. This includes showcasing innovative practices for the education of its students, as well as incorporating cutting edge research into its built environment.

The university strives to manage its economic and natural resources responsibly and sustainably. Clarkson expects its Design Teams to adhere to the spirit of these commitments and priorities in their design of Clarkson's buildings and renovations.

3.4.2 REGULATORY ISSUES

- Corps of Engineers Wetlands Delineation Manual - 1987
- EPA Wetland Regulatory Authority – Regulatory Requirements:
  http://water.epa.gov/lawsregs/lawsguidance/cwa/wetlands/regs_index.cfm

3.4.3 EFFICIENT AND LONG LASTING BUILDINGS

References:

- Clarkson Climate Action Plan: TBD

3.4.3.1 Goals and Objectives

Clarkson expects its Design Teams to integrate passive and active resource reduction strategies into the building design for optimal operations.

3.4.3.2 Direct Energy Consumption

In its Planned Climate Action Plan, Clarkson plans to commit to reducing its use of non-renewable electricity and natural gas per square foot of built space, and per full-time equivalent student, by 10% below 2006 levels by 2024—a major milestone on the path to climate neutrality.

3.4.3.2.1 Construction

- Clarkson seeks contractors that share our commitment to sustainability. It is the expectation that contractors operate according to that shared commitment, to continually improve, and to minimize their energy consumption during construction.
- The contractor shall have mechanisms in place to measure and report their metered utilities use during construction when the University is not paying for utilities.

- The Contractor shall divert no less than 50% of its construction waste from landfills on new construction projects and renovation projects over $4 million. For smaller projects he intent is to maintain this safe level but we do not ask for reports on it.

- The Contractor shall utilize low flow and energy efficient plumbing and lighting fixtures employed for temporary use throughout the project.

3.4.3.2.2 Design

- New buildings will aim to meet LEED Silver minimum qualifications for buildings and explore the feasibility of renewable energy production.

- New buildings and significant existing building renovations shall look to achieve at least a 20% energy reduction from ANSI/ASHRAE/IES 90.1 -2013.

- The Contractor shall bring to Clarkson’s attention any exposed inefficient practices within existing facilities for consideration.

- Clarkson's brand promise is to provide an exceptional educational experience that inspires innovation, fosters thought leadership, and cultivates success. As requested by the owner and where appropriate, provide signage, mechanisms, educational tools, and/or ambient devices to engage and educate building stakeholders about their building and their impact within the building. The Design Team shall ensure that these reporting systems are installed and compatible with the existing technology infrastructure and building systems.

3.4.3.2.3 Final Measurement and Verification: How Buildings Perform

- The building shall be commissioned before being occupied and a full report provided to the University.

3.4.3.2.4 Renewable Energy

- As an institution of higher learning, Clarkson has the responsibility to be a leader in the community. Clarkson has a voluntary renewable energy standard goal of power generated from renewable sources. Each project should consider its environmental impact. Current goals should be identified and, if applicable, be implemented where possible.

3.4.3.2.5 Controls Systems

- Building utilities must be measurable so that they can be managed and controlled. Clarkson encourages collaborative decision-making processes that seek win-win solutions, as opposed to pitting one criteria against another. Technical elements of the Design Manual are not intended to limit opportunities to emplace proven energy saving measures.

- Measure and report utilities (such as lighting, HVAC, chilled/hot water, and potable water) at the building level and additional levels as determined by the design. The Design Team shall ensure that these reporting systems are installed and compatible with the existing technology infrastructure and building systems.

- In order to conserve and measure progress, campus utilities and energy use must be tracked at the level of individual buildings—at the minimum, for metered utilities such as electricity, chilled/hot water,

natural gas, and potable water. The Design Team shall ensure that these reporting systems are installed and compatible with the existing technology infrastructure and building systems.

3.4.3.3 Energy Efficiency Standards

As part of Clarkson's overall energy plan, energy efficiency standards have been adopted for the purchase of new equipment. Generally, the standards meet or exceed federal ENERGY STAR guidelines and specifications for energy efficiency. Due diligence must be completed by the Constructor to ensure that energy efficient products are used where feasible.

3.4.3.3.1 Energy Saving Performance Contract (ESPC)

- Clarkson is currently planning on replacing existing plumbing and lighting fixtures under an ESPC. The Design Team shall specify products that meet or exceed the efficiencies of these fixtures.

3.4.3.3.2 Water Efficiency

Clarkson strives to be a responsible steward of its water resources and to lower its consumption.

- The Design Team shall evaluate and integrate innovative technologies to address the challenges of harvesting, storing, reclaiming, and reusing its water resources. Design Teams may need to collaborate with and address concerns of local governing authorities in certain locations and situations.

- Water use in new buildings and existing building renovations shall be 30% below the Energy Policy Act of 1992 standards. Therefore, all new construction and existing building renovations shall have water efficient fixtures and products installed, such as low-flow faucets, showerheads, toilets (waterless toilets are not permitted), and appliances.

3.4.4 SUSTAINABLE SITES

References:

- Sustainable Sites Initiative (SITES)

- The Design Team shall utilize passive design strategies to create resource efficient buildings and to address important issues such as site impact, connectivity, water quality, and habitat protection.

3.4.4.1 Goals and Objectives

3.4.4.1.1 Site Development

Design Consultants must honor Clarkson's land use plans by showcasing—and restoring, where possible—the innate and historical features of the landscape. Consequently, before new buildings are constructed on campus, Clarkson asks its Design Teams to assist in determining whether the program utilizes space in the most effective way.

- Reuse or regenerate developed sites and/or underutilized land assets over green field sites. Consider the redevelopment of poorly used sites, including creating new open spaces, or reviving existing open spaces, to promote a sense of community with people and nature.

- Build close to existing infrastructure to minimize the need for tertiary development. For example, minimize utility runs. If infrastructure is not present, consider other sites.

- Choose building renovations over new construction. Consider solutions other than new construction to meet organizational and operational needs.
- Preserve special, protected, endangered, and critical habitats.

3.4.4.1.1.1 Siting to Encourage Energy Savings

The Design Team shall design its facilities to maximize the benefits of the building's location and orientation. Some examples include:

- Minimize energy use by using solar gain or shading to the maximum extent possible.
- Utilize natural ventilation techniques.
- Maximize views and spaces for peaceful contemplation by capitalizing on the surrounding natural beauty.

3.4.4.1.1.2 Hardscape

- The design team will encourage the use of materials that will reduce the heat island effect.
- Where possible, use generous shade tree plantings on streets and paved areas. The use of light-colored reflective materials will also contribute to cooler summertime temperatures, potentially saving on air conditioning costs and countering the effects of climate change. Within LEED certification, solar PV can also be considered to reduce heat island effects.

3.4.4.1.1.3 Lighting (energy efficient fixtures; reduced light pollution)

- Street and site lighting shall be designed to minimize light pollution while providing a safe and attractive civic environment.
    - Use glare shields and light angles to reduce potential glare into the nighttime sky.
    - Specify energy efficient and solar powered exterior lights to reduce energy consumption.
    - Use LED streetlights with 100% cutoff range and LED lights in pedestrian areas.
    - Consider directing exterior lights at items that will not reflect that light back up to the sky. For example, direct lights towards greenscape rather than towards light-colored exterior surfaces that will reflect the light back up to the sky.

3.4.4.1.1.4 Transportation Support Systems

Clarkson is working on transportation infrastructure improvements as well as educational outreach and expects the Design Team to design and plan Clarkson's facilities in support of these efforts. This includes the provision of:

- A sufficient pedestrian network around campus and connecting to surrounding communities. This concept also includes other non-motorized modes of transportation, as applicable.
- Adequate biking facilities such as bike racks, lockers, and showers for bicyclists.

- Connections to existing or planned bicycle and mass transit plans from area transportation providers.
- Opportunities to utilize carpool, vanpool, and/or alternative fueled vehicles.
- Access and education about virtual interaction and technology opportunities, such as video conferencing, within or close to the building to minimize need for additional travel.

3.4.4.1.1.5 Storm water Management

- Refer to NYS Department of Environmental Conservation and US Environmental Protection Agency for technical and regulatory information concerning Storm Water Management.
- The Design Team shall evaluate and integrate innovative technologies where applicable to address the challenges of harvesting, storing, reclaiming, and reusing its water resources. Design Teams may need to collaborate with and address concerns of local governing authorities in certain locations and situations.
- Clarkson's preference is to have more pervious than impervious surfaces on campus. Where possible, Clarkson encourages aquifer replenishment by allowing water to filter slowly into the groundwater table. Where feasible, use open channel storm drainage and vegetated swales for storm water conveyance instead of pipes.

3.4.4.1.2 Habitat and Wildlife Protection

Clarkson University is committed to employ strategies to efficiently use its land resources for development; promote a pedestrian and bicycle friendly campus; and strategically preserve its woodlands, wetlands, and waterways to maintain the campus image and provide for ecological diversity. Clarkson encourages a park concept and retention of natural species and habitat. The Design Teams shall emphasize the natural beauty of its woodlands, wetlands, and waterways while following Clarkson's landscaping requirements, see Chapter 4, DIV32 Site Improvements.

3.4.5 OCCUPANT ENGAGEMENT AND WELL-BEING

Clarkson's top priority is to provide students with a transformational learning experience that supports their growth as individuals, scholars, and professionals. In addition, Clarkson's brand promise is to provide an exceptional educational experience that inspires innovation, fosters thought leadership, and cultivates success. It is Clarkson's intent to educate its community on the challenges and opportunities for fostering a sustainable world.

- Design Teams shall look to provide interactive signage, mechanisms, tools, and/or ambient devices to engage the Clarkson community in the sustainability dialogue and help them to understand the impacts of their individual and collective actions.
- All spaces shall support occupant comfort and wellbeing, as well as a healthy, enjoyable environment in which its occupants thrive.

3.4.5.1 Indoor Environmental Quality

- The design Team shall design to minimize the energy consumption of its systems while maintaining comfort and wellness for building occupants. Clarkson wants to ensure that the appropriate amount of outdoor air is brought into its building systems to maintain a comfortable and healthy environment.

- For indoor air quality, comply with ANSI's ventilation standards. Refer to Section 3.3.1 – HVAC Systems for the appropriate ventilation standards for each type of room. Refer to ASHRAE 55 for thermal comfort.

- Construction cleanup and pre-occupancy cleaning must be coordinated with Clarkson's project manager to ensure the use of low toxicity products, equipment and techniques.

- The Design Team shall promote wellness activities for building occupants. This may include the design of certain elements such as clearly identified, aesthetically pleasing, easily accessible staircases for occupants to use instead of elevators; walking trails or connections; or areas for quiet contemplation and meditation

3.4.6 MATERIALS AND RESOURCES

Clarkson values innovative solutions from its Design Teams to help lessen the impact throughout a building's life cycle—from construction, to purchasing, to disposal, and remediation. As technology advances in this dynamic field, Clarkson's ultimate goal is to be a zero waste institution.

3.4.6.1 Renovation over new build

- The Design Team will evaluate and consider creative reuse and/or recycling of existing building materials. This may include, but is not limited to, salvaging materials and repurposing existing products.

- For new construction and existing building renovations, Clarkson strives for a minimum 50% construction diversion rate. Contractors shall provide proof of their construction diversion for projects that fall into his catagory.

3.4.6.2 Recycling Infrastructure

- The Design Team shall ensure each building occupant has easy, convenient access to a recycling collection site and that each common area, trash room, or lobby has enough designated space for a recycling center that accommodates all the streams of recycling collected at Clarkson.

- For every trash receptacle, a recycling receptacle shall be co-located with it.

3.4.6.3 Purchasing

- Preferences may be given to goods produced in NYS, goods or services or construction provided by NYS person, firms, or corporations. Preference may also be given to businesses that are small, women-owned, and minority-owned businesses. Clarkson strives to support the local economy and local businesses.

- Vendors offering take-back programs for packaging or spent products should also be favored. When possible specify and purchase products that:

    - Minimize packaging.
    - Use recycled content.
    - Use materials that minimize or have no off gassing (with a strong preference for those that do not off-gas at all)
    - Minimize use of toxic chemicals throughout their lifecycle. Use lighter Materials to minimize energy/transportation costs.
    - Use local materials, local vendors.
    - Are organically derived or have biodegradable waste streams.
    - Minimize water use.
    - Minimize energy use.
    - Minimize energy and paper use in procurement/contract management measures.
    - Minimize deliveries, minimize removal from campus.

3.5 SECURITY AND LIFE SAFETY STANDARDS

3.5.1 DESIGN FOR SECURITY

3.5.1.1 General

References:

- Crime Prevention through Environmental Design (CPTED) Guidebook: http://www.ncpc.gov.sg/pdf/CPTED%20Guidebook.pdf

It is a priority for Clarkson University to create a safe and secure environment for its users. The guidelines below shall be followed:

- Adhere to the Crime Prevention through Environmental Design (CPTED) principles in all designs in accordance with the Crime Prevention through Environmental Design Guidebook, October 2003 edition.
- Increase security and crime prevention through the use of environmental controls. These controls include natural surveillance, natural access control, territorial reinforcement and maintenance as outlined below:
    - Natural Surveillance: Maximize visibility with strategic placement of architecture and physical elements.
    - Natural Access Control: Place entrances, exits, fencing, landscaping and lighting to control movement of people and vehicles.
    - Maintenance: Maintain landscaping, buildings, lighting, etc. in order to maintain visibility, preserve pride in ownership and continue declaration of ownership.
- In planning for security and crime prevention, the following design principles must be addressed (see the CPTED Guidebook for more information):
    - Natural Surveillance
    - Natural Access Control
    - Territorial Reinforcement
    - Maintenance and Management
- Within these principles, the following strategies must be evaluated and employed:
    - Sight Lines: Provide clear sightlines that allow unobstructed views to the maximum degree possible. Minimize dead space and blind spots. Carefully consider camera angles to maximize the coverage area for each camera.
    - Lighting: Lighting shall support a safe and secure campus environment. Address areas of deep shadowing, but avoid over-lighting and consider energy use.

- Concealed or Isolated Routes: These are to be minimized. If they are required for specific design reasons, provide these areas with appropriate lighting and camera coverage.
- Entrapment Areas: All designs shall avoid these areas.
- Isolation: Areas that are isolated from the rest of the campus environment shall be carefully designed to provide an adequate secure environment within and from/to these spaces. Isolated spaces should otherwise be avoided.
- Land Use Mix: Planning of the campus shall evaluate the location of various functions and encourage mixed land uses.
- Activity Generators: Entrances to buildings and areas that encourage people to gather should be spaced and adjoin other outdoor spaces in order to create active pathways and avoid unintended isolated areas.
- Ownership, Maintenance and Management: It must be clear who has oversight and responsibility for all spaces and security measures in any facility or area of the campus.
- Signs and Information: Signage and wayfinding must indicate safe zones and locations to get help when needed.

- Other factors to be considered include:
  - Vehicular barriers to prevent easy access to areas not intended for vehicles.
  - The impact of landscape design on the security of spaces in and around buildings.
  - The location and security of parking areas. Underground parking is to be designed carefully and should include best practices for perimeter control and structural considerations. Parking near a building is subject to scrutiny.

3.5.1.2 Building Access

- Refer to Part 4, Division 08 70 00 – Hardware.
- All lockable doors on campus are required to have a key bypass
- The Architect will recommend the specific lock core (per University system) with Clarkson approval; the University is responsible for keying.
- The card key system must be coordinated with the University Security Systems Manager.
- Best Cores are employed University-wide, Access control Access IT Universal are employed University-wide for card access.
- Electronic card access is generally preferred
- All buildings that contain laboratories, scene shops or art studios, or maintenance buildings where chemicals are used, must be equipped with electronic access.
- All hazardous waste and hazardous substance bulk/stock storage rooms must be keyed to the Environmental Health and Safety (EHS) Hazardous Waste Key.

- Security closets and telecom (inclusive of server spaces) rooms should have electronic card access
- Low use spaces, that are normally locked, are good candidates for wireless locking systems; conversely, high volume spaces are not well suited for wireless locks
- Access card closet must comply with UL Listings, and accommodate a 4x8 plywood area for install.
- All access systems need to have backup power and battery available.
- All doors must allow unrestricted egress at all times. Requirements for specific access points include:
    - Primary Entrances
        - Allows egress at all times
        - Card access reader
        - Electronic locking hardware
        - Door position switch
        - Request-to-exit detector
    - Secondary Entrances
        - Electronic locking hardware
        - Door position switch
        - Request-to-exit detector
        - Local alarm sounder, only as designated by University
    - "Exit only" doors
        - Door position switch
        - Local alarm sounder, only as designated by the university
        - Integrated Request-to-exit detector
- Magnetic locks are not permitted
- Padlocks must be able to accept a Clarkson University standard core.
- Building entrances shall be numbered. A street address shall be provided on the building in a visible location where applicable.

3.5.1.3 Surveillance Camera Systems

- Within building interiors, provide a camera every 2,700 square feet, as determined by Clarkson University for precise locations.

- For exterior space, provide camera surveillance at every entrance, every lot (as determined by Clarkson), and all garages.

3.5.1.4 Building Systems Security

RESERVED

3.5.1.5 Emergency Notification System

- Electronic message boards
- Emergency telephones

3.5.1.6 Parking

- Parking has separate gate security requirements

3.5.2 DESIGN FOR LIFE SAFETY

3.5.2.1 General

References:

3.5.2.2 Fire Safety and Emergency Preparedness

3.5.2.2.1 Fire Alarm Systems

- For specific information concerning fire alarm systems refer to 3.3.2.5 and DIV 28 31 11

3.5.2.2.2 Mass Notification Sign Infrastructure

- The lobby entrance should have at least one Ethernet port supplied with power (power over Ethernet) and at least one 120 Volt electrical outlet installed for future mass notification signage. The Ethernet and electrical boxes should be installed at least eight feet high in the building lobby where users can see the sign. The associated wall system should be reinforced with wood blocking that will be capable of supporting mass notification sign and/or a large screen 52 inch LCD television set.

3.5.2.2.3 Commercial Cooking Hood Systems

- There should be a hose bib with hot water, and power connection on the same level as the exhaust fans for the hood exhaust system.
- All electrical shunts, gas shutoff valves, and other associated shut off devices should be labeled.
- All Type I hoods should be protected by a wet-chemical suppression system.

3.5.2.2.4 Pitched Roofs

- Fire detection or suppression equipment that is located on a pitched roof must have the appropriate tie-offs and guide rails to facilitate a safe ascent to and descent from the equipment. Fall protection such as tie-offs and guide rails shall be in accordance with OSHA standards.

3.7 SIGNAGE STANDARDS

3.7.1 SIGNAGE

3.7.1.1 General

- Interior and exterior signage marking permanent spaces must have both the name and number in raised letters and Braille in compliance with the applicable accessibility codes.

3.7.1.2 Interior Signage

- The Design Team shall provide room and area identification signage based on Clarkson sign standards. All interior and exterior assignable rooms shall be based on room numbering standards listed in Section 2.2.4 of the Design Manual for the following space types:

    - Lobby areas, entry areas, or foyer areas incapable of having furniture being placed in them
    - Elevators, elevator mechanical rooms, or adjoining rooms that are used as mechanical or electrical space only.
    - Corridors, hallways, or other walking paths
    - Restrooms of any sort.
    - Any mechanical, electrical, and/or telephone/data rooms.
    - Any open vertical shafts or spaces made for the passing of mechanical, plumbing, or other systems.
    - Janitors or service closets
    - Any classrooms, labs, and studios
    - Administrative office suites
    - Offices and administrative work spaces
    - Stairwells (corridor side)
    - Stairwell levels (inside stairwell)
    - Fire control room
    - Vestibules and exterior cavities

- The Design Team shall provide wayfinding signage for all public spaces based on Clarkson sign standards. This will include the following sign types:

    - Building identification
    - Building directory at primary and secondary entrances and elevators
    - Directional signage (wall mounted or suspended)
    - Projecting identification (stairs, restrooms, elevator, vending, etc)
    - Area identification (theaters, libraries, study nooks, etc.)
    - Regulatory signage

- In addition to those sign types and spaces previously outlined, the Design Team is responsible for coordinating applicable signage for rooms/areas that may require special signs due to outside code regulations. In these cases, the Clarkson sign standards may be altered to meet those regulations, but must be reviewed and approved by the Project Manager.

- Initial signage needs and requirements will be determined as early as practicable in the architectural design process.

- The Design Team shall provide preliminary sign location plans and message schedule to the Project Manager once room numbers have been assigned. The preliminary sign plan must be reviewed and approved by Clarkson for adherence to sign standards and wayfinding rationale prior to preliminary drawing submission to Town of Potsdam. All such signage shall be included in this submission.

- The Design Team shall refine sign location plans and message schedule and provide finalized location plans and message schedule prior to completion of working/construction drawings.

3.7.1.3 Sign Installation

- Signage will follow ADA code.
- Each sign will be mounted on the wall next to the door frame on the door handle/latch side of the door, 3" between the door frame and the end of the room sign, and 60" to the top of the gold horizontal stripe or (to the middle of the braille number?).

- For doors and entryways with insufficient space follow current ADA Handicapped Code and consult the Project Manager and Office of Facilities Administration for an appropriate location.

- Floor, Building Section, Suite signs will include the number of the Floor, Building Section, Suite and all of the departments that reside in that area below the room number. Suite signs will be consistent throughout the suite.
- All signage for mechanical spaces will include the type of room on the sign.
- When necessary, abbreviate titles or information to ensure signs don't become inordinately large.
- All room signs will be mounted with double sided foam tape unless otherwise directed or if wall or other conditions are such that double sided foam tape will not hold the sign in place, than the sign will need to be fastened to the wall with security screws and anchors appropriate for the type of wall construction encountered.
- Departments with names on the transom over the main entrance doorway will still require a suite/room number sign located in the proper place on the wall next to the main entrance doorway.

3.7.1.4 Interior Sign Construction

- All interior signs will be constructed of vinyl plastic with a ¼" thick black solid back panel onto which 1/16" thick dark green glossy front panels are attached.
- The top section of the sign will contain the room number, braille room number, and gold horizontal stripe and will be one solid green section adhered to the black back panel.
- The bottom section below the gold stripe will contain each person's name on an individual panel that can be removed or replaced as needed.

3.7.1.5 Exterior Building Sign Construction

- All exterior building signs will be made of ¼" aluminum plate painted to match the color and layout of the interior signs complete with vinyl plastic letters, a gold horizontal stripe. Contents of the sign will be determined by the Design Team, Project Manager and/or Campus Planning.

3.7.1.6 Signage for Multiple Building Apartment Complexes

- Building Entrance signage for multiple building apartment complexes will be consistent with the building interior signage and contain two to four lines.
- The first line will contain the complex name as a 2 or 3 letter acronym.
- The second line will contain the building number.
- The third line if needed will contain either the apartment numbers or the word “Apartments” if using four lines
- The fourth line, when used, will contain the apartment numbers.

3.7.1.7 Signage Documentation

- Information will be submitted in Excel form and will include all information on the sign as well as design specifications, i.e. size, manufacturer, etc., and the location of the sign. Any alterations or changes made to the sign, its location, or mounting will also be included.