

Design Guidelines



UMASS
AMHERST



Design Guidelines



UMASS
AMHERST

John V. Lombardi,
Chancellor

9.9.04

Date

Joyce Hatch,
Vice Chancellor for Administration & Finance

9/7/04

Date

University of Massachusetts Amherst Design Guidelines

Table of Contents

Part I Building Design Guidelines

- 1.1 Introduction
- 1.2 Historical Context
- 1.3 Principles
- 1.4 Building Siting
- 1.5 Heights of Structures
- 1.6 Exterior Cladding Materials
- 1.7 Connection Between Inside and Outside
- 1.8 Commitment to Accessibility
- 1.9 Functional and Mechanical Facilities
- 1.10 Responsible Use of Energy and Natural Resources

Part 2 Construction Guidelines

2.1 Introduction

- 2.1.1 Purpose of Construction Guidelines
- 2.1.2 Design Team

2.2 Site Planning Principles

- 2.2.1 Major Roads
- 2.2.2 Minor Roads
- 2.2.3 Service Access
- 2.2.4 Parking Areas
- 2.2.5 Mass Transit
- 2.2.6 Pedestrian Travel
- 2.2.7 Major Pathways
- 2.2.8 Standard Pathways
- 2.2.9 Plazas
- 2.2.10 Building Approaches and Entrances
- 2.2.11 Trees and Shrubs
- 2.2.12 Landscaped Open Space
- 2.2.13 Landscape adjacent to Buildings
- 2.2.14 Lighting
- 2.2.15 Snow Removal

2.3 Building Planning Principles

- 2.3.1 Acoustic standards
- 2.3.2 Trash and Recyclables Removal
- 2.3.3 Campus Material Distribution System
- 2.3.4 General Room Requirements
- 2.3.5 Classrooms
- 2.3.6 Conference Rooms
- 2.3.7 Corridors
- 2.3.8 Custodial Supply Room
- 2.3.9 Custodial Closets
- 2.3.10 Electric Rooms
- 2.3.11 Entrance Lobbies.
- 2.3.12 Loading Dock
- 2.3.13 Mechanical Room

- 2.3.14 Private Office
- 2.3.15 Stairway (enclosed)
- 2.3.16 Stairway (open)
- 2.3.17 Toilet Rooms
- 2.3.18 Trash and Recycling Room
- 2.3.19 Telcom Closet

2.4 Site construction

- 2.4.1 Drainage Systems
- 2.4.2 Site Grading
- 2.4.3 Walkways
- 2.4.4 Ramps and Stairs
- 2.4.5 Railing
- 2.4.6 Curbs and Gutters
- 2.4.7 Crosswalks and Curb Cuts
- 2.4.8 Roadways
- 2.4.9 Parking Areas
- 2.4.10 Waste/recyclables Corrals
- 2.4.11 Waste/recycle Bins
- 2.4.12 Bollards
- 2.4.13 Benches
- 2.4.14 Bike racks
- 2.4.15 Trees and Shrubs
- 2.4.16 Turf Areas
- 2.4.17 Mulch
- 2.4.18 Building Identification Sign
- 2.4.19 Fire Hydrants
- 2.4.20 Fire Department Access

2.5 Building Envelope

- 2.5.1 Brick
- 2.5.2 Concrete Masonry Units
- 2.5.3 Sealants
- 2.5.4 Asphalt Shingle Roofing
- 2.5.5 Slate Roofing
- 2.5.6 Roof Flashing and Sheet Metal
- 2.5.7 Flashing in Masonry
- 2.5.8 Roof Hatches
- 2.5.9 Roof Equipment Curbs
- 2.5.10 Roof Ladders
- 2.5.11 Fall Arrest Anchors
- 2.5.12 Low Slope Roofing
- 2.5.13 Roof Drains
- 2.5.14 Grating
- 2.5.15 Louvers
- 2.5.16 Vapor Retarders

2.6 Building Interiors

- 2.6.1 Gypsum board partitions
- 2.6.2 Suspended Acoustic Ceiling
- 2.6.3 Finish Carpentry
- 2.6.4 Casework
- 2.6.5 Counter Tops

- 2.6.6 Ceramic Tile
- 2.6.7 Resilient Flooring and Base
- 2.6.8 Carpet
- 2.6.9 Seamless Flooring
- 2.6.10 Paint
- 2.6.11 Steel Doors and Frames
- 2.6.12 Wood Doors and Frames
- 2.6.13 Access Doors
- 2.6.14 Overhead Doors
- 2.6.15 Aluminum Entrances & Storefronts
- 2.6.16 Door Hardware
- 2.6.17 Entrance Mats
- 2.6.18 Chalkboards
- 2.6.19 Toilet Compartments and Screens
- 2.6.20 Building Directories
- 2.6.21 Lockers and Benches
- 2.6.22 Fire Extinguisher Cabinets
- 2.6.23 Toilet Accessories
- 2.6.24 Interior Signage
- 2.6.25 Fireproofing
- 2.6.26 Corner Guards

2.7 Furniture

- 2.7.1 Office furniture
- 2.7.2 Fixed Auditorium Seating
- 2.7.3 Blinds

2.8 HVAC

- 2.8.1 General
- 2.8.2 Hydronic piping systems
- 2.8.3 Steam and condensate piping systems
- 2.8.4 Piping identification
- 2.8.5 Refrigeration Systems
- 2.8.6 HVAC Distribution
- 2.8.7 Special Exhaust Systems
- 2.8.8 Unitary Air Conditioning Equipment
- 2.8.9 Humidifiers
- 2.8.10 Terminal heat transfer units
- 2.8.11 HVAC Instrumentation and Controls
- 2.8.12 Energy Management and Controls
- 2.8.13 HVAC sequence of Operations
- 2.8.14 Testing, Adjusting and Balancing
- 2.8.15 Control Air Systems
- 2.8.16 Mechanical Insulation

2.9 Plumbing

- 2.9.1 Domestic Water Supply Piping
- 2.9.2 Protection of Potable Water Supply
- 2.9.3 Piping Identification
- 2.9.4 Domestic Hot Water Heating Systems
- 2.9.5 Insulation
- 2.9.6 Waste and Vent Piping
- 2.9.7 Acid Waste Piping
- 2.9.10 Sump Pump and Sewage Ejectors
- 2.9.11 Compressed Air Systems-General Service Air

- 2.9.12 Natural Gas Systems
- 2.9.13 Plumbing Fixtures

2.10 Electrical

- 2.10.1 General
- 2.10.2 Campus Power Distribution
- 2.10.3 Ductbanks
- 2.10.4 Raceway
- 2.10.5 Manholes
- 2.10.6 Pad Mounted Medium Voltage Switchgear
- 2.10.7 Primary Electrical Transformers
- 2.10.8 Main Electrical Switchboards
- 2.10.9 Medium Voltage Cable
- 2.10.10 Campus Site Lighting
- 2.10.11 Raceway
- 2.10.12 Hand Holes
- 2.10.13 Branch Circuit Wiring
- 2.10.14 Poles
- 2.10.15 Building Power Distribution
- 2.10.16 Motor Control Centers
- 2.10.17 Safety Switches
- 2.10.18 Connection to Motors
- 2.10.19 Secondary Electrical Transformers
- 2.10.20 Electrical Branch Circuit Panel Boards
- 2.10.21 Enclosed Electrical Circuit Breakers
- 2.10.22 Raceway (conduit)
- 2.10.23 Surface Raceway
- 2.10.24 Conductors
- 2.10.25 Boxes
- 2.10.26 Cable Trays
- 2.10.27 Busduct
- 2.10.28 Devices
- 2.10.29 Interior Lighting
- 2.10.30 Light Fixtures
- 2.10.31 Light Controls
- 2.10.32 Emergency Lighting
- 2.10.33 Exit Signs
- 2.10.34 Night lighting
- 2.10.35 Exterior lighting
- 2.10.36 Clock Systems
- 2.10.37 Lightning Protection

2.11 Fire Alarm Systems

2.12 Fire Protection Systems

- 2.12.1 General
- 2.12.2 Wet Pipe Sprinkler Systems
- 2.12.3 Dry Pipe Sprinkler Systems
- 2.12.4 Deluge Sprinkler Systems
- 2.12.5 Stand Pipes
- 2.12.6 Fire Pumps

2.13 Information Technology and Communications

- 2.13.1 General
- 2.13.2 Campus I.T. Infrastructure
- 2.13.3 Building Entrance Terminal Room

- 2.13.4 I.T. Network Closets
- 2.13.5 Cable Support
- 2.13.6 I.T. Outlet Terminations

2.14 Conveying systems

- 2.14.1 Elevators

Part 3 Survey Standards

3.1 Datums and Accuracy

3.2 As-Builts and Deliverables

UNIVERSITY OF MASSACHUSETTS AMHERST PART 1 BUILDING DESIGN GUIDELINES

1.1 Introduction

The goal of the design guidelines is to improve the overall aesthetic character and visual unity of the Amherst campus as a whole. Each new building project will contribute to this goal through an integrated design approach that creates a desirable sense of place and reflects the appropriate scale, image, functionality and integration of building and open space. These design guidelines represent the University's commitment for future buildings to create a more cohesive campus physical environment.

1.2 Historical Context

The physical character of the University of Massachusetts Amherst campus has evolved over more than 130 years with a variety of buildings that reflect the architectural styles of their time. Traditional buildings, small in scale with brick or stone facades and pitched slate roofs, coexist with the larger modern structures that exhibit a wider variety of materials and styles reflecting the technology, aesthetics and economics of their time.

The greatest impact to the physical development of the campus came in the 1960's and 1970's building boom when more than two-thirds of the existing campus space was constructed. This era of development responded to the rapid growth in the demand for public higher education. This era produced buildings designed by renowned architects that stand as modern campus landmarks. However, the buildings were designed without affiliation to the architecture of the past or to other campus buildings constructed in the same period. The result is a campus with collage of disparate architectural styles that reflect the rich history of the institution but that lack a certain visual unity. Furthermore, there is little cohesion between campus buildings and surrounding open space.

The designs of more recent buildings have considered traditional planning concepts in their development. These buildings have blended some attributes of the past with modern design concepts and building systems. The Knowles Engineering building encloses a quadrangle that significantly improves the northern section of campus. The Mullins Center, a large multipurpose arena, uses brick and exterior detailing to respect human scale. In all cases glass is used extensively and in a contemporary manner – as curtain walls, entrances and windows.

Considering the total context of the campus today, buildings in some campus neighborhoods are relatively homogenous in scale, material and form – notably the residential areas – while other areas, especially in the core of campus, are much more eclectic. Buildings of grey and buff concrete surround Haigis Mall, the ceremonial entrance to campus; the Northeast dorms are red brick with painted white trim; the Sylvan dorms are clad in a much darker brick. Much of the campus is comprised of three-to-four-story buildings, punctuated with taller towers that create a skyline recognizable from a distance.

1.3 Principles

The purpose of a campus is to bring together diverse people and their ideas in an environment that creates potential for intellectual and social exchange. Both its buildings and its open space define the physical character and quality of a campus. The design intent for both building and landscape projects should include promoting a sense of community derived from actively shared spaces that provide enriching experiences of both planned and chance encounter.

The Amherst campus is committed to improving the visual unity of the campus as a whole. Each new building project should be sited, designed and oriented to improve the image, sense of place

and functionality of the campus. The following principles should guide the design of campus buildings.

1. Buildings and Spaces that promote Intellectual and Social Exchange: Comprised of exterior spaces (including streets, walkways, greens, courtyards, plazas, gardens and playing fields) and interior spaces (lobbies, atriums and internal connectors), community space has the potential to weave together the diverse elements for the campus and maximize the opportunities for intellectual and social exchange. Public spaces should be generous, prominent and easily accessible, providing places for conversation, relaxation and orientation. While there will always be pressure to maximize the proportion of dedicated spaces in buildings, their success will ultimately depend upon balancing the public and private spaces.
2. Respect for Context: The campus, as a physical entity is perceived at multiple levels – as a whole, as a grouping of areas or districts, and as a variety of individual pieces. New buildings should be effective at all levels, contributing to a sense of community and cohesiveness as well as being an individually strong work of architecture. Respect for context implies sensitivity to scale, materials, pattern and form without dictating strict adherence to any particular style. New facilities should be sited and designed in a manner so as to blend with their surroundings in scale, color and proportion. In addition, most campus buildings are seen from many vantage points – from the street, from pedestrian paths through the campus and, for lower buildings, from above. Buildings should therefore be designed so that they enhance adjacent buildings, streets and pedestrian paths.
3. Functionality: Campus buildings must effectively meet the programmatic needs of its users, both spatially and environmentally. For a campus building that is intended to last 50 years or more, it needs to be designed for serviceability over time. It should be designed for flexibility and adaptability. As user needs and technological requirements evolve over time, the building should be able to accommodate some level of adaptation and reconfiguration without exorbitant expense or structural modification. Whenever possible, a building should be designed in such a manner that it could accommodate an addition or additions over time.
4. Economy: As a state-supported institution with many important programs and many pressing needs, it is important that buildings are constructed in a cost-effective manner. With the typically constrained budgets of UMass capital projects, there is always pressure to economize on the first cost of a building. As an owner and operator of campus buildings, the University's focus, to the extent practical, is to design buildings that are economical over their life-cycle, not simply the lowest first cost. Utilizing a life-cycle approach to cost analysis, the most beneficial decisions over the long term may not be the least expensive first cost options. Careful analysis and decision-making are required to insure that the University receives the greatest possible value for the funds expended.
5. Quality: New buildings are major undertakings requiring significant funding both to construct and to operate. They take a long time to build, are intended to last for decades (or even centuries) and often have a profound impact on the overall campus landscape. Therefore it is essential that they be constructed to the highest standards of quality possible within the funds available. This may, at times, result in building less square footage in order to maintain the desired level of quality. The standards of high quality will affect material selections, systems choices and design aesthetics. This sense of permanence and quality has a significant impact on prospective students, faculty and staff when they are considering joining the University community.
6. Sustainability: Campus buildings are constructed to last a long time. The long-term operating costs of these buildings far exceed the original cost of construction.

Sustainability is meant to include durability and maintainability as well as concepts of “green” building. Extending the renewal cycles for building materials and reducing the consumption of energy and water have benefits for the natural environment, the quality of the campus built environment and the University’s finances. The intent is to develop buildings that require less maintenance and operational investment over time while continuing to serve the needs of users and enhance the aesthetics of the campus.

1.4 Building Siting

New building design should pay attention to the creation of new outdoor spaces and the reinforcement and enhancement of existing spaces and pathways. Some of the most successful building projects on campus were designed using traditional planning concepts such as creating appropriately scaled and usable quadrangles and courtyards. For the most part, the campus has not developed with a traditional quadrangle approach – buildings arranged in a rectilinear manner so as to frame courtyards, often with one connecting to another. The Engineering quadrangle and the Northeast Residential Area are two areas that specifically follow this pattern. However, there are other significant outdoor spaces, varying in scale and degree of enclosure – examples include Durfee Garden, Whitmore-to-Machmer corridor and the campus pond and its environs. The buildings are often organized in a more urban manner along major paths and roads, thereby defining strong edges and linear spaces. New buildings present opportunities to fill in gaps in the definition of these linear spaces and to create new types of spaces and enclosures. Through careful siting and design of infill projects, the overall experience of the campus can be enhanced.

When considering siting options for a new building project, the following priority order should be generally followed:

1. Seek to identify an underutilized and/or decaying existing building – suitable in size, location and structure -- that could be renovated to meet the needs of the new program.
2. If no renovation possibility exists, consider an addition to an existing facility, possibly linked with renovation work to the existing structure.
3. If neither renovation nor addition is feasible, consider an infill site on campus. This includes open space within the campus core (whether green or paved) as well as the possibility of removing obsolete facilities in order to make space available for the new project. Preference should be given to infill sites that have already been developed over virgin sites.
4. If no other possibility exists and if land is available, consider adding a new structure at the periphery of the campus.

Through the application of this approach, the campus will become richer, more complex and a more desirable environment.

1.5 Heights of Structures

Building design should consider the scale of surrounding structures and the streets and public ways that are adjacent to them. While there are no hard and fast height restrictions, consideration should be given to human scale when establishing building height particularly where the building is fronting on pedestrian ways. In cases where buildings must be significantly taller than surrounding structures, the use of set-backs should be considered to lower portions of the building facing streets and pedestrian ways. Care should be taken to limit the casting of shadows on open spaces or important walkways.

Wherever possible, the design of new structures should try to mitigate the undesirable impacts of existing tall structures including buffering ground level walkways and open spaces from winds.

1.6 Exterior Cladding Materials

The selection of exterior cladding material(s) plays a significant role in how a building relates to its context and in the creation of visual unity on the campus. Color, scale, texture and durability of the material affects the perception of how attractive, enduring and contextual the building is as a whole. The Amherst campus has a large number of brick buildings that defines its general character through a sense of permanence and richness and that have endured the test of time. While there is no hard and fast rule, the campus has a strong preference for brick as the material of choice for exterior cladding. Materials complimentary to brick such as natural stone can also be used successfully. The use of these materials should achieve a similar durability and richness through consideration of texture, human scale and the application of appropriate details. The intent is not to restrict creativity but to improve the visual unity of the campus as a whole.

The use of materials that are new to the market will only be considered if the designer can provide test data sufficient to convince the University's facilities staff of their durability and reliability. Sustainable materials, systems and processes should be given special consideration wherever possible within the parameters of these guidelines.

1.7 Connection Between Inside and Outside

Building entrances and adjacent lobby spaces are frequently the meeting and gathering places of those using buildings and should be designed to encourage interaction. They should be readily visible, prominent and contribute to the life and activity of the pedestrian environment. Where buildings front on public streets, the design should include public entrances and attractive, open streetscape facing the street.

The academic activities of the University, in so far as they are compatible, should be visible to passers-by. Windows should be placed to provide light and views to internal spaces, but also to give walks and streets the security and richness that derives from the visibility of adjacent activity. The use of highly reflective or deeply tinted glass should be avoided.

1.8 Commitment to Accessibility

The University is committed to providing equal access to all buildings for those with disabilities, and to doing so in a dignified manner. All new construction must comply with the Massachusetts Architectural Access Board Regulations (521 CMR) and Americans with Disabilities Act (ADA) guidelines. Renovations of historic buildings should seek to improve access for the disabled in a manner compatible with their historic integrity.

1.9 Functional and Mechanical Facilities

Areas devoted exclusively to building loading and services, to the removal of trash, or to mechanical equipment should be designed so that their visibility from public areas, including walkways, is minimized. Rooftop mechanical equipment should be enclosed in structures that are integrated into building design. Acoustic control should be included as required to ensure the quality of the surrounding environment.

1.10 Responsible Use of Energy and Natural Resources

The University has adopted the following green building design policy establishing a basis for incorporating the principles of environmental stewardship, energy efficiency and resource conservation into the design of new campus buildings and major renovation projects. Its goal is to pursue holistic, integrative and collaborative design and construction practices that significantly reduce or eliminate the negative impact of buildings on the environment and occupants.

UMass Amherst commits to a resource and energy conservation program based on continual improvement in the design and construction of new buildings and major renovations. UMass Amherst will:

- Design to minimize life cycle costs, including the use of materials that will maximize durability and longevity;
- Use resources efficiently by designing buildings that minimize energy and water use and maximize use of natural daylight, exceeding code minimums where appropriate and feasible;
- Use environmentally preferable products, including (but not limited to) those without toxic ingredients and those which contain recycled content;
- Create healthy indoor and outdoor environments for building occupants, workers and communities;
- Minimize adverse impacts that site development may have upon natural and built systems;
- Explore and act on opportunities to employ renewable energy technologies;
- Follow, to the extent practicable, guidelines for the construction of green buildings, including the Division of Capital Asset Management Sustainable Design Program and the U.S. Green Building Council's LEED Rating System;
- Integrate building commissioning into the study, design and operations of campus buildings; and
- Provide training to all building occupants on energy conserving practices relevant to the building's operation.

2.1 INTRODUCTION

2.1.1 PURPOSE OF THE BUILDING CONSTRUCTION GUIDELINES

These guidelines were developed to present the University's preferences and criteria for the design and construction of campus facilities.

These standards are not intended to limit input from the design professionals or prohibit the use of alternative systems, methods or devices not specifically prescribed. Alternate solutions shall demonstrate at least the equivalent to, or superior to, the prescribed requirements in this document with regards to quality, strength, effectiveness, fire resistance durability and safety.

Facility design and construction at a minimum shall comply with the requirements of the Commonwealth of Massachusetts State Building Code. If the University standards exceed the Code, the design shall comply with the University requirements.

2.1.2 DESIGN TEAM

The University expects the designers to use a team approach to the design process. Rather than working in isolation in their own areas of expertise, the team members shall use a multidisciplinary approach, in which the interrelated impacts of design, system and materials are recognized. All team members-owner representatives, building users, architects, mechanical and electrical engineers, lighting designers, interior designers, and others- are expected to share their specialized expertise and coordinate their individual design efforts to achieve a well- functioning, integrated project.

2.2 SITE PLANNING PRINCIPLES

2.2.1 MAJOR ROADS

Major campus roads are defined as the primary vehicular routes around and through the campus. These include the ring road system and the major entrance routes to the campus.

- Major campus roads should be designed as parkways, with trees and landscaping lining the edges of the road.
- Low impact traffic calming methods should be considered along major roads, including varying paving surfaces at important intersections, roundabouts, neck downs at major pedestrian crossings and roadside landscaping. These traffic calming methods should be balanced by the need for efficient transportation movement, winter snow plowing and long term maintenance of the road system.
- Roads should be designed to have minimum safe lane widths to encourage slower traffic speeds while still providing safe travel.
- Allow for generous sight lines at intersections and at crosswalks. Do not install landscaping elements that will obscure sight lines.
- Sidewalks should be provided along the entire length of road on at least one side, and on both sides of the road where possible.
- Major roads should be separated from pedestrian paths by granite curbs and elevation changes.
- Accommodations for bike lanes and other alternative transportation methods should be provided either within the road shoulders or immediately adjacent to the road.

2.2.2 MINOR ROADS

Minor roads are those that provide access to the campus within the ring road, to campus parking lots and other destinations outside of the ring road. They are characterized by one-or-two lane widths and slow speeds.

- Minor roads should be separated from pedestrian paths by granite curbs and elevation changes.
- Road widths should be minimized to encourage reduced speeds while not sacrificing vehicular or pedestrian safety. Traffic speeds should not exceed 15 mph on the inner road system.
- Traffic calming methods should be designed at regular intervals along minor roads, including crosswalk tables, varying paving surfaces near high-use pedestrian areas, neck downs and roadside landscaping. These traffic calming methods should be balanced by the need for efficient transportation movement and other issues such as efficient plowing in the winter and long term maintenance of the University's road system.

2.2.3 SERVICE ACCESS

Service access routes allow campus vehicles and outside vendors to access campus buildings for deliveries and service, as well as temporary short term (15 minute) parking spaces.

- Appropriate service access should be accommodated in the design of all new campus buildings. Service access should be typically consolidated to only one location for each building, possibly two for larger buildings.

- The sights, sounds and possible smells of the service location should be minimized from pedestrian pathways through the use of landscaping, topography or other visual barriers.
- Service access roads should be separated from pedestrian travel

2.2.4 PARKING AREAS

The current University policy is to limit the number of parking spaces within the campus core to service and handicapped parking and concentrate all other parking in perimeter lots. A limited number of metered spaces are also provided within the campus core for short term parking needs.

- The layout of surface parking lots should allow efficient plowing methods and provide locations to store snow.
- Whenever possible, lots should be double-loaded for the most efficient parking layout.
- Where parking lots border major sidewalks or campus roads, the edges of lots should be landscaped to provide a buffer zone and vegetative screening.
- The interior of small lots (under 300 spaces) should not include islands or isolated plantings. Large lots (greater than 300 spaces) can incorporate wide islands with appropriately-scaled plantings to soften the visual effect of the lot.
- Lots should be appropriately lit to increase safety. Lights should be directional to minimize glare and light pollution.
- Granite curb should be installed along the edge of all lots.
- Major parking lots along the campus periphery should have a convenient shuttle stop nearby.
- Entryways and vehicular circulation should be easily accessed with safe viewing angles for oncoming traffic, and clear signage should occur at each main entrance.
- Lots should have the appropriate number of service and handicapped spaces to accommodate the surrounding buildings.
- Pedestrian access to and from lots should be carefully considered to minimize vehicular-pedestrian conflicts.
- Consider using natural drainage systems where safe or porous surfaces to maintain local groundwater.

2.2.5 MASS TRANSIT

UMass Transit Services should be involved in any bus stop design and in the location of key transit exchanges for the most efficient service.

- Major campus buildings that service students, including dorms and dining commons, should have a nearby transit stop within 500 feet of the entrance.
- Bus pull-offs should be provided at all on-campus bus stops to allow the loading and unloading of passengers out of the traffic flow. These pull-offs should include enough space for two busses to be stopped at the same time.
- All on-campus bus stops should include shelters to offer waiting riders protection from the weather. Bus stops should be well lit and clearly signed and a help phone should be located nearby. Check with UMass Transit Services for additional specific bus stop requirements.

2.2.6 PEDESTRIAN TRAVEL

The UMass campus layout was developed to prioritize pedestrian travel over other transportation methods. Currently, the campus sidewalks crisscross the campus with an inadequate sense of purpose or hierarchy.

Path location should generally follow the natural “desire line” between destinations, with the recognition that in most cases 90 degree turns are not comfortable and therefore not realistic for pedestrian movement. Landscaping can be used to encourage a certain pedestrian movement, but will not be adequate to force an action that does not approximate the desire line.

Major components of the pedestrian system are the major pathways, the standard pathways, plazas, and building approaches & entrances.

2.2.7 MAJOR PATHWAYS

A major pathway will be the primary desire line between two or more major destinations. Often these paths will lead to the entrances of major buildings, to and from heavily used transportation centers like bus stops, large parking lots, and the parking garage, or be a conduit that provides links to many other paths. Major paths act as the spine of the pedestrian system.

- The width of any particular major path is a factor of the amount of traffic they accommodate and the scale of the landscape they intersect. Most major pathways should be 10-12 ft wide. In cases where they accommodate an unusually large number of people or multiple transportation types, they can be much wider. In no cases should a major path be less than 8 feet wide.
- A walkway might need to double as a fire lane, in which case it should be widened appropriately.
- The intersections of major pathways, especially those in the core campus area, should be emphasized and should accommodate seating areas, special plantings, and wayfinding elements.
- Major paths should be concrete, with edges of a contrasting material. They should be designed to blend with other major campus paths to make a cohesive whole.
- All major paths should accommodate the use of alternative wheeled transportation such as bicycles, roller blades and wheelchairs.
- All major paths should be handicapped accessible, and should not have stairs.
- Trash & recycling bins should be located along the path at regular intervals and at intersections of major paths.
- Help phones should be installed at strategic locations along major paths.
- Major paths should be well lit.
- Paths should merge when approaching roads to condense the number of street crossings to a minimum. When major paths cross vehicular roads, it should always be at a right angle with an open view of the street.
- If a bus stop is near a pedestrian street crossing, the crossing should be behind the parked bus if possible.
- Service drives should not be alongside major paths. Similarly, service crossings of major paths should be minimized.

2.2.8 STANDARD PATHWAYS

Standard pathways accommodate fewer pedestrians than major pathways. They might connect a major destination with a minor destination, or lead to a major pathway, or to a secondary entrance of a building.

The campus landscape is currently crisscrossed with standard paths. Project designs should strive to reduce the number of paths where possible to clarify the means to reach one's destinations, as well as allow larger areas of landscaping. However, by minimizing the number of paths, it becomes more critical to evaluate the location of each path, maximizing its efficiency to reach the desired destination.

- The preferred width of a standard pathway is 8 ft wide. In some limited cases where the pathway is not to be plowed in the winter, it can be reduced to a minimum of 4 feet wide. However, it should be assumed that most standard pathways will require plowing by a truck with an 8 foot plow blade.
- Standard pathways should follow desire lines to their destinations. In cases where the desire line is not appropriate, an alternative route can be built with extensive landscaping features to encourage the use of the alternative route.
- Most standard pathways will accommodate slower pedestrian speeds than major pathways, and the surrounding landscape should accommodate smaller, more intimate scaled features.
- Standard pathways should be well lit, using light poles having a height that is intimate in scale.
- Stairs should be discouraged on standard pathways.
- Standard pathways should accommodate trash & recycling bins near building entrances.
- Where service drives intersect or parallel standard pathways, the service drive should be integrated into the design of the pathway while still maintaining adequate space for both functions to co-exist. Service vehicles should never park directly on pathways, but at designated service parking spaces located adjacent to standard paths with appropriate landscaping to minimize the negative visual effect to pedestrians.

2.2.9 PLAZAS

Plazas function as paved areas for gatherings primarily in areas of heavy and frequent use. Plazas usually exist near building entrances, or at the intersections of major pathways. Plazas are an essential element to provide focus to the pedestrian experience.

The design of plazas should be appropriate for the desired activity – sheltering trees or shrubs located close together to slow down traffic and provide quiet areas, open paved areas for large rallies, and benches in areas for resting and talking in smaller groups. These various activities can possibly occur within one plaza if the space is large enough to accommodate it and a hierarchy of use is well defined.

- Clear definition of space can be accomplished through plantings, seating, elevation changes, or other landscape elements.
- The ability to move through plazas is an important design element and should be based on the desired primary activity.

- The relationship between the plaza and the surrounding buildings and significant landscape features should be an important consideration in the design.
- Stairs should be minimized on plazas.
- Views to and from plazas should be accommodated in the design.
- Texture of plaza surfaces should be used to define space and suggest intended activity.
- Sculpture or other “hard” elements should be interactive and stimulating.
- Seating arrangements should consider a variety of activities – intimate discussions, people-watching, quiet studying, group gatherings.
- The design should consider the microclimate of area, including sun exposure and seasonal conditions.
- Plantings can be an effective means to bring a human scale and intimacy to a plaza, as well as defining space and providing shade.
- Plaza should be well-lit and attractive space in the evenings as well as the daytime.
- On large open plazas, power should be provided for the occasional outdoor event.
- An appropriate number of trash & recycling bins should be located in strategic places around the plaza.
- Slopes of plazas and other paved open space or gathering areas should be 1% minimum for drainage, but not more than 2%.

2.2.10 BUILDING APPROACHES AND ENTRANCES

Public entrances to building should be easily found and accessed and be a welcoming feature on the campus.

- Appropriately-scaled landscaping should frame the building and lead to the entrance doors.
- Buildings should have at least one handicapped accessible entrance, ideally the main entrance, which provides easy access to the elevator.
- Building signs should be located near the main entrance of the building in view of the closest major walkway.
- Small landscaped areas should be located near the building entrance to serve the building occupants during lunch breaks, between classes, etc. These areas should be relatively intimate in scale and should frame views out of the space.
- Service entrances should not be located in view of the main entrances, but also should not be difficult to access for deliveries.
- A minimum of 4 bike spaces should be provided near the primary building entrances, with more for larger buildings accommodating greater numbers of people. Bike racks could be located at several doors of larger building.
- Outdoor transition space should be designed between the building approach and indoor lobbies. This transition space should include materials that relate to the materials used in the building interior or on the exterior walls. This space should also provide some protection from rain, sun, and wind.

2.2.11 TREES AND SHRUBS

Landscape projects should strive to create cohesion in the campus outdoor spaces through the careful removal of some trees and addition of strategically-located plantings.

- Certain trees having unusual characteristics or distinctive features may be planted as a focal point in the landscape, but this situation should be minimized so as to not reduce the impact of other focal trees on the campus.
- All trees and shrubs shall be non-invasive species as listed by Massachusetts Invasive Plant Group (MIPG). The University does not irrigate its landscape, so plants chosen for these open areas should be hardy for the Western Massachusetts climate.
- To reduce maintenance needs, the campus encourages the use of plants that do not require heavy ongoing pruning and that are not likely to snag unsightly trash.
- Trees should not be planted within 10 feet of steam lines, electric lines, water, sewer or drainage lines.
- Trees or shrubs that produce fruit should be located far enough from pedestrian sidewalks that the fruit does not fall on sidewalks.

2.2.12 LANDSCAPED OPEN SPACE

- Campus open spaces should be linked together as part of an overall campus landscape network.

2.2.13 LANDSCAPE ADJACENT TO BUILDINGS

Plantings should not mask building entrances, but enhance and focus attention to the entrances and other architectural features.

- Planting locations for trees and large shrubs should avoid the location of underground utility lines.
- Large plantings should be located far enough from building walls so to allow for air movement.
- Plantings should not completely obstruct views from building windows. Plants located near windows should be near enough to filter glare and bright sunlight, but distant enough from windows to maintain views.
- Plantings should not be located in a way to create hazardous conditions, and should not create dark pockets near entrances or along sidewalks at night.
- To protect building façade from lawnmower damage provide mulched planting beds or gravel borders around buildings.

2.2.14 LIGHTING

- Building entrances and campus wayfaring signs should all be well lit.
- Ground mounted up-lighting should be avoided to minimize maintenance and vandalism.
- Plants should not interfere with the effectiveness of the lighting.
- If a bicycle rack layout includes two or more aisles, the design should assume a bike length of 72 inches, and allow a minimum of 48 inches for aisle space. Aisle width should be increased to 72 inches in high traffic bicycle parking areas where many

racks might be located, such as the Student Union, Campus Center, or DuBois Library. These large parking areas should also have at least two entrances to ease congestion during times of high turnover.*

2.2.15 SNOW REMOVAL

Due to the extensive amount of walks, roads and parking areas, the University uses trucks equipped with snow plows for snow removal. Most walks should be a minimum of 8'-0" wide to allow for plowing. The layout of parking lots, plazas, courtyards, and walkways to building entrances should allow for efficient plowing methods and provide location for the storage of snow.

2.3 BUILDING PLANNING PRINCIPLES

2.3.1 ACOUSTIC STANDARDS

The following outlines base performance criteria for designing buildings for the University.

Airborne Sound Transmission: Prevent unwanted noise through wall partitions. Walls of the listed space type should minimally achieve the following STC ratings:

Impact Sound Transmission: Design structural components which eliminate or dampen impact noise. Floor/Ceiling assemblies shall minimally meet the following IIC rating for the listed space types.

Space	STC Rating	IIC Rating	Space	STC Rating	IIC Rating
Classroom	55	75	Studio/Lab	Depends on use	80
Office	50	65	Performance Space	75	100
Conference Room	50	75	Residential Unit	65	80

Sound Absorption: Where appropriate, use sound absorptive materials to aid in controlling room cavity acoustics. Materials shall be rated for Noise Reduction Coefficient (NRC) ratings for qualifying absorption performance

2.3.2 TRASH AND RECYCLABLES REMOVAL

Removal of trash and recyclables in each building is provided by the Custodial Services department. The University uses 2 separate recyclables containers: "white and colored office paper" and "bottles and cans". Each classroom, office and similar space is provided with a separate trash and recyclable containers. Custodians empty the trash and recyclable containers into "large toters" and then wheel these units out of the building to an enclosed trash and recyclable corral. Weekly, the trash and recyclables trucks empty the toters in the corrals. Enclosed corral shall be sized for storage of full and empty toters, accessible to the service entrance off the building and accessible to the service road.

2.3.3 CAMPUS MATERIAL DISTRIBUTION SYSTEM

Materials that are not delivered directly to campus facilities by national carriers such as Fed Ex, UPS, etc are delivered to the Physical Plant receiving docks. Campus trucks then deliver these materials to each building and deliver the packages directly to the end users. Provide a receiving dock with dock leveler at the service entrance to the building. Receiving dock shall be easily accessible to freight or passenger elevators.

2.3.4 GENERAL ROOM REQUIREMENTS

The following information is provided to assist designers in understanding the requirements for spaces within campus facilities. This information does not replace proper programming and evaluation of the users needs.

2.3.5 CLASSROOMS

General:	Design team shall verify the requirements of this space with representatives of the user group and the Registrar's office.
Floor slope:	Larger classrooms (100 occupants) sloped floors are preferred (1:10 slope)
Sound:	Sound control between rooms required
Finishes	Flooring- resilient flooring Walls-gypsum board, painted Ceiling- suspended acoustic tile
Electrical:	Lighting- general illumination Lighting control- multiple switching and automatic controls Outlets- quad receptacle centered on front wall below chalkboard. Duplex receptacle provided on each remaining wall.
Environment:	Heating, cooling and ventilation air required
Accessories:	Chalkboards/marker boards- extend over most of the wall at teaching end of room. Window blinds-control daylight penetration and darken space for projection equipment Project screen-recessed ceiling type, manual or electrically operated, adequately sized for viewing from the rear of the room.
Furniture:	Desk and chair for faculty Tablet arm chairs
Voice/data:	One receptacle located on the front wall below chalkboard. Additional voice/data receptacle located at rear of room or at ceiling mounted projection equipment.

2.3.6 CONFERENCE ROOM

General:	Design team shall verify the requirements of this space with the user representatives.
Sound:	Acoustic separation required around room.
Finishes:	Flooring-carpet Walls-gypsum board, painted Ceiling- suspended acoustic tile
Electrical:	Lighting-recessed or direct-indirect pendant Lighting control- multiple switches, dimming, and automatic controls Outlets-minimum one per wall
Voice/data:	Receptacles located near AV equipment
Environment:	Heating, cooling and ventilation required
Accessories:	Window blinds

Marker or chalkboards
 Tack rails or surfaces
 Project screen
 Audio visual equipment in storage cabinet or closet

Furniture: Conference table and chairs

Equipment: AV equipment and storage closet or cabinet

2.3.7 CORRIDORS

Finishes: Flooring-terrazzo, tile or resilient flooring
 Walls-gypsum board, glazed masonry
 Ceiling- suspended acoustic tile

Electrical: Lighting-general illumination, recessed or direct-indirect pendant
 Lighting control- multiple switching
 Outlets- every 50 feet along corridor and at vending machines

Environment: Heating, cooling and ventilation required.

Voice/data: Receptacles located at vending machines

Accessories Floor directories
 Room signage
 Tack boards
 Display cases

2.3.8 CUSTODIAL SUPPLY ROOM

General: Design team shall verify the requirements of this space with representatives of the Physical Plant Custodial Department
 Provide one custodial supply room per building, minimum size: 150 SF

Finishes: Flooring-resilient flooring
 Walls-gypsum board or CMU, painted
 Ceiling- exposed construction, painted

Electrical: Lighting- general illumination
 Lighting control-manual switch, automatic control
 Outlets-convenience receptacle with ground fault circuit interrupter

Environment: Heating and ventilation air

Accessories Shelving for supplies
 Floor sink with hot and cold water

2.3.9 CUSTODIAL CLOSETS

General: Design team shall verify the requirements of this space with representatives of the Physical Plant department.

Provide one custodial closet per floor, minimum size: 30 SF

- Finishes: Flooring-concrete painted
Walls-gypsum board or masonry, painted
Ceiling- exposed construction, painted
- Electrical: Lighting- general illumination
Lighting manual switch, automatic control
Outlets-convenience receptacle with ground fault circuit interrupter
- Environment: Heating and ventilation air
- Accessories: Shelving for supplies
Floor sink with hot and cold water, hose connection
Tool board for hanging mops and brooms

2.3.10 ELECTRICAL ROOMS

- General: Design team shall verify the requirements of this space with representative of the Physical Plant department.

Electric rooms should be stacked vertically.
- Finishes: Flooring-concrete, sealed
Walls-gypsum board, concrete, masonry, painted
Ceiling- exposed construction, painted
- Electrical: Lighting-general illumination
Lighting control-manual switches, automatic controls
Outlets-convenience outlets
- Environment: Heating and ventilation air

2.3.11 ENTRANCE LOBBIES

- General: All public entrances shall be accessible to physically challenged individuals. A clear hierarchy should be visible in the treatment of spaces and corridors to lead visitors from the entrance lobby to the main corridors and finally to departmental corridors. Entrance lobbies are usually the focal point of the building. These spaces have a high level of visibility and public use and warrant a higher degree of visual detail and finish.
- Finishes: Flooring-terrazzo, tile or other durable moisture resistant material
Walls-gypsum board, painted
Ceiling- suspended acoustic tile
- Electrical: Lighting-general illumination, recessed or direct-indirect pendant, cove
Lighting control- multiple switches, automatic controls
Outlets-minimum one per wall
- Environment: Heating and cooling-heating, cooling and ventilation air
- Accessories: Building and floor directories
Room signage

Floor mats
 Display cases
 Tack boards

2.3.12 LOADING DOCK

General: Design team shall verify the requirements of this space with representative of the Physical Plant department and building users.

Loading docks should be located for access by service vehicles and separated from the public building entrances. Dock should be convenient to freight elevators and building corridors.

Finishes: Flooring-concrete, sealed
 Walls-gypsum board, concrete, masonry, painted
 Ceiling- exposed construction, painted

Electrical: Lighting-general illumination
 Lighting control-manual switches, automatic controls
 Outlets-convenience outlets

Environment: Heating and ventilation air

Equipment: Dock bumpers and seals, lights

2.3.13 MECHANICAL ROOMS

General: Design team shall verify the requirements of this space with representative of the Physical Plant department.

Sound: Sound separation required

Finishes: Flooring-concrete, sealed
 Walls-gypsum board, concrete, masonry, painted
 Ceiling-exposed construction, painted

Electrical: Lighting-general illumination
 Lighting control-manual switches, automatic controls
 Outlets-convenience outlets

Environment: Heating and ventilation air

Accessories: Bulletin boards, steel shelving

2.3.14 PRIVATE OFFICES

Finishes: Flooring-carpet
 Walls-gypsum board, painted
 Ceiling- suspended acoustic tile

Electrical: Lighting-general illumination, recessed or direct-indirect pendant
 Lighting control- multiple switches, automatic controls
 Outlets-minimum one per wall

Sound: Sound separation required

Voice/data: One voice/data outlet located near desk

Environment: Heating, cooling and ventilation air

Accessories: Window blinds

Furniture: Desk and chair
Side chair
Conference table and chairs in administrator's office
File cabinet(s)
Book case(s)

2.3.15 STAIRS (enclosed)

General: Internal stairways use for general vertical circulation and emergency egress should have finishes consistent with the floors being served.

Finishes: Flooring at landings and treads-resilient flooring, non-slip nosing
Walls-gypsum board, masonry, painted
Ceiling- gypsum board soffits on underside of stair runs, acoustic ceilings at landings
Handrails- aluminum rail, aluminum or painted guard

Electrical: Lighting-general illumination
Lighting control- manual switches
Outlets-one located on landings at floors

Environment: Heating and ventilation air

2.3.16 STAIRS (open)

General: Open stairs that connect the lobby with adjacent floors should have finishes consistent with the lobby and floors being served.

Finishes: Flooring at landings and treads-resilient flooring, non-slip nosing
Walls-gypsum board, masonry, painted
Ceiling- gypsum board soffits on underside of stair runs, acoustic ceilings at landings
Handrails- stainless steel or aluminum rail, aluminum or stainless steel guards

Electrical: Lighting-general illumination
Lighting control-manual switches
Outlets-one located on landings at floors

Environment Heating and ventilation air

2.3.17 TOILET ROOMS

General: Design team shall verify the requirements of this space with representatives of the Physical Plant department.

Finishes: Flooring-ceramic tile
Walls-ceramic tile

Ceiling-suspended gypsum board, painted

Electrical: Lighting-general illumination and task lighting at lavatories
Lighting control-manual switches, automatic controls
Outlets-convenience receptacles with ground fault circuit interrupters

Environment: Heating and ventilation air

Accessories Mirrors
Paper towel dispense
Toilet paper dispenser
Sanitary napkin dispenser
Trash receptacle provided by Umass
Toilet partitions
Soap dispensers
Hose connection for wash down
Floor drain

2.3.18 TRASH AND RECYCLING ROOM

General: Design team shall verify the requirements of this space with representative of the Physical Plant department.

Trash and recycling rooms shall be large enough to sort recycling of paper, glass and metal containers, minimum of 200 SF.

Finishes: Flooring-concrete, sealed
Walls-gypsum board, concrete, masonry, painted
Ceiling- exposed construction, painted

Electrical Lighting-general illumination
Lighting control-manual switches, automatic controls
Outlets-convenience outlets

Equipment: Floor drains, hose bibb

Environment: Heating and ventilation air

2.3.19 TELCOM CLOSETS

General: Refer to Information Technology and Communications guidelines

2.4 SITE CONSTRUCTION

2.4.1 DRAINAGE SYSTEMS

Storm drainage shall be designed to handle a 10 year storm. Every effort shall be made to incorporate stormwater detention and to maximize stormwater retention. Detention shall be designed for a 10 year storm and the detention overflow shall accommodate a 100 year storm. Stormwater temperature attenuation shall be a design consideration for discharges into Wetlands Resource Areas or their Buffer Zones.

Storm drain pipe shall be PVC SDR 35 and type 1, schedule 80 PVC pipe for drainage and sub-drainage applications.

Infiltration trench material shall be washed durable stone shielded by filter fabric placed above the drain pipe. Infiltration trenches shall be constructed with a six (6) inch sump beneath the drain pipe and running the full length of the perforated pipe.

Catch basin structures shall be pre-cast concrete with oil separators/hoods. Provide manhole ladder rungs. To the extent possible, catch basins used to drain walkway surfaces shall be located within or immediately adjacent to the walkways to facilitate snow removal.

Structure castings shall be iron castings, class no. 30 for gray iron castings. All manhole covers shall have the word "DRAIN" or "SEWER" cast into cover. Round catch basin and manhole covers are preferred since they can not fall into the structure. Square openings in the catch basin covers are preferred.

2.4.2 SITE GRADING

All finished grades shall direct surface water away from buildings and structures. All low points shall be designed with a drain. Turf areas shall have a slope of no more than 3:1 and shall not be less than 1%, 2% is a preferable minimum slope. Slope greater than 3:1 must be planted with ground covers or otherwise constructed to control erosion.

The existing grade within the 'tree drip line' shall not be regarded or paved.

Swales and open drainage courses shall be graded with a minimum slope of 1% to prevent standing water.

2.4.3 WALKWAYS

Walkways shall be differentiated from vehicle ways by means of materials and elevation. Walkways shall be made of 4 inch, reinforced concrete, broom finished with a 6" processed gravel base. In areas of known high ground water, the sub base shall be graded to drain and a perforated 6" drain installed and connected to the campus drainage system. An alternative surface treatment for walkways may be proposed such as unit pavers. In such cases, the sub base shall be modified appropriately.

All walkways shall be designed to meet accessibility requirements regulations. Sidewalks shall be constructed with a maximum grade of less than 5% with a 2% cross slope

2.4.4 RAMPS AND STAIRS

Ramps, instead of stairs, are preferred on campus walkways and entrances to buildings. Stairs and steps shall be avoided to reduce the need for manual labor to remove snow. Where stairs are necessary, cheek walls shall be incorporated to prevent erosion onto the treads.

2.4.5 RAILING

Exterior railings shall be aluminum or stainless steel. Railings shall be set into metal sleeves and grouted to shed water.

2.4.6 CURBS AND GUTTERS

Standard curbing shall be vertical granite per the Mass Highway Standard Specifications for Bridges and Highways. The minimum reveal shall be 6 inches, however, at bus stops the minimum reveal shall be 4 inches. Granite curbing dimensions shall be a minimum of 6 inches by 18" with smooth split face and sawn top. All curbing shall be set in concrete.

2.4.7 CROSSWALKS AND CURB CUTS

Crosswalks shall be installed perpendicular to the centerline of the roadway. All curb cuts shall be accessible and constructed of reinforced concrete. Curb cuts shall be designed in accordance with Mass Highway Standard Specifications for Bridges and Highways.

2.4.8 ROADWAYS

Roadways shall be designed with 12 inches of compacted gravel base, a 3 inch asphalt Binder Course and an 1 ½ inch Top Course as specified in the Mass Highway Standard Specifications for Bridges and Highways. Standard curbing shall be granite.

2.4.9 PARKING AREAS

Standard parking areas shall be paved with 8 inches of compacted processed gravel, 1 ½ inches of Binder Course and 1 ½ inches of Top Course as specified in Mass Highway Standard Specifications for Highways and Bridges. Parking lots shall be lighted for pedestrian safety. Curbing shall be granite.

Parking stalls shall be 9 ft. by 18 ft with 24 ft access isles. 90-degree is preferred. Grades within the parking lot shall not exceed 6%. Parking stripping shall be 4" wide, white latex highway paint per Mass. Highway Standard Specifications for Highways and Bridges.

Accessible parking is a requirement of all projects. Accessible parking shall be provided near the building entrance and have the international symbol of accessibility painted on the pavement (blue background with white figure) and sign located at the head of each space.

2.4.10 WASTE/RECYCLEABLES CORRALS

Facilities which require the outdoor storage of trash/waste totes shall be provide with a discrete and easily accessible corral to contain the necessary totes. The corral shall include a 4" concrete slab with an enclosure integrated with the building design. Gates shall be heavy duty with padlock clasp.

2.4.11 WASTE/RECYCLE BINS

Waste/recycle bins shall be provided at each building entrance.

Bins shall be as manufactured by DuMor, Inc. or approved equal. The trash receptacles shall be circular in shape, approximately twenty-seven to twenty-eight (27" – 28") inches in diameter, with a height of approximately thirty-six (36") inches. They shall be constructed of steel pickets and rings that have been powder coated black. The liner shall be a thirty-one (31) gallon steel trash can constructed of eighteen (18) gauge steel. Each trash receptacle shall have a solid lettering band, four to five (4" – 5") inches down from the top of the receptacle. Wording for the lettering shall read "TRASH", "MIXED PAPER", and "BOTTLES & CANS". Trash bins shall be located on concrete pads.

2.4.12 BOLLARDS

Bollards at loading docks and service areas shall be 8" steel pipe, concrete filled with convex top to shed water, set 4'-0" deep in concrete. Paint bollards yellow.

2.4.13 BENCHES

Benches shall be provided near each building entrance. Sitting benches shall be as manufactured by Conversion Products, Inc., cat. No. TPB-6 (Traditional Style Park Bench), or an approved equal. Benches shall be constructed with 100% recycled plastic lumber this highly resistant to cracking and splintering. Benches shall installed on concrete pads

2.4.14 BIKE RACKS

Bike racks shall be provided near building entrances. The area around bike racks shall be well lit.

Bicycle racks shall be as manufactured by Madrax or an approved equal. The bicycle racks shall be a free standing "loop" style, powder coated hunter green. The racks shall be surface flange mounted on a 6 inch reinforced concrete pad.

2.4.15 TREES AND SHRUBS

Plant materials shall be balled and bur lapped or container grown only. Trees and shrubs shall conform to ANSI Z60.1-latest edition standards, trees will typically be a minimum of 2 ½ inch caliper. Use existing soils amended for fertility.

The entire campus is an arboretum and as such, plant material selections shall reflect diversity and hardiness.

2.4.16 TURF AREAS

Top soils shall be stripped and stockpiled for future use. All topsoils, existing and imported, shall be screened for stones and debris to 1 inch. Subsoils shall be loosened to 12 inches and screened for 3 inch stones.

Lawn seed shall be of the following mix:

- Blue Seal Classic (restoration) (one pound per 300 sf)
- Kentucky Bluegrass 98/85 35%
- Creeping Red Fescue 25%
- "Omega III" Perennial Ryegrass with endophytes 20%
- "Saturn" Perennial Ryegrass with endophytes 20%

2.4.17 MULCH

3 inches of shredded pine bark. Do not install metal or plastic edging around mulched areas.

2.4.18 BUILDING IDENTIFICATION SIGN

Building identification sign shall be located in grass area along the street side of the building and match the existing signage on Campus. Sign shall identify the building name and street address.

2.4.19 FIRE HYDRANTS

Fire hydrants shall be manufactured by Kennedy, Elmira, NY, K81-A, open right and painted red.

2.4.20 FIRE DEPARTMENT ACCESS

The Amherst Fire Department responds to the front door or main entrance of Campus buildings. The fire alarm annunciator and fire department connection for the sprinkler/standpipe system shall be located at this access point.

Fire apparatus require a clear travel lane of 10-12 feet. Fire apparatus can only cross low rounded curbs. Curbs over 4" in height and granite curbs are not acceptable.

The use of the aerial ladder is necessary at all campus buildings. Adequate space for safe fire apparatus operation must be provided.

Fire lanes must be 18 foot wide and must be capable of supporting the weight of fire apparatus. The fire lane must be clearly marked.

The Amherst Fire Dept. can provide the designer with information about their apparatus and working clearances.

2.5 BUILDING ENVELOPE

2.5.1 BRICK

Face brick shall be ASTM C 216, grade SW. The supporting construction shall be adequately stiff with deflection limited to L/720.

The clear space between the cavity side of the brick veneer and the nearest obstruction [sheathing, concrete masonry, or cavity insulation] shall be at least 2".

Veneer anchors and ties shall be type 304 Stainless Steel, galvanized is not acceptable.

Provide cavity flashing and weep holes in masonry at shelf angles, lintels, ledges and other obstructions to downward flow of water within the wall. Provide mortar drop protective mesh to protect weep holes.

Expansion joints should be provided to accommodate thermal expansion and shall be pre-molded compressible, elastic fillers, not fiberboard. The joints should be sealed with a permanently elastic sealant.

When masonry parapet walls are necessary, adequate provisions shall be made to assure that expansion and contraction are in harmony with the building walls and structure beneath.

For masonry repair work the determination of mortar content shall include laboratory analysis of mortar samples followed by special mixing of granular content. Pigments shall be avoided, if possible. Removal of failed mortar must be accomplished gently so that bricks or stone are not damaged. Hand chiseling is the only acceptable removal technique.

2.5.2 CONCRETE MASONRY UNITS

ASTM C90, Grade N, normal weight units, 8" x 16" face dimensions, load bearing units, smooth and dense surface texture. Provide CMU bull nose units at outside corners.

Joint reinforcement shall be galvanized carbon steel wire. Provide joint reinforcement and seismic bracing where required.

Mortar: ASTM C270, Portland cement mortar. Select the mortar with the best properties suitable for a particular use. Generally, use type S in exterior applications, except type M when below grade. Interior partitions use type S or N.

2.5.3 SEALANTS

Select the highest quality and longest lasting sealant material that create and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

The following types of sealant are preferred:

- Exterior vertical building joints, including concrete, masonry, EIFS, painted metal, anodized aluminum: Non-sag, polyurethane or silicone.
- Interior trim and finish joints with little movement: one part paint-able acrylic latex.

- Interior expansion, control and air seal joints: polyurethane.
- Interior joints at toilet rooms, plumbing fixtures, and wet areas: Mildew resistant silicone

Sealant selected should be of low toxicity and produce little or no odor. Backer rods should be specified where appropriate to provide effective installation and to limit the amount of sealant used to fill a gap.

2.5.4 ASHAPLT SHINGLE ROOFING

Asphalt Shingles: Mineral surfaced, self-sealing, 3 or 4 tab, fiberglass based, strip asphalt shingles, complying with ASTM D 3018, type I, class A fire test response classification.

Shingles must be made for use in the north-east region of the United States. Minimum 80 MPH wind coverage.

Shingle Manufacturer Warranty: Ten (10) years material and labor, forty (40) year limited warranty, ten (10) years against algae and ten (10) year 80 mph wind resistance.

Fasteners: Fasteners shall be hot dipped galvanized roofing nails of sufficient length to penetrate at least ¾" into solid decking.

Underlayment: Underlayment shall be 15 pound, non-perforated asphalt saturated felt and shall have been tested as a system with the shingle selected to achieve a UL class A label. Provide ice and water shield membrane at all valleys, hips and eaves for a minimum 36" width.

2.5.5 SLATE ROOFING

Roofing slate shall be new product, ASTM Grade S1, with a service period of 75 to 100 years machine punched for two nails each. All exposed corners shall be practically full. Roofing slates used on Campus are generally 20" x 10" by standard ¼" thickness and shall have a smooth natural cleft surface.

Slate nails shall be large Flat Head Slater's nails of solid round copper wire.

Provide ice and water shield membrane at all valleys, hips and eaves for a full 36" width. Over the entire area to be covered with slate, place a double layer of 30 pound asphalt saturated felt underlayment.

Provide snow guards at appropriate locations to protect the public from the danger of sliding snow and ice from the roof.

2.5.6 ROOF FLASHING AND SHEET METAL

Fabricate and install flashing and sheet metal to comply with the recommendations of Factory Mutual Loss Prevention Data Sheet 1-49 and the appropriate wind zone. Use concealed fasteners where possible.

Copper and Lead Coated Copper are used on Campus at historically significant buildings and where desired for architectural continuity or significance. Copper shall be ASTM B 370, temper H00, cold rolled except where temper 060 is required for forming. Lead Coated Copper shall be ASTM B 101, cold rolled copper sheet, both sides coated with lead weighing not less than 12 or more than 15 lbs/199 sq.ft.

The following minimum metal thickness shall apply to copper and lead coated copper items. Lead coated copper items shall be from sheets of copper with the following weights before coating:

- | | |
|--|--------|
| ▪ Cleats, hip flashing, downspout straps | 16 oz. |
| ▪ Gutters, cornices, coping, valleys | 24 oz. |
| ▪ Downspouts, including elbows and shoes | 24 oz. |
| ▪ Conductor heads | 24 oz. |

Aluminum for highly visible work, such as fascias, gutters and downspouts, counter flashing, drip edge and eave flashing, shall be 0.050" minimum, while extruded aluminum should be 0.080" thickness. For concealed work, 0.040" is minimum. Since aluminum cannot be soldered, consider the methods of seaming and jointing. Specify and detail joints which are both visually acceptable and which offer long-term weather-ability. Clear anodized and color anodized should be Class 1 [at least 0.7 mils thick].

Metal counter flashing built into masonry walls shall be two-part, removable for future reproofing.

2.5.7 FLASHING IN MASONRY

Do not use aluminum as a flashing material in contact with masonry or concrete.

ASTM A-167, type 304. Stainless Steel flashing is acceptable in masonry and concrete construction. Stainless Steel will corrode over time when in contact with steel, galvanized steel, and lead and should be protected or separated. Stainless Steel flashing shall be 30 GA. min. (.0157") in through-wall construction and 26 GA. min. (.0217") thickness when exposed to weather.

Copper flashing is acceptable in masonry and concrete construction provided it is adequately detailed to avoid staining of the building. Copper will corrode aluminum, steel, stainless steel and zinc and should not be in combination or contact with these metals. Copper flashing shall be 10 oz. min. in through-wall construction and 20 oz. min. thickness when exposed to weather.

2.5.8 ROOF HATCHES

U.M.A. does not prefer roof access hatches at new construction. Stairs with doors onto the roof are preferred. Where roof access hatches are used they should have insulated metal lids. The minimum acceptable access hatch size is 3'-0" long by 2'-6" wide; larger units are preferred. Units shall be pre-fabricated and have integral cap flashing and gaskets and insulation in the cover and sides. Hatch must be equipped with rust resistant hardware and a padlock eye on the interior.

2.5.9 ROOF EQUIPMENT CURBS

Pre-fabricate roof equipment curbs and support units are preferred. Fabricate units to a minimum of 12" above height of finished roof surface around curb.

2.5.10 ROOF LADDERS

Roof ladders and platforms shall be aluminum and installed to provide access to all roof levels and over parapet tops.

2.5.11 FALL ARREST ANCHORS

Stainless steel fall arrest anchors shall be provided in number and location for maintenance personnel to safely access all roof areas and roof top equipment.

2.5.12 LOW SLOPE ROOFING

The University does not have a preferred roof membrane for use on every building. Designers shall analyze the particular roof application and provide recommendations. The University, based upon past experiences, has the following requirements which will effect roof system selection and installations.

Roofing system shall be designed for the buildings exposure, location, height and parapet height. Minimum Factory Mutual 1-90. Roofs shall slope to drains, minimum 1/8" per foot, more if achievable. Provide crickets to divert water from behind roof top equipment and to direct to roof drains.

Roof membranes shall be fully adhered. Roof insulation shall be mechanically attached or fully adhered to the building. Roofing membrane should be long lasting, resistant to UV degradation, and resistant to damage from falling objects and maintenance operations.

Warranty shall include Roofing System Manufacturer's Total System Warranty, 15 year minimum, and 20 years if available. During this period, the Membrane Manufacturer shall repair and replace, if necessary, any defect in the specified roofing system and related components, including insulation. Membrane manufacturer shall warrant all roofing related materials including membrane, insulation, flashings and roof edge treatment. Warranty shall not be prorated.

The University has experienced problems with EPDM membranes and is reluctant to accept this type of roof membrane.

Light colored roofing membranes are preferred to reduce summer heat buildup.

Insulation panels shall not exceed 4' x 4' length x width dimensions. Insulation shall be installed in a minimum of 2 layers, staggering insulation joints from first layer. Splay roof insulation around roof drains.

Only "Anti-fume or Fume recovery" kettles capable of reducing fumes, odors and particulate emission generated during the asphalt heating and holding processes shall be used.

Back side of parapet walls shall be covered with membrane flashing or other waterproof product. Roofing flashing membrane shall extend under gravel stops and be attached to the front face of the building. Parapets shall have metal caps.

Provide area dividers and roof expansion joints where required by the roof membrane manufacturer. Pitch pockets are to be avoided, and if necessary, shall be covered with a sheet metal cap.

Wood nailers and blocking shall be treated, acceptable to roof membrane supplier. Nailer attachment shall meet the requirement of the current Factory Mutual Loss Prevention Date Sheet 1-49.

Provide walkway pads from roof hatches or doors to mechanical equipment or to areas requiring periodic maintenance.

2.5.13 ROOF DRAINS

Roof drain shall be cast iron including dome.

2.5.14 GRATING

Grating over air intakes, areaways, etc. shall be galvanized with hinged access door and padlock hasp. Provide galvanized ladder to bottom of areaway unless other means of personnel access is provided.

2.5.15 LOUVERS

Exterior louvers shall be anodized aluminum, stiffened to resist wind loads, and designed to minimize water penetration during storms. Provide screens to protect louvers from flying objects and vandalism.

2.5.16 VAPOR RETARDERS

Vapor retarders must be provided where heat loss calculations identify a dew point within the wall construction. Vapor retarder shall have low permeability, high strength and durability and selected according to their intended performance.

2.6 BUILDING INTERIORS

2.6.1 GYPSUM BOARD PARTITIONS (INTERIOR NON-LOAD BEARING)

Gypsum board systems are acceptable in areas and locations where vandalism and high impact resistance will not be an issue. In areas prone to vandalism, concrete, masonry, ceramic tile or other hard wall systems may be more appropriate. Do not use gypsum board assemblies in wet areas such as animal rooms, cage wash rooms or shower rooms.

High impact resistant gypsum board is recommended for use in corridors and areas prone to damage.

The University requires 5/8" min. thickness tapered edge gypsum boards at single layer applications. Provide sag-resistant gypsum wallboard at ceiling applications. Provide isolation and control joints where required to control cracking.

Sound rated assemblies shall be sealed around the perimeter, and at openings and penetrations with a continuous bead of sealant.

Moisture-resistant boards (5/8" min.) may be used for painted walls in toilet rooms and where not subject to wetting. Glass-mat water-resistant backing board may be used as an alternative to moisture resistant boards.

Do not use moisture-resistant gypsum boards as a substrate for ceramic tile when subject to wetting; use "Durock", or-equal glass mesh mortar units.

Gypsum Association's GA-214, Levels of Gypsum Board Finishing, shall be level 4 minimum. In accessory spaces such as mechanical, electrical, janitor closets, etc. level 3 is acceptable.

Framing members shall be galvanized or provided with other corrosion resistant coating. The maximum deflection limit for gypsum board assemblies is L/240. Tile finishes applied to gypsum board assemblies require a maximum deflection limit of L/360.

To allow for structural floor deflection, provide deflection tracks for the top runner.

2.6.2 SUSPENDED ACOUSTIC CEILING SYSTEMS

Avoid the use of concealed spline systems or ceiling tiles that are stapled, strapped or adhered in place. Fire-rated acoustical ceiling systems are not recommended.

24" x 24" ceiling tiles with exposed grid suspension systems are preferred.

Select ceiling tiles that provide the appropriate humidity resistance to withstand tile sag. Tiles located at ceiling plenums, in areas of frequent access, at corridors and other high use public areas must be surface scratch and impact resistant.

Provide humidity resistant ceiling tiles in high moisture areas such as laboratories, kitchens, locker rooms, and indoor pools. Ceilings installed in laboratories, clean rooms and food preparation areas should meet industry scrub-ability standards.

Coordinate ceiling tile selection with the lighting system to be used. When using indirect lighting systems, select ceilings with light reflectance values of .89 or higher. For direct and direct-indirect lighting applications, provide ceilings with light reflectance values of .80 or higher.

The Noise Reduction Coefficient (ASTM E1264) should be considered when selecting acoustical ceiling products. In open office areas, classrooms, conference rooms, auditoriums and similar spaces a minimum value of .65 is desirable. The Articulation Class (ASTM E 1110 and 1111) should also be considered in the design of open office areas and similar spaces with a minimum value of 170 preferred.

The Ceiling Attenuation Class (ASTM E 1264) should be considered where sound can penetrate plenum spaces and carry to other spaces. A minimum CAC of 25 is acceptable in open plan offices while a minimum of 35 is acceptable in closed offices, conference rooms and classrooms.

For most classrooms and office installations, suspension systems should be Class A, 15/16" grid face, intermediate-duty, hot-dipped galvanized with baked paint finish. Specify stainless steel or aluminum finish suspension systems for high humidity locations.

2.6.3 FINISH CARPENTRY

Provide "Premium Grade" architectural woodwork as defined by The Architectural Woodwork Institute publication "Architectural Woodwork Quality Standards, Guide Specifications, and Quality Certification Program".

2.6.4 CASEWORK

For most applications, AWI quality standard "Custom" grade is acceptable. AWI quality standard "Premium" grade is required for areas or items that have particular architectural significance.

Shop finish is preferred with field finishing of items requiring extensive cutting, fitting and adjusting. Backprime concealed surfaces to protect against moisture penetration.

Provide high quality ball-bearing drawer slides with load capacity appropriate for the intended use. Drawer and door pulls should be barrier-free. Hardware used on casework must be readily heavy duty and commonly available.

2.6.5 COUNTERTOPS

Plastic laminate countertops: AWI material and fabrication grade "Custom". All exposed core faces must be completely covered with laminate or thoroughly sealed.

Solid surface countertops such as Dupont Corian and Nevamar Fountainhead are acceptable materials for countertops.

Countertops should be adequately braced and framed to support heavy and unusual loads.

2.6.6 CERAMIC TILE

In public toilet rooms, the University prefers unglazed ceramic tile or terrazzo floors and glazed ceramic tile for the walls. In less heavily used toilet rooms ceramic tile floor and base are acceptable. Where slip-resistance is a concern, specify floor tile with the appropriate coefficient of friction.

Ceramic wall tiles shall be installed over cement backer board or masonry.

In new construction, and where possible in existing buildings, tile floors should set in a thick bed, not thin-set, and should be set in compliance with TCA recommendations for the type of application and installation.

Provide waterproofing membrane beneath tile floors in areas where the floor is periodically wet or requires floor drains. Carry the membrane up perimeter walls behind wall finishes and flash membrane to floor drain assemblies.

2.6.7 RESILIENT FLOORING AND BASE

Solid vinyl tile, rubber tile, vinyl composition tile and resilient flexible terrazzo tiles are acceptable flooring product for use in public spaces, such as building entrances, lobbies and primary circulation areas.

The University generally does not use sheet vinyl flooring due to the difficulty in replacing and repairing damaged areas.

Solid vinyl shall be monolithic tile compliant with ASTM F 1700, Class 1, rating. Tile size shall be 12"x 12" and 1/8" minimum thickness.

Vinyl Composition Tile shall be Class 1 or Class 2 per ASTM F 1066. Tile should have color all the way through the cross section, not just on the surface. Select tiles with high static- load resistance to protect from indentation. Select appropriate tiles for resistance to chemicals found in the particular application. VCT tile size shall be 12" x 12" and 1/8" minimum thickness.

Rubber tile shall be class 1-A or 1-B per ASTM F 1344, homogeneous rubber. Rubber tile size shall be 12" x 12" or 24" x 24" and 1/8" minimum thickness.

Resilient Flexible Terrazzo Tiles shall be composed of marble or granite chips with resin matrix. Tile size shall be 12" x 12" and 1/8" minimum thickness.

Wall Base shall be rubber base, solid or homogeneous, scuff and abrasion resistant. Use cove base at hard floors and straight base at carpet, 6" minimum preferred, 1/8" thickness, pre-cut lengths of 4' minimum. Outside corners shall be pre-molded and match straight sections in appearance. Do not wrap inside corners; cut and cope base at inside corners.

Flooring and base installation adhesives shall me low odor and low VOC.

Resilient Stair Flooring and Trim shall be used in utility stairs and other stairs not requiring special finishes. Specify heavy-duty, full tread width with integral nosing and tread edge abrasive strip.

2.6.8 CARPET

Do not use carpet or carpet tile in the following areas:

- Where food is prepared, served or eaten.
- In basement or below grade level where dampness or water may be present.
- At main entrances, lobbies, main floor corridors, primary circulation areas near classrooms or lecture rooms.
- Utility spaces such as mechanical and electrical rooms.
- In areas with wheeled traffic.
- Laboratories.

Carpet shall have low indoor air pollution emissions, low overall VOC emissions, and low concentrations of toxic and irritating components.

Carpeting to be level-loop design with a face yarn weight of at least 26 oz., non-organic backers, solution dyed and possessing anti-fungal and anti-static features. Specify carpet with the appropriate Average Pile Yarn Density (APYD) for the intended use.

Specify only Class 1 rated products, per ASTM. E648.

Carpet Installation shall be glue-down. Use only strip-able, water-resistant, mildew resistant, non-flammable, non-combustible adhesives. Low odor adhesives are required.

Use loose laid carpet tiles with adhered grid of tiles at 10 feet on center as needed to control tile movement. Fully adhere tiles in very high traffic areas and where recommended by carpet tile manufacturer. Coordinate installation with type of carpet tile backing used; some backings require 100% adhesion.

2.6.9 SEAMLESS FLOORING

Seamless flooring may be required in animal rooms, cage and glass washing areas, sterilizing rooms, and other wet areas where chemical and/or acid resistance are required. Seamless flooring systems should have integral wall bases to form a “bathtub”.

2.6.10 PAINT

Paint products should be low odor, low or zero VOC coating with anti-microbial properties.

Specify one primer and two finish coats for each surface. Paint wall surfaces behind permanently fixed equipment or furniture with prime coat. Prime or seal the edges, ends, faces, undersides and backsides of wood, including cabinets, counters, cases and paneling. Back-prime paneling where masonry, plaster or other wet wall construction occurs on backside. Seal tops, bottoms and cutouts of unprimed wood doors. Finish exterior doors on tops, bottoms and side edges the same as exterior faces.

Preferred Paint Types for Identified Substrates:

<u>Surface</u>	<u>Paint System</u>
▪ Painted Doors:	Semi-gloss alkyd.
▪ Handrail Systems:	Semi- gloss alkyd.
▪ Animal Rooms:	Full gloss alkyd, waterproof epoxy systems
▪ Glassware Washing Rooms:	Full gloss alkyd, waterproof epoxy systems
▪ Sterilizing/Autoclave Rooms:	Full gloss alkyd.
▪ Office Walls:	Eggshell latex alkyd system.
▪ Classroom Walls:	Eggshell latex alkyd system.
▪ Typical Lab Walls:	Eggshell latex alkyd system.
▪ Corridor Walls:	Eggshell latex alkyd system.
▪ Interior Masonry Walls:	Block filler and Eggshell latex alkyd.
▪ Interior Metal Doors/Frames:	Semi-gloss alkyd system.
▪ Interior Wood:	Polyurethane; satin finish

The UMA Physical Plant uses a standard off-white, interior paint color throughout campus facilities in maintenance updates. Designers are encouraged to design and specify with Sherwin Williams "Cameo White" or an approved equivalent where appropriate and not interfering with design significance.

2.6.11 STEEL DOORS & FRAMES

Door sizes must comply with codes, space use and special mobile equipment requirements. A 3'-0" wide and 7'-0" door height is standard for most doors. The following are some guidelines for door widths at U.M.A. facilities.

Wet weather and salt de-icers plague exterior ferrous metal entrance doors. U.M.A. discourages the use of hollow metal and wood materials at exterior door locations. Anodized aluminum, stainless steel and glass-fiber/polyester-resin faced doors that do not react with water and salts are preferred.

Design vision panels in corridor, major public area, classroom doors and laboratory doors. Vision panels in doors shall be laminated safety glass. In fire-rated doors, laminated safety wire glass shall be used. Use 5" x 20" vision panels in lieu of 10 x 10 in B-labeled fire rated doors. Provide non-removable stops on outside of exterior doors and on secure side of interior doors.

Exterior Doors:

- Door Frame Material Gauges: ANSI 250.8 - level 4, (0.1046") minimum 12 gage. Specify frames with fully welded seamless construction to the greatest extent possible.
- Door Material Gauges: ANSI 250.8 - level 4, maximum duty, cold rolled, 14 gage (0.0747") minimum face sheets, with seamless construction. Most doors should be 1 ¾" thick. Specify exterior doors with closed seamless tops and no places to catch and hold water.
- Insulation: When heated space is on one side, specify laminated construction, thermally insulated doors using an insulation product that will not settle, sag or hold moisture.

Interior Doors:

- Door Frame Material Gauges: ANSI 250.8 - level 3, (0.0747") minimum 14-gage frame wall thickness. Frames to be fully welded seamless construction. Specify factory applied rust-inhibitive primer to doors and frames.
- Door Material Gauges: Specify minimally ANSI 250.8 - level 3, extra heavy duty, cold rolled, 16 gage (0.053") minimum face sheets, with internal steel stiffeners at 6" O.C. each way, and seamless construction. Most door thickness should be 1 ¾".
- Metallic-Coated Steel Sheets: Specify hot-dipped galvanized face sheets for all exterior and wet location doors and frames where alternative materials cannot be specified.
- Acoustical Steel Doors: Specify acoustical insulated doors with perimeter sound-stripping and appropriate STC rating for assembly locations near or adjacent to noisy machine rooms, television rooms, audio rooms, and elsewhere noise control is needed. Special applications may require higher STC performance.
- Frame Stops: Specify frames with stops extending to the sub-floor, except provide hospital stops at spaces needing extensive cleaning.

- Specify factory applied rust-inhibitive primer to doors and frames. Ensure products compatibility with the specified finish paint products.

2.6.12 WOOD DOORS AND WOOD FRAMES

Exterior Wood Frames and Wood Doors are not recommended to be incorporated into designs unless special project conditions warrant. These conditions include repair/restoration of historical buildings and contextual requirements of important building facades.

Interior Wood Frames in new construction are not preferred for most work. Selective design use for areas requiring contextual integration may be permitted.

Wood Doors may be used for interior construction, however, do not use wood doors in areas prone to high humidity and wetness, vandalism/security and in instances where daily use/abuse will quickly damage the integrity of the door.

Exterior Stile and Rail Wood Doors: when conditions warrant specify minimum 2-¼" thick AWI Premium Grade solid wood construction. Do not use veneer construction for any exterior door components.

Interior Flush Wood Doors: 1-¾" thick AWI Premium Grade, stave core, 5 ply construction. Specify minimum face veneer thickness.

Interior Stile and Rail Wood Doors: Specify minimum 1-3/4" thick AWI Premium Grade construction.

Provide push or protection plates on the push side of wood doors at corridors and other heavy traffic areas.

The University prefers transparent finished doors to be factory finished. Shop-prime all doors to be field painted.

2.6.13 ACCESS DOORS

Designers must size access door and panel sizes to be large enough to accommodate the intended use.

<u>Type of Use</u>	<u>Minimum Size</u>
Reach-In Access Door	12" x 12"
Access Door for Torso Only	24" x 24"
Access Door for Complete Body Passage	30" x 30"

Locate access doors in drywall, plaster and other inaccessible finishes to provide maintenance access to valves, controls, junction boxes, and other maintenance and testing items which otherwise would be inaccessible.

Finishes: factory primed / field painted access doors to match adjacent wall or ceiling are specified. In highly finished areas such as main lobbies or corrosive environments, special finishes such as stainless steel or bronze may be specified.

Locking: Doors should be equipped with screw-driver operated cam locks.

2.6.14 OVERHEAD DOORS

Stainless Steel and Aluminum for slat or grill door material is preferred. All materials and components should be heaviest duty available and high cycle rated.

Electric Operation: Design electric operation with motor size recommended by door manufacturers. Provide manual chain hoist back-up operation for motorized doors.

Exterior door should be insulated and gasket sealed.

2.6.15 ALUMINUM ENTRANCES AND STOREFRONTS

Provide doors with a wide style design, over 5 inches wide, with 8" center rail and 10" bottom rail. Doors shall be manufacturer's heavy duty, 1-3/4" minimum thick with a minimum 0.125 inch wall thickness extruded tubular rail and stile members. Reinforcement at all corners should be heavy-duty brackets, welded construction or full width tie rods joining the stiles and rails

Class 1, Anodized finishes provide the most durable wear surface for exposed aluminum components. Painted finishes including KYNAR™ paint finish systems are discouraged.

Unless insulated glass is necessary for energy code compliance, use single-pane, 1/4" min. thickness, laminated, safety glass for door glazing. Storefront surrounding panels should feature safety glass compliant to codes.

Include all required hardware items proprietary to the aluminum entrance manufacturer excluding key cores. Ensure specification of lockset design compatibility with U.M.A. proprietary Best key core system.

2.6.16 DOOR HARDWARE

Due to high use, door hardware must be of heaviest duty and grade available. Specify heaviest grade Steel, Brass and Bronze base materials for hardware components. Ensure wearing and mechanical parts are of the strongest materials and no plastic components are found in mechanical works.

Specify solid material finishes for exterior and wet/humid applications. Solid stainless steel and brass are acceptable base materials. On interior doors of light frequency use plated finishes are acceptable. At all other applications solid metal finishes should be specified.

Hinges: fully mortised, flat tip, commercial-grade, heavy-duty, ball-bearing hinges. Do not use plate finishes. Hinges shall feature stainless steel pins. Non-Removable Pin [NRP] hinges where security is a concern and for all exterior doors and non-rising pins for other interior doors.

For doors 1 3/4" thick by 7'-0" high and up to 3'-0" wide, minimally specify heavy weight, ball bearing, bronze or stainless steel, 4 1/2" butt height.

For doors 1 3/4" thick by 7'-0" high and greater than 3'-0" wide, minimally specify extra heavy weight, ball bearing, bronze or stainless steel, 5" butt height.

Specify three hinges per door leaf for door height 90 inches or less, and one additional hinge for each 30" of additional door height. Fire rated doors shall have not less than 3 hinges per door leaf for doors 86 inches or less in height with one additional hinge for each 30" of additional door height.

Hinges manufactured by Stanley, McKinney and Hagar have provided acceptable performance in the past.

Continuous Hinges: For exterior or heavily-used doors, a continuous hinge may be appropriate. Specify heavy duty, bearing-gear type aluminum or stainless steel hinge, with stainless steel bearings, tested for 1,500,000 cycles.

Removable Mullions: Specify keyed-removal type removable mullions fabricated from heavy duty steel. Mullion assemblies shall be certified to exceed one hundred thousand (100,000) full load operations.

Mullions manufactured by Von Duprin have provided acceptable performance in the past.

Coordinators: At pairs of doors with an attached astragal, specify an automatic coordinating device. Coordinators should be surface applied. Provide a filler bar to the correct length to span the entire width of the opening.

Coordinators manufactured by Glynn Johnson, Ives and DCI have provided acceptable performance in the past.

Flush Bolts: Specify automatic and manual flush bolts with brass or bronze face plate, lever, guide and strike. Flush bolts for hollow metal doors should be extension rod type, and for wood doors, detail corner wrap type.

Floor strikes for flush bolts shall be dust-proof type, bronze, with plunger.

Flush bolts manufactured by DCI, Ives and Glynn Johnson have provided acceptable performance in the past.

Locks and latches: Locksets shall be specified to be heavy-duty mortise type locks manufactured from heavy gauge steel. Locksets must have a 2 ¾" backset, with a minimum ¾" throw, two-piece stainless steel latch bolt. Specify deadbolt with stainless-steel, 1" throw. The lock case must be easily handed without chassis disassembly.

U.M.A. prefers lever handles, which comply with barrier-free accessibility requirements for nearly all locks and latches.

Designers shall specify only products that provide compatibility with U.M.A. proprietary key system.

Tactile Warning: All doors accessing hazardous areas, whether accessible or not, are required to provide tactile warning for visually impaired persons. The warning shall be cut into the lever or knob surface, not surface applied coating materials.

Locksets by Best, Arrow and Schlage meeting standards of the Schlage L9000 series have provided acceptable performance in the past.

Lock Cylinders: U.M.A. only uses BEST interchangeable-core 7- pin tumbler insert cylinder, WB keyway. The Designer shall only specify this key core. All projects should be specified for the contractor to provide construction cores and to deliver final key cores to the U.M.A. key shop for keying. Provide 3 key blanks per lockset.

All cylinders that are removed from existing installations during demolition shall be returned to the U.M.A. Key shop to be reused. Cylinders / locksets shall not be discarded by a Contractor.

Closers: Specify heavy-duty, surface mounted, parallel arm closers. Closure durability must be rated for certification to exceed ten million (10,000,000) full load cycles. Specify closers with heavy duty cast iron cylinder, continuously adjustable spring power and hydraulic regulation by tamper-proof valves. Closers must feature separate adjustment for latch speed, general speed and back-check. Hydraulic fluid shall be type requiring no seasonal adjustment to closure. Specify through-bolting door mounted components.

Doors of high, peak-volume traffic or used for deliveries should be specified with hold-open feature.

4010/4110 Series Closers manufactured by LCN has provided acceptable performance in the past. Other manufacturers must meet or exceed this standard.

Protection plates: Kick, mop and armor plates should be specified of stainless steel or brass, 0.050 thick with beveled edges and installed with suitable fasteners with finish to match plates.

Push plates: Specify and detail push plates min. 8" wide x 16" long x .050 thick of stainless steel or brass and fastened with machine or wood screws finished to match plates.

Push plates by Hager, Ives and Rockwood have provided acceptable past performance.

Door pulls: Specify heavy duty, solid bar stock aluminum, stainless steel or brass pulls. Specify through-bolt models.

Door stops: Specify heavy-duty brass, bronze or aluminum bumpers and stops. Specify wall bumpers with a concealed type flange wherever possible.

Where wall bumpers cannot be used, specify dome type floor stops of the proper height. Ensure floor anchoring will be satisfactory to floor finish and sub-floor detailed.

Where a wall or floor stop cannot be detailed, overhead stop may be used with heaviest duty hardware and vandal-proof armature assembly. This stop shall only be specified as a "last option available".

Door Hold-open Devices: Doors should not be specified with manual type hold-open devices. Where hold-open feature is required or functionally desired, the designer should specify electromechanical (EM) type device. All devices must be disengaged by fire alarm activation. The designer must coordinate specification of EM hold-open device with hardware specification/schedule and with all pertinent electrical and fire alarm drawings and specifications.

Do not specify magnetic holders that may require degaussing or which may hold doors open even when electrical current is disconnected.

Panic & Fire Exit Hardware: Specify rim type devices for single doors latching to non-removable mullions. Specify exposed rod two-point devices for doors swinging to removable mullions and door.

Specify panel type release devices with fluid dampening to decelerate the panel return stroke. Ensure specified devices are certified to meet or exceed one million (1,000,000) full load cycles.

Latch bolts shall be deadlocking. Only compression springs may be featured in devices, latches and controls.

Lever trim for exit devices shall be vandal-resistant type, rotate free to 90 degree down position when more than 35 pounds of torque is applied, and, can be easily re-set.

Fire exit devices must not be dogged. Non fire rated exit devices shall have cylinder dogging.

Ensure specified locking devices are compatible the U.M.A. proprietary key system.

Von Duprin series 98/99 has provided acceptable performance in the past.

Automatic Door Operators: In existing buildings where no other means of providing access for persons with disabilities exists, motorized automatic door operators may be required. Wall mounted, accessible reach, door activation push-pad device are the preferred means to activate operators.

Products manufactured by Dor-O-Matic have provided acceptable performance in the past.

When operators are required for both leafs of door pairs, specify separate controller to operate each leaf.

Weather-stripping: Specify components that are heaviest-duty, provide the most durable seal and are easiest to maintain and replace.

Jamb and head weather-stripping: specify surface-mounted, adjustable, rigid, heaviest-duty ribbed block or slab type of neoprene or vinyl.

Door Sweeps: specify surface-mounted heavy-duty fin or slab type sweeps of neoprene or vinyl.

Thresholds: Doors to exterior must feature thermal-broken styles. Most assemblies should be of milled aluminum or bronze.

Card Access: At all new buildings and major renovation projects, the exterior doors, and some interior doors shall be prepped for the installation of security locking hardware connected to the Campus's UCard system. Prepping of the doors shall include conduit and modifications to doors, frames, thresholds, etc. to accept future installation of electric strikes and or electric locks.

2.6.17 ENTRANCE MATS

Entrance vestibules should be equipped with an entrance mat. Mats should be full sized to the vestibule space and laid on the finish floor.

Heavy-duty, vinyl-backed carpet mats are desired inside building entrances and lobbies. Specify mat with a minimum depth of 10' and width exceeding that of the total entranceway.

UMA Custodial Services has a vendor contract for floor mat cleaning and replacement. Provide compatible floor mat products.

2.6.18 CHALKBOARDS

Chalkboards shall be porcelain enamel coated steel. Minimum 24 gage face sheets over high quality core material and backing sheet, 25-year warranty on writing performance. Provide aluminum chalk tray, frame, and display rail with cork insert including map rail accessories.

Marker-boards: Porcelain enamel writing surface on 24-gage steel facer skin for dual magnetic feature, backer skin and high quality core construction. Specify matte finish for marker-boards where glare issues may cause visibility issues..

Tack-boards: Bound within an aluminum frame, fabric covered board surface on composite cork/hardboard core.

2.6.19 TOILET COMPARTMENTS AND SCREENS

1" thick, solid polymer-resin or solid acrylic partitions, with solid color throughout. Provide metal heat sink strips.

Specify solid plastic or stainless steel shoes solidly anchored to structural floor with a minimum of 2 stainless steel anchors. Provide continuous solid plastic or aluminum wall brackets at pilasters, wall panels, through bolted to pilasters and panels with one-way sex bolts. Attachment of brackets to walls shall use stainless steel screw anchors along the length of the bracket.

Stainless steel or clear anodized aluminum, heavy-duty hardware with continuous wrap around self-closing hinges and heavy duty extruded overhead head rails. Surface mounted slide lock unit with door strike. Manufacturers standard heavy-duty surface mounted coat hook and door pull.

In new construction, ceiling supported partitions are the preferred method of installation. In areas prone to high use and or abuse, floor to ceiling supported installations are desired. In areas where framing cannot be installed above the ceiling and areas not prone to abuse, overhead braced installations are acceptable.

2.6.20 BUILDING DIRECTORIES

Provide building directory at major building entrances. Provide floor directories at the main lobby and at upper-floor elevator lobbies. Floor directories typically show department names, room numbers and may list personnel names.

Message strip type directories should be constructed with a heavy duty metal frame with a continuous hinged and lockable door.

2.6.21 LOCKERS AND BENCHES

Solid door wardrobe lockers with vents are typically used. Lockers that are not recessed into walls should have heavy-gage sloping tops.

Specify latching mechanism with padlock eye detail. Do not specify padlocks. Concrete platforms with resilient base are preferred for most permanent applications and required in wet areas.

Benches must be capable of supporting 100 pounds per linear foot live load. Bench pedestals and supports should be designed to permit simple floor cleaning. Wall mounted benches are

preferred over floor mounted benches. Metal bench supports at the floor should be highly water and corrosion resistant.

2.6.22 FIRE EXTINGUISHERS AND CABNETS

Provide fully recessed cabinets with glazed doors. Use roller catches. Do not use locks or latches that require breaking glass or other special access.

Extinguishers shall be type ABC, 10 pound unless otherwise required by authority having jurisdiction.

Extinguisher Identification: Provide signs and identification to comply with 527 CMR 10.02.

2.6.23 TOILET ACCESSORIES

Whenever possible, design accessories to be surface mounted and raised off the floor. Specify accessories that feature mar-resistant finishes. Current preference and products are listed below as a guide. Identified accessories may not be proprietary specified without as-equals.

Waste Receptacles: Custodial Services prefer non-corrosive, wall-mounted units "Slim Jim" by Rubbermaid Model #3540.

Paper Tower Dispenser (handicap accessible type only): roll dispenser type only. Impact #4099 and Fort James #562-01 are currently being requested by custodial services.

Soap Dispenser: Surface-mounted lotion soap dispenser Triad #9350P are currently being requested by custodial services.

Toilet Tissue Dispenser: Valay Model 1007 dispenser with lock mechanism.

Sanitary Napkin Receptacle: Bobrick wall-surface mounted ABS plastic unit # B-5270.

Shower Soap Dish: Bobrick B-973, extra heavy-duty, chrome-plated cast bronze dish with vandal-resistant screw anchorage.

Shower Rods: Extra heavy duty, minimum 1-1/4" diameter, 18-gage stainless steel with concealed anchors.

Accessibility Grab Bars: Peened non-slip gripping surface is preferred with concealed mounting flange anchorage. Through bolt bars where installed in toilet partitions. Wall cavity blocking should feature steel plate laminate for additional resistance to pull-out.

Wall Mirrors: Framed type. In some areas, vandal-resistant mirrors may be appropriate.

Shelving: Providing shelving both inside toilet stalls and at lavatory areas is desired for placement of purses, books, lap-top computers and other carried items. Shelves must be stainless steel, well supported and at least 8" deep. Ensure proper clearance for underside of shelf to other accessories such as top-filled soap dispensers.

Hooks: Similar to shelving, providing hooks in stalls, lavatory areas and at shower areas is appropriate. Ensure adequate blocking is provided in cavity wall construction and anchorage is capable of withstanding 75 pound of force.

2.6.24 INTERIOR SIGNAGE

2.6.25 FIREPROOFING

Fireproofing should match UL tested and listed assemblies

Fireproofing must be concealed with architectural finishes in all public areas. In certain utilitarian spaces accessible only by maintenance staff fireproofing may remain exposed to view, but should be sealed or encased to reduce friability.

2.6.26 CORNER GUARDS

Provide corner guards in corridors and areas where rolling carts may damage wall finishes. Corner guards shall be durable, cleanable and easy to replace.

2.7 FURNITURE AND ACCESSORIES

2.7.1 OFFICE FURNITURE

The University generally purchases furniture through the Massachusetts Higher Education Consortium (www.mhec.umass.edu)

All furniture shall meet the requirements of California Technical Bulletin 133 (Cal 1330 and any other requirements of the Amherst Fire Dept.

2.7.2 FIXED AUDITORIUM SEATING

Seating shall be durable and have steel or cast iron standards on both sides of each chair. Seats and backs shall be upholstered with molded plastic shells, arm rests shall be wood or solid plastic, not laminate and without cup holders.

Seating shall be California bulletin 117 and 133 compliant.

2.7.3 BLINDS

Blinds shall be either vertical or horizontal louver type fabricated from aluminum slats

2.8 HEATING, VENTILATING & AIR CONDITIONING (HVAC)

2.8.1 General

System design and equipment selection shall be determined by life cycle cost analysis including first, operating, and maintenance costs.

Central systems are preferred with the equipment (chillers, pumps, cooling tower, air handling units, etc.) located in the basement and/or penthouse mechanical rooms

HVAC equipment, including individual electrical components as well as electric motors, shall be UL certified and stamped at the manufacturer's facility prior to shipment.

Make use of existing building systems wherever possible, i.e. steam, air, chilled water, hot water. When connecting to existing systems, the actual operating conditions, (temperatures, volumes, etc.) should be used, not the design values shown on the as-built drawings.

Electricity should only be used for heating if other energy sources are not available.

Unoccupied areas, such as mechanical and electrical rooms, should be ventilated and heated to 50°F for temperature control.

Air intakes should be located as far away as possible from streets, loading docks, exhaust vents, cooling towers and other sources of contamination. Bird screens should be provided. It is desirable that the intake be located a minimum of 10 feet above grade.

Building exhausts should be located as remote as possible from air intakes.

Design equipment and controls for the different types of occupancy and schedules within the building. Provide setback temperature controls, with manual override, for nights, weekends and holidays. Where setback cannot be accomplished, reduced flow operation should be provided.

Each project should be analyzed for the recovery of usable energy. The Engineer shall perform an economic analysis to determine the appropriateness of energy recovery systems.

All ventilation systems shall have the capacity to use 100% outside air to meet cooling and ventilation requirements with economizer control.

Centralized chilled water systems are the preferred means for providing process cooling for equipment, such as lab equipment, and for HVAC needs. If chilled water systems are used for process cooling or other year round cooling applications, then provision for economical winter chilling should be provided.

Systems shall be designed to meet ASHRAE guidelines for indoor and outdoor sound power levels. Noise criteria (NC) levels for offices and classrooms shall be NC 35, auditoriums NC 25, and storage spaces and computer rooms shall be NC 40.

Design systems to maximize flexibility to accommodate future changes and renovations. This should include future additional capacity and room to add additional components. Design duct and piping systems for a minimum of 100% design flow, including foreseeable future loads. Minimize the number of individual systems but provide cross connections for redundancy wherever possible.

Specify rotating equipment for 200,000-hour L50 bearing life; more if readily available.

Provide ample service access to all components, particularly those requiring regular maintenance. Provide access doors, inspection plates, etc... Include piping unions for equipment replacement.

Hot, chilled and condenser water lines shall not be installed over electrical switchgear, motor control centers, transformers, nor in elevator in elevator machine rooms and shafts.

Provide chilled water metering equipment. Meters should be sized to handle the expected maximum and minimum flows and report to physical plant through the Campus energy management system. Turbine meters are favored.

2.8.2 HYDRONIC PIPING SYSTEMS

The pump head for a buildings chilled water system and heating hot water systems shall include a safety factor for strainer plugging and future pipe roughness. Provide extra capacity (flow) when VSD's are used.

Loads with similar pressure drops should be grouped together on a building loop. More than one loop can be provided within a building. Process (continuous) loads and HVAC equipment loads shall be separated onto different loops.

Building chilled water and heating hot water pumps shall be variable speed to enable pump capacity control with the minimum energy usage.

Provide high quality air removal devices, Spirovents are preferred. (Erik to verify)

Provide thermometers and gauges as required for periodic maintenance and trouble shooting.

All systems shall be cleaned with a commercial grade cleaner, circulated and flushed under the supervision of a water treatment contractor.

HEATING WATER PIPING SYSTEMS

Hot water heating pipe shall be standard weight black steel or continuous weld pipe and/or type K copper for pipe sizes up to two inches.

CHILLED AND CONDENSER WATER PIPING SYSTEMS

Chilled water and condenser water supply and return piping shall be standard weight black steel or continuous weld pipe.

Fittings 2 inches and smaller shall be 125 pound SWP black threaded cast iron, forged steel welded fittings or wrought copper for use with type L copper piping. Grooved Piping Systems (an engineered system of rolled piping with couplings and gaskets designed for the application) may be used.

Fittings 2-½ inches and larger shall be Schedule 40, butt welding seamless forged steel. Elbows shall be long radius and flanges shall be 150 pound SWP, forged steel, welding neck, or slip-on, welded inside and outside or wrought copper for use with type K copper piping.

2.8.3 STEAM AND CONDENSATE PIPING SYSTEMS

Steam is generated at the University Power Plant and is distributed throughout the campus through a piping distribution system. Generally, the steam leaves the power plant at 15-18 psig and 75-95 psig at 245oF - 450oF. Condensate is returned to the power plant using gravity and pumped condensate return piping systems at temperatures ranging from 125oF - 180oF.

Trenches or tunnels are preferred for steam distribution systems. Where direct buried piping must be used it will be drainage/dryable systems equal to Perma-Pipe Multitherm 500.

The designer shall be aware of the danger of injury or death that might occur due to condensate induced water hammer (CIWH). Steam traps should be provided for the removal of condensate at collection points in steam piping systems and at drip legs, unit heaters and at terminal ends of companion piping. All low points in steam lines and the ends of long headers should be provided with drip legs and traps. On headers with long sections at one elevation, drip legs should be installed at intermediate points in addition to those at low points and at the ends. Steam traps should be installed below and close to the equipment or pipeline being drained and the trap should be accessible for periodic inspection. Each trap should serve only one collection point and shall be properly sized for both flow rate and ANSI pressure rating. Steam trap discharge lines shall be sloped for drainage where possible. The designer shall apply the trap manufacturer's recommended safety factor when sizing traps but in no case shall a safety factor less than 3 be used. Strainers with blow down valves shall be located ahead of each float and thermostatic (F&T) trap.

Provide condensate and steam metering at each building, reporting to the Campus energy management system. Meters should be sized to handle the expected maximum and minimum flows. Vortex meters or orifice plates or annubars with "smart" multivariable transmitters are favored.

STEAM SUPPLY AND RETURN PIPING

Steam lines shall be engineered with provisions for expansion and the removal of condensate. Generally, bends or loops shall be used to absorb the pipe expansion and contraction. Expansion joints or ball joints may be used in manholes.

Pipe anchors to control movement of piping shall be shown on drawing. Anchors shall be welded to the pipe, but anchor connection to the building structure must be bolted. Provide structural support for all kinetic forces.

Pressure reducing valve (PRV) shall be located to be accessible without the use of a ladder. All gauges shall be readable from the floor. Pressure gauges shall be selected to read the normal system operating pressure at the midpoint of the gauge. Each regulator shall be valved so as to allow its removal from the system while the system is in operation.

Valves 2" and smaller shall be gate valves. Valves over 2" shall be triple offset metal seated butterfly valves, equal to Dezurik. Valves 4 inches and above shall have by-pass systems.

For small valves on high pressure system warm-ups, traps, regulators, etc., provide cast carbon steel ASTM A216 Gr. WCB or equivalent steel bodies due to the 450°F+ design temperatures. Bronze or brass bodies are not acceptable

Locate thermometers and gauges on steam lines and equipment where temperature or pressure should be identifiable for operation and maintenance. Include upstream and downstream pressure gauges and thermometers. Thermometer scale shall be to 550°F for steam.

Each steam service entrance shall have a low point with a full size dirt leg at least 8" (eight inches) deep, located ahead of the first valve. This dirt leg shall have a 2" (two inch) nipple and cap in the bottom to facilitate cleaning. Trap take-offs shall be at least 2" (two inches) above the bottom. Each leg shall have two take-offs, each equipped with steel body root valves, with 2" (two inches) of vertical separation. Trap connections shall be to the upper connection. Blow-offs shall be connected to the lower port. Drip legs on underground steam distribution piping have special requirements.

All traps and blow-offs shall have strainers. All strainers shall have valves and caps on the cleaning port.

Steam piping (0 to 49 psig, temperature less than 297°F) shall be Schedule 40, ASTM A-53, Type E, Grade B black steel pipe. Schedule 40 butt welding seamless forged steel fittings shall be used with NPS 2-½ inch and larger pipe. Elbows shall be long radius; flanges shall be 150 pounds class forged steel, welding neck, or slip-on, welded inside and outside. For 2 inches or smaller pipe, either 250 psig black iron screw fittings or forged steel fittings may be used. 125 psig class black cast iron screwed fittings maybe used at pressures below 50 psig.

Steam piping (50 to 200 psig, temperature less than 600oF) Schedule 40, ASTM A53, Type E, Grade B Black steel pipe. Flanges shall be 300 pounds class. For 2 inches or smaller pipe, fittings may be socket weld forged steel, 2000 psig, WOG (minimum) class.

All piping utilizing threaded fittings shall be Schedule 80. Threaded fittings are not permitted on Schedule 40 piping.

Condensate piping shall be schedule 80 black steel pipe, ASTM A-53, Type E, Grade B with Schedule 80 butt welding fittings of seamless steel or forged steel socket weld fittings 2000 pounds WOG. Special materials might be approved, upon request, if pressure and temperature characteristics are submitted in advance of design.

Consider schedule 40 stainless steel for underground or other difficult to replace condensate piping.

All condensate receivers shall be sized to prevent overflow and excessive cycling. Size for a one minute run time with a maximum inflow.

All condensate pump sets shall be duplex with an alternator and high level override. Provide pressure operated pumps in severe environments.

2.8.4 PIPING IDENTIFICATION

Piping shall be permanently identified with color bands per ANSI A13.1 guidelines.

Each valve in each piping system shall be tagged with a brass or aluminum tag numbered consecutively for each system and attached to the valve with a brass or aluminum chain. Valve tags shall have stamped abbreviations of the system in addition to the valve number. A valve schedule with tag numbers shall be installed and located in a conspicuous place preferably in a mechanical room.

2.8.5 REFRIGERATION SYSTEMS

Design systems to operate as close as possible to variable flow constant temperature rise over the entire load range (all seasons) and with as high a temperature rise as possible.

The selection of the energy source for chilling systems include electric, steam, or gas and should be established with input from the University. The use of central chilled water plants is desirable.

Integrate the chiller's microprocessor controls with the campus EMCS (Johnson Controls Metasys) system. At a minimum provide start/stop, status, alarm, and capacity control.

ABSORPTION WATER CHILLERS

Absorption water chillers should be gas fired or low pressure steam fired.

CENTRIFUGAL WATER CHILLERS

R-123 and R-134a are in general acceptable as refrigerants. Electric drive, centrifugal type compressor efficiency rating shall not exceed 0.60 kW/ton and generally should be better than this for R-123 machines. All chillers should have reseatable pressure relief devices, and all low pressure chillers should have high efficiency purge units and evaporator heaters for pressure control when not operating.

Compressors shall be capable of capacity modulation by the use of inlet guide vanes from 100% to 25% of full load. Where chiller will operate for an appreciable time at part load, variable speed drive should be considered for capacity modulation.

Sound power level shall not exceed 85 dBA when tested according to ARI 530.

Centrifugal chillers shall not be located outside of the building.

Pipe rupture disks should discharge to a safe point.

RECIPROCATING WATER CHILLERS

Use only on very small projects. Air cooled units must be justified by analysis. Scroll compressors are preferred over reciprocating compressors.

ROTARY-SCREW WATER CHILLERS

Horizontal helical rotary screw type compressor efficiency rating shall not exceed 0.62 kW/ton. Compressor capacity control shall be accomplished by a valve in the rotor section. Capacity control shall allow continuous unloading down to 10% of capacity of each chiller without causing noise or vibration.

Sound power level shall not exceed 89 dBA when tested according to ARI 530.

COOLING TOWERS

The proximity of cooling tower exhaust and building outside air intake should be reviewed with the University during the schematic submittal.

Construct framework, casing, and cold and hot water basin of stainless steel. Louvers, fan cylinder, and fan guard shall be heavy galvanized steel. Fill and drift eliminator to be PVC. Remainder of cooling tower shall be stainless steel, fiberglass or PVC.

Power use shall not exceed 0.030 kW/ton of cooling based on 1 ton equivalent to 3 gpm of water cooled from 95oF to 85oF with a 78oF entering wet bulb temperature.

Centrifugal fan forced draft cooling towers may be considered with input from the University.

Provisions for flushing and draining the cooling tower including its sump shall be incorporated.

Fan motors shall be variable speed, controlled and sequenced to obtain the condenser water temperatures needed.

Provide handrails and ladders with cages for access.

Provide drains near cooling towers to handle overflow to the sanitary sewer system.

Provide hose bib at tower for seasonal cleaning.

REFRIGERANT SYSTEM COMPRESSORS AND CONDENSERS

Semi-hermetic compressors are preferred for reciprocating type compressors. Over five (5) horsepower, hermetic are not acceptable for refrigeration service; over twenty-five (25) horsepower hermetic are not acceptable for air-conditioning service. Hermetic compressors shall be serviceable type.

All refrigerant lines must be adequately supported by hangers and supports and insulated.

Chillers should be located in the basement mechanical room. Refrigeration compressors, condensers, and condensing units shall be located in mechanical rooms or a weather protected enclosure. A minimum of 36 inches horizontal clearance around each unit shall be provided for service access.

Each condensing unit should serve no more than one evaporator or refrigerated space.

Condensation drains from evaporators shall be piped to drains. They shall be insulated and heated with electric heater cable or tape when installed in spaces below 32°F.

Blow-through evaporative condensers are preferred to draw-through units. For all season operation applications, the preference is for the condenser to be located within mechanical equipment room with the discharge of air to the outside. Where this is not possible and the condensers must be located outside, then the system shall be provided with adequate winter protection to prevent short cycling.

Air cooled condensers shall be selected in accordance with ASHRAE Standard 20-70 or ARI Standard 460-70 using 115°F condensing temperature and 95°F dry bulb entering air temperature. Water-cooled condensers utilizing city water are prohibited. Limit air cooled condensers to very small systems or for equipment serving constant temperature rooms.

Environmental control chambers/refrigerated rooms shall be designed to provide frost/fog free viewing. Rooms shall include an internally actuated audible alarm system for personnel protection and temperature limit alarm (automatic) with audible and visual signals, and two

contacts for remote monitoring. Chambers shall be connection to the campus Johnson Metasys system. All electrical conduits and piping entering the space shall be vapor sealed. All condensate lines shall be easily accessible and should not be located behind equipment.

2.8.6 HVAC DISTRIBUTION

Provide individual zone controls to occupants wherever practical.

Generally, offices and classrooms shall be conditioned by variable air volume systems with 100% economizer capability. All systems shall have individual temperature control with cooling and heating controlled in sequence with deadband.

Laboratories, animal rooms, and other areas requiring high ventilation rates shall include reheat as necessary

AIR DISTRIBUTION SYSTEMS

Use double wall air handlers and avoid duct insulation lining whenever possible.

Air handlers shall be provided with the ability to go to 100% outside air (economizer) under enthalpy control. Air handlers should be designed for minimum static pressures. A maximum internal static pressure of 1.6 inch w.c. with clean 80% filters at design airflow is suggested. Air systems shall have reserve capacity above that required for loaded filters.

VAV air handler systems shall be provided with "cross manifolding" to allow shared capacity when one air handler is off line.

Include return air fans in ventilation systems. Provide controls to coordinate return air fans with supply fans and to use return air or outside air as needed for highest energy efficiency.

Locate the drives as close as possible to the motor. Motors located in the air stream shall be of the totally enclosed fan cooled type. All motors shall be UL certified and stamped at the manufacturer's facility prior to shipment.

100% outside air systems shall be designed to prevent coil freeze-up. Acceptable means include glycol coils, steam coils with a minimum of 12" drop for condensate or external face and by-pass dampers. All air handlers with large quantities of outside air (over 20%) shall be designed for good mixing of outside air to prevent coil freezing. Provide draining, filling and venting accessories at cooling coils.

Steam preheat coils shall be non-freeze type with perforated inner distribution tubes within vertical tube. Outer tube wall shall be 0.045 inches (minimum) red brass. Each section shall be individually trapped

Heating coils shall use glycol, for preheat applications, and hot water, for heating and reheat applications. Steam coils may be used for preheat at face and by-pass dampers. Discharge temperature control shall be by means of a modulating control valve, not face and bypass dampers.

Locate all air heating and cooling coils so that water jet or steam cleaning may be employed. Provide ductwork access panels on each side.

Constant full-flow water coils are required for preheat use. Steam coils, if used, shall be positive drain type with vacuum breakers, air vents, and double parallel condensate drip traps to reduce the possibility of freeze-up

Double wall insulated stainless steel drain pans shall be sloped in two directions. Provide condensation drain pans below chilled water, glycol, and refrigerant coils. Provide intermediate drain pan as described above with copper drain line extended to lower pan. The drain pans at floors shall be depressed below the air handler floor level to prevent overflow.

Chilled water temperatures vary according to the chiller system used and the environment being air-conditioned. Coils shall be piped counter-flow for air and water. The designer should select coil face area and number of rows to improve temperature rise and reduce coil air and water pressure drops. For clean ability, use straight fins and min. 500 fpm face velocity. Keep pressure drop to a maximum of 0.75" W.G. Design actual cooling coil face velocity less than 450 fpm for performance and future capacity.

Air handlers shall be supplied with pleated disposable pre-filters of 25-40% dust spot efficiency, and filters of 80-85% dust spot efficiency according to ASHRAE Standard 52-76. Laboratories and clean rooms have specific filter requirements that will vary from project to project.

Low pressure air systems duct velocities shall be limited to 2500 FPM, and maximum supply pressure to 2.0 inches w.c., less than 1.5" is preferred.

All duct systems shall be designed, constructed and supported in accordance with SMACNA standards and ASHRAE recommendations. Duct sections should meet appropriate SMACNA leakage class in accordance to their maximum design pressure. Specify acceptable leakage rates and that the contractor to perform a duct leakage tests.

All sections of ductwork shall be protected from mold, dust, moisture, and the elements throughout the construction process.

Fully ducted return systems are preferred. The use of ceiling cavities as return air plenums is prohibited.

Utilize Heavy duty flexible fan/duct connectors of minimum 3/16" reinforced neoprene. Provide flanges to facilitate removal.

Utilize belt drive equipment, wherever practical, using fixed sheave drives.

Consider air patterns when designing diffuser locations for both heating and cooling. Supply diffusers should be aspirating types to prevent "dumping" of air into occupied spaces. Innovative supply air approaches such as underfloor air supply systems should be considered.

2.8.7 SPECIAL EXHAUST SYSTEMS

Variable air volume fume hoods shall be installed unless accepted design practice dictates otherwise.

Refer to "Standards for the Design, Construction, Maintenance and Use of Laboratory Fume Hoods", prepared by the Chemical Hazards Use Committee and the Department of Environmental Health and Safety, for additional requirements for fume hood design, construction, use and testing.

www.ehs.umass.edu/fume-hood.html

Supply air delivery must be designed to ensure hood performance and safety. The benefits of a dropped ceiling in achieving optimal air distribution should be considered.

The designer shall ascertain the compatibility of the duct material to be used with the chemicals being exhausted.

Main ducts shall be seamless. Ductwork shall take the straightest route to the roof, minimizing bends and horizontal runs. In general, the hoods should be ganged together and the ductwork configured in a manner to maximize exhaust dilution.

Exhaust fans shall be located on the roof. Exhaust motors shall be located to allow access for maintenance.

During the design process the University will require an analysis of effluent plume shape and dispersion by a specialist in air wake analysis. Specialist shall be approved by the University. Such analysis is typical for all discharge stacks such as laboratory fume hood or other laboratory discharges.

Exhaust fans handling contaminated air from fume hoods shall discharge vertically from an outlet at least 10 feet above the roof level with a velocity of at least 3000 feet per minute. Discharge volume should be maintained at a constant or near constant value to maintain design dilution rates. Designers are encouraged to utilize systems which intake or induce dilution air to aid in the dilution of contaminants. In all cases the exhaust plume must remain clear of other roof lines, air intakes, operable windows, or grade level.

Provisions should be made for local exhaust of instruments, gas cabinets, vented storage cabinets or special operations not requiring the use of a fume hood (local capture devices).

HEPA or charcoal filters are generally not required for most routine uses of fume hoods. Where filters are required, the housing shall be located in the fan room or roof before the blower. The filter housing shall be located to allow for easy filter changing by the bag-in bag-out technique. Exhaust fans shall be sized accordingly to handle the increased pressure drop across the filter.

Each perchloric acid hood shall have an individual exhaust system (i.e., individual duct to individual fan). The ductwork shall go straight from the hood to the roof with no horizontal runs or sharp turns. "Wash-down" facilities shall be built into the hood and ductwork. An air ejector system or an exhaust fan may be used. An air ejector exhaust system eliminates the possibility of acid reaction with fan components and allows for ease of cleaning. If a fan is used, the blades shall be made of acid resistant metal or a metal protected by an inorganic coating. The fan shall be lubricated with a fluorocarbon type grease.

Hydrofluoric Acid Hood ductwork shall be constructed from a PVC or equivalent material. Horizontal runs and bends in ductwork must be kept to a minimum. The motor and blower housing shall not have exposed metallic parts.

Fume hood exhaust ducts shall not contain fire dampers (NFPA 45, 6-11.3). Fans shall be as close to the discharge point as possible.

Duct chases should be reasonably oversized for future additional ducts. Systems that require maintenance or inspection shall be accessible.

Heat recovery options should be evaluated.

2.8.8 UNITARY AIR CONDITIONING EQUIPMENT

Window air conditioning units are generally not incorporated into renovation or new construction, and are specifically not allowed in labs. Window air conditioning units shall be equipped with a timer or other means of control that can be programmed to shut off when the space is not occupied.

2.8.9 HUMIDIFIERS

The engineer shall discuss the selection of the humidification system type (spray, steam, other) with the University early in the design. Central steam should not be used for direct humidification.

2.8.10 TERMINAL HEAT TRANSFER UNITS

Finned tube radiation may be provided to heat the perimeter of the building and is preferred for walls which are un-insulated or have windows.

Surface mounted convectors shall have sloping top. Avoid custom enclosures

Fan coil units are acceptable only where an all air systems cannot be installed. Cooling coil condensate drains shall be no smaller than $\frac{3}{4}$ inch diameter. All coils shall be of the "low flow" or "high water temperature rise" type with temperature rises selected as high as practical (minimum of 10°F, minimum of 4 rows). Installation shall require extended drain pans with the control valve over the pan. Condensate piping should be run through dedicated insulated copper lines to drain risers. Consider 100% outside air dedicated ventilation system to meet ventilation requirements.

2.8.11 HVAC INSTRUMENTATION AND CONTROLS

Automatic temperature control systems shall be DDC type connected to the campus Johnson Controls Metasys Energy Management and Control System (EMCS) system using existing energy management fibers on the campus fiber backbone. Control down to the terminal unit shall be DDC. Software and point definition shall match existing systems. DDC systems shall be fully compatible with existing campus EMCS, sharing all data and commands in real time with all existing controllers, workstations and user interfaces.

2.8.12 ENERGY MANAGEMENT AND CONTROL SYSTEMS

The EMCS programming shall control occupied, Partial occupancy and unoccupied operation of HVAC systems to reduce or shut-off ventilation air, exhaust air, fan systems, pumps, etc. The EMCS shall control local room day/night set point temperatures and shall monitor local space temperature and occupant adjusted set points.

Direct Digital Control of the mechanical systems shall be performed by a field programmable microprocessor-based direct digital controller (DDC), which incorporates closed loop control algorithms, all necessary energy management functions, and provides for digital display and convenient local adjustments of desired variables at the controller cabinet. A minimum of one DDC panel will be provided in each building to provide local monitoring and operator control of the system. Systems which require the existing user-defined data base to be reentered through the operator's terminal after a failure or power interruption shall not be acceptable.

The following energy management routines shall be employed wherever possible:

Time of day scheduling

Start/stop time optimization
 Duty cycling (temperature compensated)
 Dry bulb economizer control
 Supply air reset
 Chilled water reset
 Outdoor air reset
 Event initiated programs
 Simultaneous heating and cooling monitoring

All control functions shall be executed within the control unit. University personnel shall be able to customize control strategies and sequences of control, and shall be able to define appropriate control loop algorithms and choose the optimum loop parameters for loop control. Control loops shall support any of the following control modes:

Two position
 Proportional
 Proportional plus integral
 Proportional plus integral plus derivative

In addition, the University shall be able to create customized control strategies based upon arithmetic, Boolean, or time delay logic. The arithmetic functions shall permit simple relationships between variables (+, -, x, ÷) as well as more complex relationships, e.g., square root and exponential.

If the controller is configured by anything other than the creation of a source language program, such as by the use of a menu-driven prompt and response program, by the filling-in of a computer generated template, or by the use of graphical programming tools, the Contractor shall likewise provide all software necessary to carry out the configuration process.

All inputs to the DDC shall be available for remote monitoring by the University EMS. A scan by the EMS shall identify all alarm conditions and clock functions in a manner compatible with the EMS software.

All temperature control strategies and energy management routines for any DDC on the network shall be accessible by an operator or technician through a local operator's terminal, one of which shall be provided for each controller. The terminal shall be an integral key-pad and LED display or a hand-held terminal. The system shall be provided complete with all equipment and documentation necessary to allow an operator to perform the functions listed below for the DDC to which the terminal is connected as well as any other DDC on the Campus network:

Read the value of a measured variable
 Start or stop equipment
 Monitor the status of controlled equipment
 Read the set-point and tuning parameters of control loops
 Read all active alarms

To assist efficient operation and maintenance, provide equipment status and alarm monitoring system pressures, air filter differential pressure, air and water flow for large systems, VSD and fume hood monitor network connection. Match existing campus sequences wherever possible.

2.8.13 HVAC SEQUENCE OF OPERATIONS

The designer will write sequences of operation for all equipment controlled by the HVAC control system. Please strive for simplicity while providing accurate control of temperature and ventilation with minimum energy consumption.

2.8.14 TESTING, ADJUSTING AND BALANCING

Designers should specify what the parameters of airflow, water flow, and temperature will be measured and at what locations measurements should be taken. Be specific in the TAB specifications, for example: "Read supply and exhaust airflows at room diffusers," or "traverse supply and exhaust ductwork in the mechanical room." Specify flow elements, particularly in water systems, to facilitate balancing. Avoid the widespread use of automatic flow valves (Griswold, etc.) to avoid the pressure drops they entail. In variable flow systems specify the conditions under which they will be balanced.

Final settings shall be clearly marked on each balancing valve, quadrant, etc.

The balancing contractor shall be responsible for the labor and materials required for sheave changes necessary for the balanced operation of the system.

2.8.15 CONTROL AIR SYSTEMS

Control air compressors shall be duplex with refrigerant air dryer. Tank mounted (ASME stamped tank) duplex compressors sized to meet peak system demand shall be used. Compressor shall be belt driven, oil lubricated with air intake filter.

Copper pipe, type K or L, shall be used where air-line is exposed. Fire rated virgin black polyethylene tubing (Dekoron or equal), 2000 psig tensile strength, with vermin resistant treatment, with barbed brass fittings may be used if run through conduit.

For long pipe runs, control air shall be delivered at full line pressure with a pressure reducing valve mounted near the final point of delivery or equipment at a pressure of 25 psig.

2.8.16 MECHANICAL INSULATION

Provide removable insulation for steam and condensate equipment applications including unions, valves, regulators, expansion joints, condensate pumps and chilled water pumps where maintenance access is needed. Do not insulate cleanouts, access openings or identification plates

Insulation and vapor barriers shall be continuous. Breaks in insulation and vapor barriers such as at brackets, through walls or within dropped ceilings are not permitted

HEATING WATER, HOT WATER, COLD WATER AND CHILLED WATER PIPING:

Inside Buildings: Molded glass fiber with All-Purpose white jacket and PVC Zeston (or equal) fittings covers. Seal all gaps.

Outside Buildings: Molded glass fiber with 0.016" aluminum jacket applied over pipe and fitting insulation.

Where insulation is susceptible to damage, either inside or outside buildings, cellular glass insulation such as "FOAMGLAS" shall be used.

REFRIGERANT LINES

Cellular glass or closed cell foam plastic with flame-resistant vinyl jacket

STEAM AND CONDENSATE PIPING:

General inside building (to maximum 300oF): Molded glass fiber with All-Purpose white jacket and PVC Zeston (or equal) fittings covers. Seal all gaps.

General outside building (to maximum 300°F): Molded glass fiber with 0.016" aluminum jacket applied over pipe and fitting insulation.

DUCT INSULATION:

Exterior insulation: Fiberglass blanket with minimum density of 2 lbs. per cubic foot and flame resistant Foil-Scrim-Kraft (or equal) vapor barrier.

Interior insulation (lining) for sound attenuation only: Rigid fiberglass duct liner board with air stream surface covered with black plastic coated mat facing.

2.9 PLUMBING

2.9.1 DOMESTIC WATER SUPPLY PIPING

All copper piping shall be type K. All piping 4 inches and smaller shall be copper. Piping greater than 4" may be copper or galvanized steel. Joint connections for copper piping greater than 4" shall not be soldered.

Connections between copper and steel piping shall be made with a dielectric union. All joint connections for copper piping which are code compliant are acceptable provided that piping and fittings are type K or higher or type K equivalent.

Support all horizontal piping on clevis type hangers. Use trapeze hangers where several pipes or conduits can be installed in parallel and at the same level. Specify copper-plated devices for copper pipe and split-ring type for galvanized pipe. Perforated strap hangers are prohibited. Trapeze hangers and roller hangers are acceptable.

Provide sleeves for pipes passing through wall or floor construction. Sleeves may be omitted at monolithic construction such as concrete. Insulation on pipes shall be continuous through the sleeves. Provide protection for the insulation from abuse such as floor polishing machines and vacuum sweepers. Space between the pipe and sleeve must be sealed

Unions or flanged connections shall be provided to facilitate repair or removal of equipment such as pumps, valves, fixtures, etc. A union or bolted flange fitting shall be provided downstream of and within approximately 12 inches of each valve, and adjacent to both inlet and outlet of pumps and other equipment.

Flush valves shall be exposed for easier maintenance.

The water supply to a building must include two code compliant Reduced Pressure Zone Backflow Preventers (RPZBP), with strainers, in parallel with ball or butterfly shut-off valves. Include pressure gauges on both sides of RPZBP. All RPZBP relief drains shall be piped with full sized drain lines to the nearest sanitary drain. The sanitary drain shall be capable of handling a full discharge flow from the RPZBP. Units must be removable and accessible for maintenance.

Town of Amherst water supply shall not be used for cooling systems that discharge to waste.

Water supply meters shall read in gallons with electrical contact closure provided for pulse output to remote readout or building automation system, and be flanged and valved with full size bypass to permit convenient replacement. For building meters provide compound type meter to read lowest flow rate. Locate deducting water meters on cooling towers and water cooled devices which discharge directly to storm sewers. Meters shall be high quality with locally available repair parts, Hersey or equal.

Check Valves shall be provided on showers, automatic washers, and other items or equipment equipped with cold and hot water mixers.

Each valve in each piping system shall be tagged with a brass or aluminum tag numbered consecutively for each system and attached to the valve with a brass or aluminum chain. Valve tags shall have stamped abbreviations of the system in addition to the valve number. A valve schedule with tag numbers shall be installed and located in a mechanical room.

Shut-off valves shall be provided on all branches off of main water lines and ahead of dielectric unions. Branches shall be provided with drain valves to facilitate drainage. Each fixture and piece of equipment shall be provided with a fixture stop. Groups of fixtures shall be valved separately. Stops for flush valves shall be screwdriver stops with protective caps.

Provide water hammer arrestors in water lines to equipment or fixtures having quick closing or flush valves and any equipment that might produce water hammer. Provide gauges and/or thermometers (not self-sealing test connections) in the following locations:

- Pressure gauges at all pressure reducing valves to indicate both high and reduced pressures.
- Pressure gauges at all pump suction and discharges.
- Pressure gauges shall have range that will read mid-scale at normal operating pressure.
- Thermometers on domestic hot water systems to indicate supply and return temperature.

2.9.2 PROTECTION OF POTABLE WATER SUPPLY

In buildings containing laboratories, water lines to drinking fountains shall be run on separate risers connected to the mains ahead of laboratory equipment lines. Vacuum breakers shall be provided at all laboratory equipment and laboratory water lines.

2.9.3 PIPING IDENTIFICATION

Piping shall be permanently identified with color bands per ANSI A13.1 guidelines.

2.9.4 DOMESTIC HOT WATER HEATING SYSTEMS

Domestic hot water systems shall be designed to reasonably assure an expeditious flow of hot water at ALL outlets at any time. The design may include recirculating line(s) and pump(s).

The use of steam to hot water heat exchangers with storage tanks is preferred.

All heat exchangers shall be designed for performance based on 5 psig steam entering shell side of heat exchanger.

Hot water storage tanks below 150 gallon, tanks shall be glass lined.

Maximum Fouling Factor shall be used in sizing domestic hot water heaters. Factory assembled units are preferred.

Locate thermometers on the hot water inlet and outlet of the hot water heater where temperature should be identifiable for operation and maintenance.

Locate pressure gauges on suction and discharge sides of pumps and elsewhere in domestic hot water systems as needed to properly identify pressure within the piping system.

2.9.5 INSULATION

Do not insulate cleanouts, access openings or identification plates

Insulation and vapor barriers shall be continuous. Breaks in insulation and vapor barriers such as at brackets, through walls or within dropped ceilings are not permitted

HOT WATER, COLD WATER AND CHILLED WATER PIPING:

Inside Buildings: Molded glass fiber with All-Purpose white jacket and PVC Zeston (or equal) fittings covers. Seal all gaps.

Outside Buildings: Molded glass fiber with 0.016" aluminum jacket applied over pipe and fitting insulation.

Where insulation is susceptible to damage, either inside or outside buildings, cellular glass insulation such as "FOAMGLAS" shall be used.

2.9.6 WASTE AND VENT PIPING

PVC piping for interior vents, soil, waste and storm drains shall be prohibited.

Interior underground vent, soil, waste and storm drains shall be extra-heavy weight centrifugally cast iron soil pipe with lead, rubber gasket or "no hub" joints.

Type K copper tubing and copper drainage fittings may be used for 3 inch diameter and smaller.

All cleanouts 4" or less shall be full line size. Cleanouts shall be provided as follows:

- Cleanouts shall be furnished with brass countersunk plugs with lead seal for sanitary waste.
- All "J" traps will have cleanouts

2.9.7 ACID WASTE PIPING

For interior acid waste and vent systems, Duriron may be used in any location. Labline/Enfield polypropylene, or equal, flame retardant piping (ASTM D4101) with mechanical joints may be used within any room but may only penetrate ceilings, floors, or fire rated walls using U.L. listed penetrations and fire stop materials.

2.9.10 SUMP PUMP AND SEWAGE EJECTORS

When sump pumps and sewage ejector pumps must be used they shall be of the duplex, submersible type. They shall be fitted with mechanical float switches and remote-mounted pump panels with H.O.A. switch for each pump. The duplex pumps and ejectors shall be equipped with an alternator as well as a high water audible and visual alarm. They shall also have the ability of two-pump run control. Motors shall have three phase protection for three phase motors. Gas-tight gasketed cover with grommets openings for piping and wiring shall be provided as well as gas-tight manholes. Venting should be through dedicated vent stack. Pumps shall be serviceable with quick-removal system. Pits over 5 feet deep shall be fitted with a guide rail system.

2.9.11 COMPRESSED AIR SYSTEMS - GENERAL SERVICE AIR

Automatic condensate traps shall be provided at all air receiver tanks and low points on compressed air lines.

Compressed air piping shall be seamless hard-copper tubing, type K or L, or Schedule 40 galvanized steel pipe.

Air compressors (10 hp and under) shall be air cooled. Caution shall be exercised in locating compressors, with respect to heat-producing equipment and room ambient temperature and sound level requirements.

2.9.12 NATURAL GAS SYSTEMS

Concealed piping shall be welded.

Locate pressure gauges at the service entrance, and upstream and downstream of pressure reducing valves.

2.9.13 PLUMBING FIXTURES

All piping that penetrates walls shall be fitted with chrome plated escutcheon plates. New installations shall be fitted with one-piece escutcheon plates. All other installations may have split ring.

WATER CLOSETS

Water closets shall be of elongated design with open front seat, color as approved by the University. Wall hung water closets with automatic flushometers are preferred.

URINALS

Siphon jet or blowout type urinals shall be used except where sound control is a problem. Only wall hung urinals with integral traps shall be used. Automatic flushometers are preferred.

LAVATORIES

Traps on lavatories and sinks shall be chrome plated cast brass "P" traps with brass nut. Supply line to lavatory fittings shall be chrome plated steel with accessible steel stop valve. Automatic flushometers are required.

CUSTODIAN SINKS

Custodian sinks shall be floor mounted precast terrazzo or molded stone. Provide a single heavy duty nozzle with separate hot and cold levers.

EMERGENCY SHOWER AND EYE WASH STATIONS

Water for the emergency shower/eyewash station shall be tempered. Floor drains are not to be provided at emergency shower and eye wash stations.

The water supply to showers and or shower/eyewash combination units should be controlled by a shutoff valve which is visible and readily accessible. The valve shall be placed in an open tamper

proof location where it can be locked open with a removable padlock and not inadvertently closed.

DRINKING FOUNTAIN/COOLERS

Individual electric refrigerated water coolers shall be provided in new buildings. Wall hung types are preferred. .

WALL HYDRANTS

Provide freezeless wall hydrants every 100 feet on exteriors of new buildings. Hydrants shall have special key design handle as used by the University to limit accessibility.

2.10 ELECTRICAL

2.10.1 General

All materials and products provided MUST be listed and labeled by U. L. or a recognized National Organization acceptable to the Authority Having Jurisdiction.

2.10.2 CAMPUS POWER DISTRIBUTION

The high voltage electrical distribution system serving the campus is a private system, owned and maintained by Physical Plant Utilities Department.

The University's high voltage primary distribution systems consists of a 13.8kV, 3 wire, 3 phase looped underground distribution system and a 2400V, 3 wire, 3 phase radial underground distribution system. The West side of the Campus is served with two 13.8kV Primary feeders from the Podick WMECO substation. The East side of the Campus is served with three 13.8kV Primary feeders from the WMECO Amherst substation. The 2.4kV feeder can be supplied from the coal fired Power Plant at the center of the campus as well as by Western Massachusetts Electric Co.

The two Medium Voltage Systems are three phase, three wire 13,800 V. delta with ground, and three phase, three wire 2,400 V. with ground.

The Low Nominal System Voltages are three phase, four Wires, 480/277volt and/or four wires 208/120 V. The Low Nominal Utilization Voltages are 460 V. and/or 200 V., respectively.

New buildings shall be supplied by two medium voltage feeders in a primary selective system. This arrangement provides the University with the flexibility of switching the building to a standby feeder during periods of loss of power or while performing maintenance on the original feeder.

The University's Utility Department shall be consulted whenever connection to the primary voltage distribution systems is required. Taps into either system can be accomplished using exterior pad mounted switches as manufactured by the S&C Electric Co.

2.10.3 DUCTBANKS

All underground buried raceways for the medium voltage systems shall be installed in ductbanks.

All ductbanks shall consist of a minimum of two 4" schedules 40 PVC conduits encased with concrete and reinforced with rebar. Typically, provide one spare conduit for every used conduit.

All ductbanks that cross roads or heavily traveled traffic areas shall be schedule 80 PVC.

All underground conduit sweeps shall be PVC coated rigid conduit, as shall be all final stub ups into buildings.

Whenever possible, ductbanks should not be located within 5' of water or sewer utilities. Ductbanks shall be located more than 10' away from any steam line, or covered with rigid insulation when separation distance cannot be maintained.

Slope all ducts slightly towards manhole for drainage purposes.

All conduits shall be swabbed with a mandrel after installation and shall be provided with a #12 pull wire.

All ductbanks and in-ground services shall be marked by the University's Surveying Department prior to backfilling.

2.10.4 RACEWAY

Raceway shall be schedule 40 PVC.

2.10.5 MANHOLES

Manholes shall be manufactured of concrete and be a minimum of 8' wide x 8' long x 7' high and shall be accessed using chimneys a minimum of 30" wide with a full height galvanized steel ladder. Include steel galvanized pulling eyes in the walls and floors, nonmetallic adjustable arm cable racks on all four walls, and a 5/8" x 10' copper ground rod in the corner with a 1" x 1/4" copper ground bus on the inside perimeter walls of the manhole. Bond all components together (including the ladder) using an exothermic weld process.

Manhole covers shall be cast iron, and the word "Electric" and the feeder designation cast on the cover in 3" lettering.

Manholes require a sump drain hole and cast iron grate connected to the closet sewer storm drain.

All conduits entering manholes shall be provided with bell ends. Plug any spare conduits with insulation to prevent egress of moisture and steam. Locate duct entrances close to corners to maximize available space for future conduits.

2.10.6 PAD MOUNTED MEDIUM VOLTAGE SWITCHGEAR

All pad mounted medium voltage switchgear shall be UL Listed and shall be manufactured by the S & C Electric Co.

The pad-mounted gear shall consist of a single self-supporting enclosure, containing interrupter switches and power fuses with the necessary accessory components, all completely factory-assembled and operationally checked.

The ratings for the integrated pad-mounted gear shall be as follows:

14.4 kV Nominal, 17.0 kV, Maximum
95 kV, BIL
600A Main Bus Continuous

Three-Pole Interrupter Switches
600A Continuous
600A Load Dropping
Two-Time Duty-Cycle Fault-Closing,
22,400 Amperes Rms Asymmetrical

Fuses with Integral Load Interrupter
200E Maximum, Amperes
200A Load Dropping
Two-Time Duty-Cycle Fault-Closing
Capability, 14000 Amperes Rms Asymmetrical

Short-Circuit Ratings
 14000 Amperes Rms Symmetrical
 350 Mva Three-Phase Symmetrical
 at Rated Nominal Voltage

The momentary and two-time duty-cycle fault-closing ratings of switches, momentary rating of bus, interrupting ratings of fuses, and one-time duty-cycle fault-closing capabilities of the fuses with integral load interrupters shall equal or exceed the short-circuit ratings of the pad-mounted gear.

Interrupter switches shall be provided with a single blade per phase for circuit closing including fault closing, continuous current carrying, and circuit interrupting. Spring-loaded auxiliary blades shall not be permitted.

Interrupter switches shall have a readily visible open gap when in the open position to allow positive verification of switch position.

Key interlocks shall be provided to prevent paralleling the two source interrupter switches. Two defeater keys are to be provided to the UMA Utility Department.

Ground studs shall be provided at all switch and fuse terminals. Ground studs shall also be provided on the ground pad in each interrupter switch compartment and on terminals and ground pad in any bus compartment. The momentary rating of the ground studs shall equal or exceed the short-circuit ratings of the pad-mounted gear.

Switch terminals and bus-compartment terminals shall be provided with adapters to accommodate two cables per phase.

Mounting provisions shall be provided to accommodate one three-phase fault indicator with three single-phase sensors in each switch compartment.

Fuses shall be disconnect style, solid-material power fuses, and shall utilize refill-unit-and-holder or fuse-unit-and-end-fitting construction, S&C #SMU-20.

Solid-material power fuses shall be equipped with a blown-fuse indicator that shall provide visible evidence of fuse operation while installed in the fuse mounting.

Fuse-mounting jaw contacts shall incorporate an integral load interrupter that shall permit live switching of fuses with a hookstick.

Switchgear pads shall be heavy duty, ¼" thick fiberglass box pads covered with a gel-coat with UV stabilizer. The pad shall be 36" deep, installed on a 12" traprock base and shall be manufactured to meet requirements for size and weight of switch installed. Pads shall be manufactured by Nordic Fiberglass, Highline Products, or approved equal.

Ground all pad mounted medium voltage cables by installing two 5/8" x 10' copper ground rods at outside corners to pad and surrounding the entire perimeter with a #3/0 bare copper conductor. Bond all grounding components together using exothermic weld process.

2.10.7 PRIMARY ELECTRICAL TRANSFORMERS

All medium-voltage transformers shall comply with NEMA ST 20, IEEE C.57.12.01 and IEEE C.57.12.01 and shall be listed and labeled as complying with UL 1562.

All transformer installations shall be provided with grounding details including main and supplementary grounding electrode types and locations. All grounding locations such as structural steel and water pipe shall be shown on the contract drawings in the actual location that they exist and shall comply with the Massachusetts Electrical Code.

The engineer shall submit calculations for K-factor rated transformers. Transformers shall be air cooled, 3 phase, 3 wire, 60 Hz, delta primary; 3 phase, 4 wire wye secondary electrical distribution system. All medium-voltage transformers shall be dry VPI type. Oil filled transformers are not permitted. All transformers shall be provided with the following:

Insulation System: UL 220°C

Temperature Rise: 80°C maximum rise above a 30° average ambient temperature.

Harmonics: Transformers shall be rated to mitigate the building harmonic loads.

Core: Grain oriented non-aging silicon mitre cut steel, minimum grade M-6. The core shall be visibly grounded to the frame by means of a flexible grounding strap.

Windings: All windings shall be aluminum and vacuum pressure impregnated twice (double dipped). The encapsulating materials used for the VPI process shall have 100% solid content and shall be either polyester or silicon based. All windings shall be continuous without splices except for taps. All connections shall be welded or brazed.

Taps: Provide six full capacity 2-½% taps. Two above and four below rated high voltage. Provide flexible links on the face of each HV coil for changing tap settings.

Outdoor Enclosure: NEMA 3R vandalproof, tamperproof heavy gauge steel padmount enclosure with olive green UL Listed outdoor polyester powder paint, Munsell 7GY3.29/1.5. All ventilated openings shall be tamperproof, shall be in accordance with NEMA and NEC standards for ventilated enclosures, and shall be provided with air filters. All hardware shall be tamperproof.

Indoor Enclosure: NEMA 1

Shielding: Shall be electrostatic. Each winding shall be independently single shielded with a full width copper electrostatic shield arranged to minimize interwinding capacitance.

Sound Level: Medium-voltage transformers shall have a sound rating a minimum of 3dB less than NEMA TR 1 standards for transformers of that type and rating.

BIL Rating: 13.8kV transformers shall have a BIL rating of 95kV. 2.4Kv transformers shall have a BIL rating of 60kV. The BIL rating shall be accomplished without the use of supplementary lightning arrestors.

After transformer has been energized for a minimum of one week and after normal loads have been connected transformer taps shall be adjusted to provide optimum voltage for the load served. The Engineer shall obtain from the Electrical Contractor a record of primary and secondary voltages and tap settings along with transformer test results. They shall be reviewed by the Engineer of Record and shall be submitted to the University prior to project closeout.

Indoor transformer shall be installed on a 4" concrete pad.

2.10.8 MAIN ELECTRICAL SWITCHBOARDS

Main switchboards shall have copper busses with no reduction. Front and rear access is preferred. Provide 25% spare breakers and no spaces.

New building service switchboards and replacement service switchboards shall have Square D power logic.

Switchboards shall be installed on a 4" concrete pad.

2.10.9 MEDIUM VOLTAGE CABLE

The University Utility Dept. has specific requirements for medium voltage cables and needs to be consulted prior to specifying acceptable products.

2.10.10 CAMPUS SITE LIGHTING (walkways, parking areas, roads)

The campus site lighting is 480/277 Volt.

The Campus is divided into zones for powering the site lighting. Each zone has a central location containing power panels controlled by a photocell and lighting contactor. When providing additional Campus site lighting an analysis will need to be performed to determine if an extension from the closest pole is acceptable or whether a new underground feeder run back to the central location will be required.

2.10.11 RACEWAY

Minimum 2", PVC, direct burial. When near to, or crossing steam lines, use fiberglass raceway instead of PVC.

Provide concrete ductbanks when crossing roadways or heavily traveled traffic areas. Typically, provide one spare raceway for every used raceway within ductbank. End ductbanks at hand holes.

Spare conduit shall have capped ends.

2.10.12 HANDHOLES

Stackable, 18"x16"x12" , open bottom, precast concrete handholes as manufactured by the Quazite Co. shall be installed on 12" compacted gravel base and be provided with precast concrete, traffic rated, covers imprinted with the word "ELECTRIC."

Hand-holes shall be installed in grass areas, at each lighting unit and at intervals not greater than 100 feet.

2.10.13 BRANCH CIRCUIT WIRING

All exterior lighting circuitry shall be in raceways with hand-holes for future access. Direct buried cable is not acceptable.

Conductors shall be minimum # 6 AWG, soft drawn, compact, stranded copper, type USE-2 insulation. Color coded full length.

Circuits shall be arranged so that in the event that a circuit is lost only every third luminaire will be de-energized. Provide a manual bypass for all automatic controls.

An equipment grounding conductor shall be installed with all circuits.

All contactors shall have minimum 25% spare capacity for future expansion

2.10.14 POLES

Identification tags shall be provided at each pole and shall include building # or area # as identified by the Physical Plant Utility Department, circuit # and fixture letter. Identification tags shall match those installed on the University campus, in color and texture.

Provide a 5/8" x 10' copper clad ground rod and cad weld to pole base.

Walkway lighting:

Pole- Walkway and mall poles shall be as manufactured by Stress-Crete Limited, Burlington, Ontario, Canada, hexagonal section, U-MASS 16, S29 color and finish, 12 foot exposed height and 4 foot butt.

Luminaire shall be King Luminaire K118-LPR-III-(wattage code)-HPS-voltage-K12-K16R (or approved equal)

Roadway lighting:

Pole-shall be as manufactured by Stress-Crete Limited, Burlington, Ontario, Canada, hexagonal section, U-MASS 29,S29 color and finish, 24 foot exposed height, 5 foot butt and 4 foot bracket arm.

Luminaire shall be American Electric Lighting, Roadway Series 325, 250 and or 400 watt, high pressure sodium, cutoff fixture with photocell receptacle catalog #C325337.

Parking lot lighting:

Pole- shall be as manufactured by Stress-Crete Limited, Burlington, Ontario, Canada, hexagonal section, U-MASS 34-1 and 34-2 with 2 foot bracket arm, S29 color and finish, 29 foot exposed height, 5-foot butt.

Luminaire shall be American Electric Lighting, Roadway Series 325, 250 and or 400 watt, high pressure sodium, cutoff fixture with photocell receptacle catalog #C325337.

ROADWAY LIGHTING STANDARDS

- Spacing: approx. 80' on center, Light level: IEEE: Roadway Collector (serving traffic between major and local roadways); Lux - 13, Footcandles - 1.2. Local (direct access to residential, commercial or abutting property; Lux - 10, Footcandles - 0.9. (Average Maintained Illuminance on the Horizontal).
- Traffic Conflict Areas, intersections and pedestrian crosswalks shall be illuminated at least 150% of the average route value.

SIDEWALKS LIGHTS (roadside)

- Spacing: approx. 80' on center cut-off and/or 60' on center King Luminaire. Luminaire and spacing depend on the ability of the roadway lighting to establish footcandle levels required, ie; side of the road, trees between walk and roadway e.t.c.
- Light level: IEEE: Intermediate areas (Moderately heavy night-time pedestrian activity). Minimum Average Levels; Lux - 6, Footcandles - 0.6. (Average Maintained Illuminance on the Horizontal).

WALKWAY LIGHTS (distant from roadways)

- Spacing: approx. 60' on center
- Light level: IEEE: Minimum Average Levels Park walkways and bikeways; Lux - 5, Footcandles - 0.5. Pedestrian stairways; Lux - 6, Footcandles - 0.6. (Average Maintained Illuminance on the Horizontal).

PARKING LOT LIGHTS

- Arms: 2', Single or double depending on layout.
- Spacing: 116' in lot (every other row), 117 or 126' in rows depending on layout, poles must be between spacing.
- Light level: IEEE: Educational facility parking (Low Activity). Vehicular Traffic; Lux - 5, Footcandles - 0.5, Uniformity Ratio - 4:1 Pedestrian Safety & Security; Lux - 9, Footcandles - 0.8, Uniformity Ratio - 5:1 (Average to Minimum Illuminance).

2.10.15 BUILDING POWER DISTRIBUTION

SHORT CIRCUIT COORDINATION: The engineer shall design all electrical systems with proper Coordination so that the over current protective device nearest a fault is the only over current protective device that trips if an overload or short circuit condition occurs. We use only fully rated circuit breakers. Series rated type circuit breakers are unacceptable.

2.10.16 MOTOR CONTROL CENTERS

Motor control centers shall be NEMA Class 1, with Type B wiring and shall be totally enclosed, dead front, front access only in NEMA Type 1 free standing enclosures.

All motor control centers shall be sized with a minimum of 25% spare capacity complete with bus bar, rails, and wireways. All bussing and connectors shall be tin plated copper. Busses to be full length with no reduction.

Motor starters for motor control centers shall be combination type with circuit breaker type disconnects, and starters shall be wired so that after loss of power, the motor will revert back to automatic operation when power is restored. Starters shall be NEMA type. IEC type is unacceptable.

Motor control centers shall be installed on a 4" concrete housekeeping pad.

2.10.17 SAFETY SWITCHES

Provide safety switch at all motors.

All enclosed disconnect switches shall be heavy duty and provided with the following features:

Lockable handle at both on and off positions and interlocked with cover in closed position
Ground bar

Fuses shall be time delay, current limiting type with minimum 200,000 ampere interrupting capacity. Provide low peak type where required.

2.10.18 CONNECTION TO MOTORS

Provide flexible raceway at final connections to motors

2.10.19 SECONDARY ELECTRICAL TRANSFORMERS (600V or less)

All transformers shall comply with NEMA ST 20 and shall be listed and labeled as complying with UL 1561.

The engineer shall submit calculations for K-factor rated transformers.

Transformers shall be air cooled, designed for 60 Hz service and shall be dry type. Oil filled transformers are not permitted. All transformers shall be provided with the following:

Insulation System: UL 220°C

Temperature Rise: 80°C maximum rise above a 30° average ambient temperature.

Harmonics: Transformers shall be rated to mitigate building harmonic loads.

Core: Grain orientated nonaging silicon mitre cut steel, minimum grade M-6.

Coils: Continuous without splices except for taps. All coil connections shall be welded or brazed. Copper only.

Taps: Provide six full-capacity 2 ½% taps. Two above and four below rated high voltage.

Enclosure: Indoor ventilated type with powder coated 1½ mil thick ANSI 61 gray paint.

Shielding: Electrostatic. Each winding shall be independently single shielded with a full width copper electrostatic shield arranged to minimize interwinding capacitance.

Sound Level: Comply with ANSI and NEMA ST 20 standards for dry type ventilated transformers.

2.10.20 ELECTRICAL BRANCH CIRCUIT PANELBOARDS

All panelboards circuit breakers shall be fully rated to withstand fault currents. No series rated circuit breakers will be allowed.

All panelboards shall be provided with the following:

- Copper bussing
- Hinged to box cover (door to door)
- Bolt-on circuit breakers
- Equipment ground bar
- Minimum 25% spare spaces

Provide two spare 1" conduits from each new flush mounted panel board to accessible area above ceiling.

No load centers or tandem circuit breakers shall be permitted.

All panel boards shall have full size and height phase, neutral and ground busses and shall extend the full height of the panel without reduction.

2.10.21 ENCLOSED ELECTRICAL CIRCUIT BREAKERS

All enclosed switches and circuit breakers shall be UL listed and labeled and shall comply with NEMA KS-1, UL 98 and UL 489. Circuit breakers shall be molded-case.

Provide adjustable magnetic trip setting for circuit breakers frame sizes 250A and larger.

2.10.22 RACEWAY (conduit)

All feeders shall be in rigid conduit, IMC or EMT

Branch circuit wiring for motors and specialized equipment shall be in rigid conduit, IMT or EMT.

Branch circuit wiring for lighting and receptacle power: Use rigid conduit, IMT or EMT from panel boards to the junction box(es) provided in a room or area for power or lighting. Multiple junction boxes shall be interconnected by use of rigid conduit, IMT or EMT. Type AC cable or flexible metallic conduit shall be used from the junction box(es) within the room or area to the individual light fixtures, switches and receptacles.

Conductors for lighting shall be in a separate raceway from power.

Minimum raceway size shall be ¾" except for control circuit wiring and lighting switch legs where ½" conduit will be acceptable.

The proposed routing of all raceways 1 1/2" and larger shall be shown on the contract documents

All conduits shall be installed concealed wherever possible.

Route raceway to avoid all heat producing items including steam pipes.

Install in each raceway a green ground conductor sized per MEC requirements and bond accordingly.

Provide a 200 lb. Test, nylon fish line in all spare conduits with 12" slack at each end.

All conductors in abandoned raceways, boxes and enclosures shall be removed in their entirety.

Rigid galvanized steel conduit shall be installed where abuse or damage protection is needed.

2.10.23 SURFACE RACEWAY

Surface raceway shall be steel, minimum size shall be equivalent to Wiremold #700.

For combination power/data applications, Wiremold #4000 or #6000 divided surface metal raceway.

Divided surface raceway may be either metal or non-metal.

2.10.24 CONDUCTORS

All conductors for feeders and branch circuits shall be annealed copper, 98% conductivity, stranded, rated 600V with Type THHN/THWN insulation.

All branch circuits shall be provided with separate neutral conductors.

All neutral conductors for computer panels shall be sized at 200% minimum.

2.10.25 BOXES

Minimum size for device boxes shall be 4" x 4" x 2". Non-metallic device boxes are not acceptable.

Pull boxes shall be galvanized sheet steel, minimum 14 gauge.

2.10.26 CABLE TRAYS

Cable trays shall be ladder type manufactured from aluminum or steel and shall comply with NEMA VE1.

2.10.27 BUSDUCT

Bus duct shall be copper.

2.10.28 DEVICES

Switches shall be 120/277V, 20A industrial specification grade, back and side wired, and with grounding terminal.

Receptacles shall be NEMA 5-20R, industrial specification grade.

Ground fault circuit interrupter receptacles shall be feed-through type with integral NEMA 5-20R duplex receptacle.

Emergency receptacles shall be red in color with a red engraved cover plate that reads "Emergency Power".

Install a 125V/20A duplex receptacles 50' on center in all corridors and on all stairway floor landings for floor cleaning equipment, in all lobbies and in all elevator cars. These receptacles shall be connected to their own circuit and shall not share circuits with offices.

2.10.29 INTERIOR LIGHTING

Incorporate the most energy efficient technology for lamps, fixtures and control equipment.

The lighting designer shall correspond with the Western Massachusetts Electric Co. to see if the lighting installation is eligible for any lighting rebate program.

Consider the architectural and lighting quality benefits of direct lighting, direct/ indirect lighting and lighting from wall surfaces.

Provide specific area task lighting to reduce the need for higher general overhead light levels

Lighting design shall emphasize accessibility to fixtures for periodic re-lamping, cleaning and maintenance. Pay particular attention to lighting accessibility in lobbies, auditorium, stairways, and other areas with high ceilings.

The lighting design in offices and other areas using personnel computers or other visual display terminals should take into account veiling reflections. Use indirect or deep cell parabolic ceiling fixtures or other measures to visual discomfort.

Office lighting will generally be fluorescent with a fairly even level of general illumination. Task lighting should be provided in situations, such as systems furniture, where additional lighting is required for the specific functions.

Lighting in shops, supply or warehouse areas with high ceilings above 16 feet should be color improved high performance sodium or metal halide.

Lighting in mechanical and electrical spaces should be industrial type fluorescent fixtures.

2.10.30 LIGHT FIXTURES

Specify energy efficient lamps for the intended use. Generally, interior lighting should be fluorescent. Lamps shall be T-5, T-8 and compact fluorescent, full spectrum/daylight. Generally, incandescent lighting shall only be used for special architectural purposes.

When multiple switching is used for lighting control, provide fixtures that will allow for independent control of each lamp within the fixture.

Generally, parabolic lenses are preferred to acrylic lenses.

2.10.31 LIGHT CONROLS

Enclosed space lighting controls should include multiple switching and either occupancy, daylight or light level sensors. For small closed spaces with glazing, provide multiple switching and photoelectric sensors. For small closed spaces without glazing, include multiple switching and occupancy sensors.

Occupancy sensors should be considered for private offices, classrooms, toilet rooms, and conference rooms.

Open space lighting controls should include multiple switching and light level sensors for spaces adjacent to glazing. Large open spaces should be sub-divided into lighting zones and incorporate multiple switching.

Two lamp fluorescent light fixtures in offices shall have both lamps switched separately while in corridors, mechanical rooms, storage rooms, etc.; every other light fixture shall be separately switched.

Classrooms utilizing AV equipment, whether portable or built in equipment, shall utilize lighting control equipment to uniformly reduce the light levels throughout the room by the use of multiple switching or dimming.

Conference rooms, auditorium and similar spaces utilizing AV equipment, whether portable or built in equipment, shall have full dimming capability.

2.10.32 EMERGENCY LIGHTING

Connect emergency lighting fixtures to emergency generators where they exist.

Central emergency lighting systems, such as inverter units, are preferred to individual battery pack units.

Where general use lighting fixtures are on the emergency circuit to provide emergency lighting, a provision for switching shall be provided to allow normal shutoff but override for power loss conditions.

Battery-powered emergency lighting fixtures, when used, shall comply with UL 924. It shall have a test switch and LED indicator visible and be accessible without opening the light fixture. The battery shall be minimum 10 year life.

A blue stick-on dot shall be placed on every emergency light fixtures or on the ceiling grid adjacent to the emergency fixture.

2.10.33 EXIT SIGNS

Exit signs shall be LED type.

2.10.34 NIGHT LIGHTING

Shall be considered on a case by case basis.
When needed?

2.10.35 EXTERIOR LIGHTING

Exterior lights at all means of egress shall be connected to an emergency circuit. Lights shall be controlled by a photo-sensor.

2.10.36 CLOCK SYSTEMS

Most clocks on campus are centrally controlled through the campus fire alarm loop.

2.10.37 LIGHTNING PROTECTION

Provide lightning protection where needed and as defined by code.

2.11 FIRE ALARM SYSTEMS

The University requires automatic fire detection systems in all occupied buildings. The fire detection system shall notify the building occupants with both visual and audible signals and send a notification signal through the campus fire alarm loop.

The campus fire alarm loop is a hardwired system with transponders located in each building. The transponders transmit signals to the Simplex 2120 head end piece located at the University Public Safety office at Dickinson Hall. Each transponder is capable of transmitting a limited number of alarms; pre-alarm, alarm, trouble and water flow. The system does not allow specific information relative to the type of device or zone that is in alarm to be transmitted to the Public Safety office.

Fire detection systems shall be addressable. Pull stations shall be double action.

All activation devices shall be provided with a permanent label which identifies the device address.

Smoke detectors shall be installed in locations readily accessible for testing and replacement. Provide remote LED where the smoke detectors are not readily accessible. Remote test switch for duct detectors shall be visible upon entry into mechanical rooms and where approved by authority having jurisdiction.

Duct smoke detectors shall shut down the mechanical equipment and send a pre-alarm trouble signal, not an alarm signal.

All fire alarm cabling shall be in raceway and all fire alarm risers shall be rigid conduit. Fire alarm cable shall be approved by the Fire Detection system manufacturer

Fire alarm control panels shall not be installed in mechanical rooms. Provide a separate fire alarm room or dedicated alcove adjacent to the building corridor. Provide remote annunciator panels at locations required by the authority having jurisdiction, typically at the building entrance. Annunciators shall have LCD display.

The Authority Having Jurisdiction (AHJ) for most campus projects is the Amherst Fire Department. The Amherst Fire Department has extensive permitting, documentation and testing procedures that are the responsibility of the designers and contractors, not the University, to satisfy.

To assist the permitting process, the University requires construction documents to include separate drawings depicting only fire alarm related elements, and not to include the work of other trades. Drawings shall indicate specific location of every device in the fire alarm system and include a fire alarm riser diagram indicating by floor and by zone/circuit, every device to be attached to the fire alarm system, including relays and end of line devices.

2.12 FIRE PROTECTION SYSTEMS

2.12.1 GENERAL

The Campus has a looped water main distribution with pressures of approximately 80-120psig, depending on location. The University Environmental Health and Safety Department (EH&S) and the designers will perform flow tests to obtain data for the required hydraulic design calculations.

A post indicator valve is required on the fire service entering each building, and shall be protected by bollards if located in an area subject to damage by vehicles.

Each fire protection system shall be monitored by the building fire alarm system. All control valves shall be provided with tamper contacts for connection to the building fire alarm system.

The Amherst Fire Dept. may require buildings equipped with fire sprinkler systems may be equipped with an exterior local alarm (bell and strobe) initiated by the flow detection device.

A permanent placard should be provided at the base of each riser stating the design criteria of the system for hydraulically designed systems.

Piping shall be designed to facilitate flushing and sterilization of the system. In existing systems where major renovation work is done, the system shall be flushed and piping inspected internally at the discretion of the local fire department or authority having jurisdiction (AHJ).

The main line shall be flushed prior to connection to the sprinkler system, and the sprinkler system shall be thoroughly flushed prior to connection to the water supply.

Sprinkler system controls shall be wall mounted in a location that is accessible without the need for a ladder. Ceiling type sprinkler control installations are not acceptable.

All new systems or new portions of existing systems shall be hydrostatically tested in accordance with NFPA. The test shall be witnessed by the University.

2.12.2. WET PIPE FIRE SPRINKLER SYSTEMS

Wet pipe systems shall be used in the majority of system applications.

N.F.P.A. approved Victaulic or Gustin Bacon type piping systems are acceptable.

Provide easily accessible fire pump test manifolds adjacent to the siamese connection at grade level.

Antifreeze systems shall not be used unless specifically approved by the authority having jurisdiction.

2.12.3 DRY-PIPE FIRE SPRINKLER SYSTEMS

Where dry or pre-action systems are required galvanized pipe as approved by Factory Mutual may be used.

The system should be monitored for low air pressure.

Air pressure shall be maintained by a nitrogen system or automatic air compressor powered from a dedicated circuit supplied from the building emergency circuit where available. If no dedicated emergency circuit is available, air pressure shall be maintained by a nitrogen system.

2.12.4 DELUGE FIRE SPRINKLER SYSTEM

Deluge fire sprinkler systems will not be used at the University unless required by code. If required, the deluge valve assembly including the valve, trim packages, and actuation system, shall be UL listed or approved by Factory Mutual, as a complete assembly.

2.12.5 FIRE PROTECTION STANDPIPES

Standpipes shall be wet type without hose cabinets. Provide removable valved and capped connections at each floor.

2.12.6 FIRE PUMPS

Fire pumps shall be a centrifugal pump. The fire pump test connection cluster, with 2-½ inch valves; shall be located on the building exterior adjacent to the fire department siamese connection for the purpose of performing proper testing of the fire pump for initial acceptance and annual testing. Include piped drainage. Test valves shall have piped in drainage.

2.13 INFORMATION TECHNOLOGY AND COMMUNICATIONS

2.13.1 GENERAL

Our facilities require state-of-the-art communications and information technology infrastructure. The Campus currently cables its buildings with fiber and structured Cat 6 copper cabling utilizing Krone hardware.

Early in the design phase, the designers, building occupants, UMass project manager and UMass Office of Information Technology need to review the project's IT requirements.

2.13.2 CAMPUS I.T. INFRASTRUCTURE CONNECTION

Each new building shall be connected, via 4" schedule 40 PVC conduits encased within concrete ductbank, to the nearest existing Telcom manhole.

Minimum ductbank entry into the building is generally (1) - 4" conduit for telephone, (1) - 4" conduit for fiber and (2) - 4" spare conduits.

Connections for adequate phone cable and fiber shall be provided. Consult with *OIT* Cable Engineering for additional requirements and details.

2.13.3 BUILDING ENTRANCE TERMINAL ROOM

This is where incoming building entrance terminals (BET) cables are to be terminated. The room should provide adequate space for equipment and service personnel, be located in the basement or lowest level and in the immediate proximity to where the cable feeder conduits enter the building. Provide in this room the following:

- Minimum room size shall be 6 ft by 10 ft however building size and function may require larger spaces.
- Provide 19" Equipment Racks with cable tray tie-ins.
- Low-static vinyl tile floors.
- Do not install drop ceilings.
- Provide two 20 Amp dedicated circuits minimum, with corresponding receptacles every 6 ft along walls, on emergency power if it exists.
- Install a copper ground terminal block 12" wide with a #6 copper cable (minimum), in a 1/2" conduit tied into the building system ground at the electric service entrance. Also bond this terminal block directly to the steel frame of the building using #6 Cu cable.
- Install Plywood backboard, 3/4", with two coats of fire retardant paint, sky blue color. Backboard to be mounted directly on walls, typically from 9" AFF up to a height of 8'-6" AFF. All receptacles can be located below backboards, 6" AFF.
- Install cable tray around the perimeter of the whole room. Install at a height of 8 ft AFF.
- If a cable tray runs down the adjoining corridor, run a cable tray section through the corridor wall and tie to the cable tray within the BET room.
- Provide smoke detector type fire protection. If sprinklers are absolutely required by code, add wire cage protective covers over sprinkler heads. Substitute smoke detection, if possible, in the hope that it obviates possible water discharge events.

2.13.4 INFORMATION TECHNOLOGY NETWORK CLOSETS

Provide closets centrally located on each floor and directly accessible from the building corridor, minimum size 3 ft deep and 6 ft wide with double doors swinging out. Stack these closets

vertically within the building. In each of these spaces provide the items listed above and additionally:

- Closets and network spaces should be "stacked" within a building, with 4 - 4" sleeves to the spaces above and below. Make the sleeve/ bushing rise above the floor approximately 3" to minimize the possibility of water migrating down through the building. The sleeved openings should be located against a wall with backboard attached.
- Install cable tray from the Building Entrance Terminal room to one of these stacked closets. Alternatively, install an adequate quantity of 4" conduits. If conduit runs are used to feed closets they shall have readily accessible pull box(es) at or after every two 90 bends and/or every hundred feet.
- Install 19" Equipment Racks with cable tray tie-ins overhead, fiber termination units and Ethernet data switches.
- If a cable tray runs down the adjoining corridor, run a cable tray section through the corridor wall and tie in to the cable tray within the network closet.
- IDF (Intermediate Distribution Frame)

2.13.5 CABLE SUPPORT AND PATHWAY REQUIREMENTS

Where main corridors have readily accessible suspended ceilings provide cable tray sized according to expected Information technology cable capacity. Coordinate height to allow easy removal of ceiling tiles and also allow 8" minimum clearance above for cable placement. Alternatively, run a Snaketray type support system along both sides of the corridor with cross-overs spaced as required.

Cable path shall be installed to meet all requirements of Cat 6 structured wiring system. Since this limits workstation cable lengths to 295 feet, the corresponding designed cable path should not exceed approx. 270 feet.

Where a few cables are to be installed above a suspended ceiling, such as an office or work room, provide metal hangers fastened to the underside of the slab or to building steel above. Hangers to be Erico Caddy "Cable Cat Clips" for Category 6 cable support OR approved equal. Distance between hangers shall comply with Cat 6 requirement, slightly randomized separation distances between 3 ft and 5 ft and averaging ~4 ft overall.

Where cable path is in an exposed area use adequately sized EMT with pull boxes every 80 feet maximum and/or every two 90 degree bends. Bends shall be sweeps (or at pull boxes) not LB types. EMT shall be identified every 20 ft with plastic adhesive type labels, lettering .5 inches high, to read "PHONE/DATA". EMT shall have a pull string installed.

2.13.6 INFORMATION TECHNOLOGY OUTLET TERMINATIONS

The I.T. infrastructure needs to provide telecommunication outlets at the following locations: phone, FAX, Ethernet, card access, CCTV, security, networked equipment such as printers, Xerox machines, vending machines, elevators and their control machinery, power and energy management monitors, clocks, etc.

Phone/data outlets shall comprise a 4" square metal box, flush in the wall where possible, with an adapter for a single gang cover plate.

Outlets shall have a 1" EMT homerun to the nearest I.T. network closet. Homeruns to have bushings at each end, and pull string. Alternately, if there is a readily accessible drop ceiling (must be drop-in/removable tile type), stub a 1" EMT up behind the wall and extend it up to the

ceiling space. Typically that means just stubbing out of the wall just above the drop ceiling in the immediate vicinity of the outlet. Install plastic bushings and pull string.

Provide a path for cable support from EMT stub up to the IT Network closet using hangers, cable trays or snake trays. Metal hangers shall be fastened to the walls or underside of floor/ceiling construction above. Hangers shall be Erico Caddy "Cable Cat Clips" for category 6 cable support or equal. Distance between hangers shall be random spacing between 3ft and 5 ft with 4 feet average.

Outlet height shall be in the range 18" to 48" AFF. Coordinate with the furniture specifics and equipment locations. Outlets should not be installed in a location that will later be covered over by a modular furniture panels or become otherwise inaccessible.

The University Office on Information Technology will provide, at a cost to the project, the outlet covers, jacks and phone data cabling, and switching programming.

2.14 CONVEYING SYSTEMS

2.14.1 Elevators

The University has multiple contracts with outside vendors for the maintenance and repair of the elevators on Campus. Campus elevators shall have a non proprietary control system which will allow any manufacturer's representative or the University's Elevator Shop personnel to diagnose and repair the elevator. The elevator supplier must provide the University with all necessary software and maintenance manuals to maintain and service the elevator.

The elevator control system shall be microprocessor based and software oriented and operates in real time, continuously analyzing the car's changing position, condition and work load. All controller and operational circuits including the brake control and drive system shall be digital.

All lamps for signaling devices shall be LED.

Car operation panel shall have vandal resistant push button fixtures. Adams Survivor Plus has provided acceptable performance in the past. Key switches shall be provided for lights, fans, independent service switch, and inspection switch. All key switches shall be Best WB7 key system used on Campus.

Door protection device shall use microprocessor controlled infra-red light beams. A mechanical reopening device is not acceptable. Janus Elevator Products has provided acceptable performance in the past.

Elevator cabs shall be provided with an emergency communication system. Emergency phone shall be a hands free unit. A button to activate the emergency phone shall be installed in the car operating panel and labeled. Emergency communication system shall be equipped with a built-in LED which lights when a call has been received by the monitoring station to notify person unable to hear a response to their call and also cycles on and off when the answering party speaks or listens. Talk-A-Phone has provided acceptable performance in the past.

Emergency power: Elevators shall be connected to the building emergency power system when it is available in the building. For buildings without emergency power, the elevator control system shall include all hardware and software to allow the elevator to be connected to emergency power when provided in the future. All hydraulic elevators shall be provided with battery backup to operate the emergency power lowering device.

Provide a phone outlet, via the University OIT dept, in the elevator machine room for connection to the help phone in the cab.

Hydraulic elevator jacks shall be provided with a PVC liner and a packing system that does not require pressure to maintain the seal. Elevator Equipment Corp. and Cemco Lift Elevator products have provided acceptable performance in the past.

For most applications, elevator cabs shall have stainless steel cab faces, ceiling, handrails, doors and hoist way openings. Lighting shall be fluorescent. Flooring within the cab shall be long wearing 1 piece rubberized flooring. Crash pads are not required. Provide a certificate frame in cab.

Maintenance service during warranty period: Elevator installer shall provide 1 year full maintenance service, including monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning and adjusting as required for proper elevator

operation at rated speed and capacity. Provide maintenance service during normal working hours. Emergency call back service shall be provided 24 hours/ 7 days a week.

PART 3 SURVEY STANDARDS

3.1 DATUMS AND ACCURACY: All site surveys completed at The University of Massachusetts at Amherst will be based off of the Massachusetts State Plane Coordinate System, Mainland Zone, North American datum of 1983 and the North American Vertical datum of 1988.

A relative horizontal Control accuracy of the Federal Geodetic Control Committee (FGCC) Second Order Class One (1:50000), and a Vertical Control accuracy standard of third order (0.05ft x the square root of "m") where "m" is the distance between benchmarks in miles are required. Electronic distance Measuring instruments shall have a minimum accuracy of +-5mm + 5ppm. These control standards will be incorporated for all control networks established for the University.

3.2 AS-BUILTS AND DELIVERABLES: The designer shall require the contractor to complete as-built surveys on all structures and or utilities that are either above ground or buried below ground. Utilities will be as-built at every horizontal and vertical location where direction and or elevation changes but no greater than twenty feet between as-built shots. As-built surveys will be measured to within 1/100th of a foot.

Electronic drawings shall be 100% compatible with AutoCAD release 2002. All as-built drawings and other related deliverable work shall incorporate the use of Massachusetts State Plane Coordinate System, Mainland Zone, North American datum of 1983 and the North American Vertical datum of 1988.

All deliverable field data, electronic files and maps will incorporate University CAD standards (i.e. code, symbology and layers) which will be provided to the University on a CD.

*** End of Design Guidelines ***