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TECHNICAL STANDARDS

Refer to Table of Contents in “NAU Technical Standards”, which can be found at http://nau.edu/Facility-Services/DP_Contract/

RECEIPT ACKNOWLEDGEMENT

Design Professional's and Contractor's acknowledgement of receiving NAU Design Guidelines and Technical Standards

On each project, the DP and the General Contractor shall acknowledge receiving, reading and following NAU Design Guidelines and Technical Standards by completing and signing below: In the event of a conflict between NAU Design Guidelines and NAU Technical Standards, please contact NAU Project Manager for clarification on how to proceed with the design.

Project #: _____

Project Name: _____

DESIGN PROFESSIONAL:

Design Professional Firm: _____

Name of DP Signatory: _____

Signature: _____

Date: _____

GENERAL CONTRACTOR:

General Contractor Firm: _____

Name of DP Signatory: _____

Signature: _____

Date: _____

**TO BE RETURNED TO NAU PROJECT MANAGER
PRIOR TO START OF DESIGN**

INTRODUCTION

The Purpose of This Manual

These Design Guidelines, along with the NAU Technical Standards, cover all NAU construction and renovation projects. They are intended to assist architects, engineers, other design professionals, contractors and university staff in understanding the preferences of University in the development, maintenance and repair of its facilities:

- Those persons at Northern Arizona University who manage projects, to assure that the standards and procedures outlined in this manual are implemented in the projects that are built on campus.
- Those persons involved with facilities on NAU Campus. Such persons can include, but are not limited to, administrators, user-groups, faculty, staff, trades-people, suppliers, vendors, University construction and maintenance shop personnel, etc.
- The Design Professionals, to use as their guide in preparing all necessary documents and submittals.
- The CM@R's, General Contractors, Subcontractors, Suppliers, to use as a cross-reference with DP provided Specifications and as their guide in procuring all materials for the project. In case of conflict between these Design Guidelines and Technical Standards, these entities shall bring it up to NAU Project Manager for be evaluated with the Construction Project Team.
- The Design Professionals are advised to refer to those sections of the manual that relate to their projects and to adhere to its guidelines.

These Design Guidelines and Technical Standards are intended to create a common basis for the design, construction, maintenance, renovation and general care of facilities on NAU campus. The standards are the result of years of experience in designing, building, and operating facilities on the campuses, with a historical knowledge of what has served the University well. As such, they form the preference and knowledge base for all facilities on the campus. It should be clearly understood by all persons using these standards that they are not specification documents, nor are they procedures for construction. Design and document preparation continue to be the design professional's responsibility. Means, methods, techniques, and procedures remain the Contractor's responsibility.

These standards represent the preferred construction products, materials, details and systems to use in the development of programs, plans, specifications and construction documents. Components shall be selected through pre-qualification guidelines including, but not necessarily limited to, performance characteristics, code/regulatory compliance, maintenance control, and inventory standardization.

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These standards represent the intent of the University to address the following primary criteria while providing optimal life cycle cost benefit to the University:

- Safety
- Reliability
- Maintainability
- Efficiency
- Sustainability

Building Codes

The requirements in this document do not supersede any applicable building codes. These requirements are in addition to all applicable codes, ordinances, statutes, regulations, and laws. If there is a conflict with any requirements in the design guidelines or in the Technical Standards, the applicable building codes take precedence.

Refer to Div. 1 Section 01 41 13 for all applicable codes adopted by Northern Arizona University.

Building Code Variance Requests

Requests for variance shall be evaluated by the NAU Fire Marshal (NAUFM) staff and NAU Building Official (NAUBO) staff, to ensure the proposed design, use, or operation satisfactorily complies with the intent of the IFC, IBC with related codes and NAU Technical Standards, as adopted by Northern Arizona University.

The NAU Variance Requests Procedure can be found on the Facility Services website under the following link: ***(link is pending – please contact Project Manager for further assistance)***

Substitution to the Design Guidelines: Substitution Request

The Design Guidelines are a set of minimum requirements for design and construction at NAU. When these Design Guidelines and Technical Standards refer to a single manufacturer, it is not intended to exclude all other alternatives for all projects, proven to be equal or better, *unless specifically stated*.

Design professionals and Contractors must adhere to the Design Guidelines and Technical Standards in all cases, however, the intent of these Design Guidelines and Technical Standards is *not to limit creative solutions*. In order to deviate from these Design Guidelines and Technical Standards, a written substitution authorization must be obtained from NAU.

Substitutions to the Design Guidelines and Technical Standards must be requested in writing by the Design Professionals to the NAU Project Manager.

NAU Project Manager must then obtain written approval for the substitution from Facilities Management (Director of Planning, Design & Construction), with recommendation from NAU Trades, as necessary.

The University will consider requests for substitutions in order to provide the best benefit to the University and will typically require a life cycle cost analysis to be completed as part of the substitution process.

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Written authorization shall be received prior to incorporation of the proposed substitution into the documents. The substitution must be made as early as possible but no later than completion of the design development phase.

Refer to Section 01 62 00 for Product/Material Substitution Form.

Updates

These Design Guidelines and Technical Standards are intended to be a continually evolving document. As new systems, components and techniques become available and they are deemed appropriate for use as a standard, they will be incorporated into these documents.

The technical content of this manual represents the culmination of input from many design, construction and maintenance professionals, included but not limited to NAU Trades Supervisors, NAU Project Managers and DP/CMARs who performed projects for the University in the past. Although it is felt that this effort produced a more up to date listing of NAU Technical Standards, it is realized that improvements are always possible and that many iterations may be required to achieve perfection.

To pursue this goal, please feel free to submit any recommendations for improvements via email to NAU, addressed to Stephanie.bauer@nau.edu.

This manual will be updated as requirements and procedures of NAU and the Arizona Board of Regents (ABOR) change.

Advice to the Design Professionals

Your team has been chosen as the Design Professional team most uniquely qualified to design the project, based upon your ability to effectively communicate and demonstrate to the selection committee your team's design expertise, your understanding of the project, and your commitment to service. In order for your team to successfully exercise the highest degree of design potential afforded by the project, we offer a few words of advice in the attainment of that goal.

1. Ask Questions

Although your team was chosen as best suited to the project, this may be the first project of this particular building type you have undertaken at NAU. Time spent in researching the goals NAU had in mind when preparing the RFQ, familiarity with campus infrastructures, how and why design was handled in a particular way on a similar project, and familiarity with the University and user group structure prior to the beginning of architectural programming, will be invaluable to your Design Team. The Facility Services Project Manager assigned the responsibility to lead this project on behalf of NAU is your single point of contact for the project.

All questions and communications regarding this project, the user group or the University must be routed through the NAU Project Manager. This is the established project protocol, and will be further detailed to you by those individuals. It is their responsibility to answer, or

direct you to those that can answer specific questions regarding any topic connected with the project in a timely and professional manner.

2. Communication Ground Rules & Documentation

The project budget, schedule and your compensation will allow for both a successful design and a successful business partnership provided the following items are observed:

- Under no circumstance should verbal approval be accepted or given. Any inquiry or direction that potentially affects project scope, budget, schedule or your compensation should be made in writing and responded to in kind.
- Assume nothing. Assumptions made by your team without written clarification in the form of letters, meeting minutes, sketches or written telephone conference logs will promote misdirection, miscommunications, design errors and subsequently lost time. It is your responsibility to ask for and receive clarification.
- Direction, approvals, clarifications, etc. that do not originate or go through the Project Manager, no matter what the lever or area, are not acceptable and are not binding.

3. Contingencies

Some Design Professionals may be under the impression that project contingencies (design, construction and inflation) are for the use of design “extras”. This is an erroneous and dangerous impression. NAU is mandated by the Arizona Board of Regents to carry contingencies based on level of functional and construction difficulties and total project duration. Contingencies shall only be utilized to attain the projects critical, functional and quality parameters, or “base” scope, as defined by the architectural program and subsequent schematic design.

4. Expectations

The Design Team is required to be within the particular design phase budget, and if the project estimate at the completion of a particular phase indicates the design is over budget, the team will not gain the approval necessary to enter into the next phase. The team will then be required to expend the necessary time and effort to be within that budget, at the Design Team’s expense.

It is easy to recognize that the further over budget the design is, the more time and effort will be required to bring the project within the budget. This is time that will not be compensated. It is therefore in the best interest of the Design Team to obtain the highest degree of detail appropriate to all phases of design, to recognize all cost ramifications to particular design intent, and avoid promotion and pursuit of design elements that can neither be justified by the program nor afforded by the particular phase budget.

It is the University’s expectation that by following the guidelines, procedures and advice as presented in this manual, the Design Team will produce a facility that not only meets program, budget and schedule, but also achieves a quality of design excellence.

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There are seven principles of design that are thematic through the Design Guidelines and Technical Standards. It is advised and expected that Design Professionals consider these, as well as other industry standard design principles when working on NAU projects:

- a. Design Aligns with the Campus Context
Does the design of the space align with the campus master plan, academic master plan, enterprise goals, and university mission?
- b. Planning and Design Process
Ensure participation in the design process and build consensus and support with Facility Services staff, as well as the user groups and other key stakeholders.
- c. Support and Operations
Consider not just the initial design and construction of a space, but also the follow-on support and maintenance required.
- d. Environmental Quality
Since users spend long periods of time in our spaces, they should address human needs that go beyond the obvious components like technology and furniture. For example, we know how distracting it can be if a room is too cold, has flickering lights, or provides uncomfortable furniture that doesn't encourage collaborative work.
- e. Layout and Furnishings
A successful space design anticipates not just what the occupants will be using but also how they will be using it. This includes considerations such as movement paths through the space, seating density, reconfigurability of the room, visibility of learning activities (if a classroom environment), and comfort of the furnishings.
- f. Tools and Technology
Some technologies are foundational to a design, such as adequate electrical power or sufficient network capacity. It is critical to consider not simply how advanced technology is, but rather whether it is truly capable of supporting the anticipated activities for the space.
- g. Innovation
NAU has specific design guidelines and technical standards, but innovation is still necessary. Think outside the box to solve design challenges and enhance a space's functionality.

These principles are adapted from a 2015 Educause article by Malcolm Brown, located: <http://www.educause.edu/ero/article/seven-principles-classroom-design-learning-space-rating-system>.

PROJECT TEAM / STAKEHOLDERS

This project is being administrated by NAU Facility Services Planning, Design and Construction. As such, the Director of Planning, Design and Construction will assign a Project Manager responsible to manage this project. Several NAU Departments will be involved in this project, with different roles and responsibilities. The Design Professional and the Contractor, along with NAU Project Manager, shall ensure that all applicable Departments are consulted throughout the project. Below are the different Departments that shall be involved in every project's design and construction, with a brief description of their responsibilities. These groups will participate in the Plan Review process prior to issuance of a Building Permit.

1. NAU FACILITY SERVICE PLANNING, DESIGN AND CONSTRUCTION GROUP

NAU Project Manager

The Project Manager, referred to as "NAU PM", guides each project from programming through project close out and warranty. The NAU PM works with the User Group and CMAR to review the DP's work for compliance with program requirements, schedule, budget, and for conformance to required codes and NAU standards and procedures.

The NAU PM is the direct contact person for the DP, CMAR, and other project consultants once the project has completed programming. After project programming is complete, all project work, information, and correspondence is directed to the NAU PM. The NAU PM is the liaison for the user group as well as other NAU departments. The NAU PM is also responsible for monitoring project activities during design and construction through occupancy.

The responsibilities of NAU PM include, but are not limited to, the following:

- a) Insures the appropriate development and conformance of the project to the program, budget, schedule, and NAU standards.
- b) Manages all meetings between NAU User Groups, DP, and CMAR after project programming.
- c) Recommends approval of all payment to DP and CMAR.
- d) In conjunction with NAU Contracts Administration, manages the negotiation for a GMP.
- e) In conjunction with NAU Contracts Administration, develops the contract for construction (Design/Bid/Build, CMAR).
- f) Manages the construction contract.
- g) Evaluates the DP and CMAR performance for construction phase.
- h) Manages warranty issues.

NAU Plan Record/Vault

Facility Services has been assigned the responsibility to keep all documentations related to the

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University's past projects, regardless of size and importance. All Construction Drawings, Specifications, RFI, ASI, Submittals, Shop Drawings, As-Built Drawings, Owner's Manuals, etc... that have been turned over to the University since the Campus has been created in the beginning of the 20th Century are kept at Facilities. The documentation kept by NAU Facility Services is only as good as the documents provided to the University at completion of a project and as you get involved in projects involving renovation of existing building(s), you will have to appreciate the fact that documents available to you are only as good as those you will turn over at the end of a new construction project. NAU encourages all DP and Contractors to be most vigilant when it comes to the Close-Out process and ensure that complete and accurate documentation is provided for record keeping.

2. **NAU UTILITIES**

The Director of Utilities shall be consulted for:

- a. Location of existing utilities
- b. Location of point of connection for any new utility
- c. Coordination of any new utility layout
- d. Optimization of building orientation on proposed site based on energy modeling
- e. Review of proposed mechanical systems
- f. Review of all energy modeling
- g. Submittal to ACC (Arizona Corporation Commission) for Natural Gas scope of work

3. **NAU FACILITY SERVICES OPERATIONS AND MAINTENANCE**

Facility Services Operations and Maintenance is responsible for all NAU physical facility maintenance and operational activity, and therefore has a vested interest in the maintainability and long term of operational cost of every physical addition to the NAU campus. The NAU PM attends all scheduled project meetings in both the design and construction phases, and may elect to include other Facilities personnel as their experience and technical expertise is required.

During the Plan Review process, NAU Trades Supervisor will assist in the plan review effort by bringing up questions/comments regarding longevity, maintenance requirements, accessibility of construction materials and building systems.

4. **NAU USER GROUPS**

The NAU User Groups are those colleges, organizations or departments that will be the actual occupants or the direct beneficiaries of the project. User groups can be comprised of several colleges, organizations or departments, students, or a single uniform group. The User Group acts in an advisory and informational capacity to the project Design Team regarding programming/design function and space parameters.

5. **NAU BUILDING OFFICIALS**

Facility Services includes in its organization the NAU Fire Marshal and the NAU Building Official, both in charge of verifying that all new construction and renovation projects meet all applicable

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codes as adopted by the University. Combined together, they have authority to perform Plan Reviews, issue Construction Permits, perform Field Inspections and issue Certificate of Occupancy prior to Substantial Completion Certificate issued by NAU PM in conjunction with the DP.

The University is now issuing Permits and Certificate of Occupancy, and depending on the scope and size of the project, you might be subject to it. Please contact the NAU Building Official (via NAU Facility Services Project Manager) to confirm if this project will be subject to issuance of a Permit and a Certificate of Occupancy.

6. NAU POLICE DEPARTMENT

This group must be consulted when a project affects any campus pedestrian and vehicular circulation and use patterns.

The responsibility of this department is to review the project for:

- a. Photometric levels at Parking Lots, Parking Garages and access paths to buildings.
- b. Security systems and reporting to NAU PD.
- c. Site design for safety, including camera locations, blue phone locations.
- d. Pedestrian and vehicular access, flow, density, direction on Campus.
- e. Traffic Study as applicable.
- f. Any proposed traffic changes, scope changes that might impact circulation on Campus.
- g. Any proposed new pedestrian crossways.
- h. Any proposed new street lights or street signs.
- i. Approval of the Site Logistic Plan prior to start of construction.
- j. Traffic Control Plans during construction.
- k. Security Access to Utility Tunnels.

Prior to starting Construction on Campus, the Contractor shall submit a Site Logistics Plan showing site fencing, site access (including Emergency Access point during construction), jobsite trailer location, temporary parking, and showing how the construction of this project will affect circulation on Campus (truck route).

This group shall review and sign-off on the Site Plan (permanent scope) prior to design completion and Site Logistics Plan (interim) prior to start of construction thru NAU Facility Services formal Plan Review process. The DP is responsible for submittals and incorporation of any comments received regarding the Site Plan.

It is highly recommended to schedule a meeting with NAU PD and NAU FM to ensure that all Emergency Response parties are familiar with access to the construction site.

7. NAU PARKING & BUS SERVICES

This group must be consulted when a project affects any parking or bus routes on campus, either on a permanent or interim/temporary basis.

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This group shall review and sign-off on the Site Plan (permanent) prior to design completion and Site Logistics Plan (interim) prior to start of construction thru NAU Facility Services formal Plan Review process.

The DP is responsible for submittals and incorporation of any comments received regarding the Site Plan. The Contractor is responsible submittals and incorporation of any comments received regarding the Site Logistics Plan.

8. NAU EQUITY AND ACCESS/DISABILITY RESOURCES

Facility Services has signed a Memo Of Understanding with the CDAD Committee (Commission for Disability Access and Design). A CDAD representative will review the project for ADA Compliance.

The DP is responsible for submittals and incorporation of any comments received during the design review.

9. NAU TV SERVICES AND TELECOMMUNICATIONS

TV Services and Telecommunication encompasses all voice and data communication and transmission design for NAU. TV Services and Telecom reviews and assists all project design engineering regarding telecommunications and data for conformance with NAU standards. The DP is responsible for submittals and incorporation of any comments received. If required, this group will advise the DP in the design phases regarding NAU telecommunications and data interfacing, serviceability and maintenance. In regards to server rooms, for new construction or major renovations, DP shall not design new server rooms.

DESIGN GUIDELINES

CAMPUS MASTER PLAN

In 2010, NAU contracted with Ayers Saint Gross as the Design Professional to update the Campus Master Plan. Lots of thoughts and efforts were put in this Plan, involving key players within the University (Students, Faculty, Staff, and Administration) and within the Flagstaff Community (City of Flagstaff) and it is expected that any Design professional working on this Campus will get familiar with the 2010 Campus Master Plan.

Northern Arizona University Campus Master Plan is available on line:

http://nau.edu/uploadedFiles/Administrative/Finance_and_Administration/Facility_Services/Folder_Templates/2010_MasterPlan.pdf

In 2015, NAU contracted with WLB Group as the Design Professional to prepare a Landscaping Master Plan. It is expected that any Design professional working on this Campus will get familiar with the 2015 Landscaping Master Plan. It is available online at:

https://nau.edu/uploadedFiles/Administrative/Finance_and_Administration/Facility_Services/Documents/DP_Contract/2015%20Landscape%20Masterplan%20Final.pdf

3. PRE-CONSTRUCTION DESIGN DELIVERABLES

Design Professionals are required to provide the utmost complete drawings and specifications set to allow for minimum request for information during construction.

Contractors are expected to do a thorough review of these documents prior to construction for coordination purposes and to report any conflicts, incomplete information, etc... to also prevent last minute changes in the field during construction.

At a minimum, the Design Professional and the Contractor shall provide, during the Pre-Construction Phase, all documents listed in their contract agreement. Refer to Design Professional contract and its associated exhibits, for the specific deliverables applicable to your firm's effort on this project. The DP is to submit a Basis of Design (BOD) along with the program development submittal and an updated BOD at each subsequent design phase submittal. An energy model and associated report is to be submitted when evaluating options for building orientation and architectural components and updated for each subsequent design phase submittal.

The DP is to submit a Basis of Design (BOD) along with the program development submittal and an updated BOD at each subsequent design phase submittal. An energy model and associated report and a Total Cost of Ownership report is to be submitted when evaluating options for building orientation, architectural components and MEP systems. These reports will be used by the University to select the building materials and systems. The energy model and reports shall be updated and submitted for each subsequent design phase submittal.

4. DRAWING NUMBERING

The intent of these drawing numbering standards is to provide a set of documents that are consistent with the needs of Northern Arizona University for both Facility Services and future construction, and are consistent from one project to another.

ELECTRONIC FILE FORMAT

- Facility documentation drawings and construction project drawings must be submitted to Facility Services in full compliance with AutoCAD software (file extension = .DQG)
- Northern Arizona University shall not accept any drawings in the Drawing Interchange Format (DXF) or any other format that .DWG. If any drawing translators are used prior to submittal, the results of such translation shall be 100% complete. It is the responsibility of the Design Professional to cross-check translated drawings for errors and omissions.

TEXT

- Text size must be legible and appropriate to the graphic information presented and the intended plotted scale of the drawing. Text must be in all upper case letters throughout the drawing.
- Text usually should not touch other graphic objects, and must be placed with enough space around it to be legible when the drawing is plotted and reproduced.

TITLE BLOCKS

The title block should be placed in paper scale, with its insertion point inserted at a coordinate location of (0, 0, 0), and at a scale of 1:1. Depending on the purpose of the drawing, whether it is for facility documentation or construction, the drawing's title block should contain certain essential information that Facility Service needs, to store and retrieve each drawing in its library.

Project Information

- Project Number - assigned by the Facility Services Planning, Design and Construction
- Project Name - assigned by the Facility Services Planning, Design and Construction
- Firm Name - representing the drawing author
- Building Name and Building Number - specify only if the project name does not include this information already, and the project is building specific.

Drawing Information

- Drawing Title - indicating the drawing content, e.g. floor plan, section, detail, etc.
- Facility Services Project Number – shall be referenced on all sheets

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- Drawing Number
- Date of Drawing – original drawing date including significant revision dates
- Drawing Scale – representing the intended plot of the drawing with title block
- North Arrow
- Electronic File Name and Effective Date

STANDARD SHEET SIZES AND FORMATS

All sheet sizes are to be limited to five standard formats. Required sheet size is specific to each project and is under the discretion of the University. They are as follows:

- A Sized Plot 8 1/2" x 11"
- B Sized Plot 11" x 17"
- D Sized Plot 24" x 36" (preferred format)
- E 1 Sized Plot 30" x 42"
- E Sized Plot 36" x 48"

CAD FILE TRANSMITTAL

The content of electronic drawings must match the delivered original hard copy set. To ensure the integrity of the electronic drawing set upon delivery, Facility Services:

- Ensure the drawings adhere to the guidelines presented in this document.
- Include a transmittal sheet (electronic and hard copy) with all submittals indicating the Facility Services project number, project name and complete listing of all materials submitted, including file names and sheet numbers for each item included in the submittal. File names shall contain the sheet number they represent. This ensures the completeness of the drawing set and assists in archival procedures.
- Electronic data deliverables (.DWG and .PDF format) are required at all submittal stages.
- The Project Manager shall withhold final payment until all closeout documents have been received from all parties.

CD-ROM LABELING

All CDs are to be labeled as follows:

- DATE – The date when the submittal was delivered to the campus for final acceptance.
- PROJECT – Title of the project name and project number.
- SUBMITTAL – Project submittal phase (i.e. 50% schematic, etc.).
- BLDG NUMBERS – Building number identified by the campus specific to the project.
- COMPANY – Name of design professional firm for the project.

SUBMITTAL REQUIREMENTS

- All submittal documentation forwarded to Facility Services shall be submitted in a timely fashion, coinciding with the needs of the project and the Facility Services Planning, Design and Construction Staff. The delivery of submittal documentation during various stages shall be timed appropriately to ensure Facility Services receives the most accurate information available.
- Ensure the Facility Services Project Number is located on all drawing sheets (including the cover sheet) and all other submitted documentation, i.e. Specifications and Operations and Maintenance Manuals. The Facility Services project number should be located in the title block of all drawings, and in the header or footer of Specifications and Operations and Maintenance Manuals, and any other submitted items.
- The following documentation shall be delivered to Facility Services at the following project milestones:
 - Review Sets (Programming Package, 100% SD, 100% DD)
 - 100% Construction Documents (final CDs not for review), i.e. Bid Set
 - Completion of Civil Utilities Installation (Utilities As-builts)
 - Completion of Site Work (Site As-Builts)
 - Record Documents (Building As-Builts)

VALIDATION OF DELIVERED MATERIALS

- Facility Services will validate the CAD data and other materials submitted by Design Professionals. If submittals do not conform to the Facility Services Drawing Numbering Standard Guidelines, Facility Services may return the materials to the Design Professional. The Design Professional is responsible for revising the materials to make them conform to the Facility Services Drawing Numbering Standard Guidelines.
- The NAU Project Manager shall withhold final payment until all closeout documents have been received from all parties.

5. BUILDING, FLOOR, AND ROOM NUMBERING GUIDELINES

Overview

These guidelines will allow floor, room numbering, and way-finding procedures to be applied consistently to all University buildings.

For new buildings, these standards should be followed as closely as possible. In cases of renovation or additions to existing buildings, the building's existing numbering system can be extended, or abandoned in order to use the following standards to renumber the entire building including the renovated and/or added space.

The intention is for each facility's floor and room numbering scheme to be structured so that the numbers flow through the building in a consistent, comprehensible, and user-friendly pattern. The scheme should be clear to the users of the facility, not causing confusion for individuals attempting to locate spaces.

All drawings issued for construction shall contain accepted room numbers so that all affected equipment including but not limited to doors, electrical panels, telephone backboards, air distribution devices, as-built information, and air balance reports will not have to be cross-referenced or revised during construction or after occupancy of the space.

Room numbers affect several agencies including emergency responders, multiple campus databases, chemical inventories, maintenance, and telecommunication systems; because of this room numbers are not to be changed without a formal review process by the Space Management department.

Questions may be forwarded to the Space Management department, 928-523-6988 or SpaceManagement@nau.edu.

1. Building Numbering

The Office of Space Management will assign new building numbers with the approval of Facility Services.

2. Floor Numbering

2.1 Floors

Floors are numbered using a 1-digit standard starting with '1' for the first floor and continuing up for every floor above. The first character of a room number indicates the floor level of the building. The level with a "1" as the first character should be the uppermost floor entered at grade or one half flights above grade. Levels below this can use the character "B" (basement). Buildings located on steeply sloping sites may need to

vary from this rule; where necessary, the floor numbered “1” may not in fact be the uppermost floor entered at grade.

2.2 Mezzanines

Large mezzanines shall be numbered as a whole floor. Example: When a mezzanine exists between the first floor and the next whole floor, it will be numbered as the second floor.

A mezzanine is defined as a partial floor located between structural floors.

2.3 Attics and Roof Levels

Usable attic floors and penthouse levels should be numbered as if they are whole floors. For example, a two-story penthouse atop a three floor building will be numbered as the fourth and fifth floors. Do not use prefixes such as “R” for roof level.

3. Room Numbering

3.1 Use 3 or 4 digit numbers (plus optional alpha prefix or suffix) consistently throughout the building

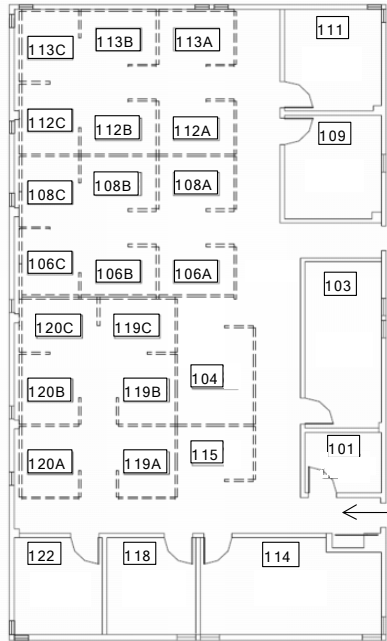
3.1.1 Three digit numbers shall be used for rooms with assignable or public space. The first digit shall indicate the floor number, for example: first floor will be numbered 100’s; second floor will be 200’s; third floor will be 300’s etc. Ground floor or basement rooms will be numbered as B01, B02, etc. When rooms open off of another room and not from a corridor (such as in a suite of offices), use the number of the first room with a letter suffix (example: Reception 301, Office 301A, Office 301B, Office Storage 301C). Rooms in a designated wing shall have an alpha prefix specific to the wing (example: A112A, B112A)

3.1.2 Four digit numbers shall be used for non-public rooms. Number shall be as a suffix to the 100 level to describe restrooms, electrical and mechanical rooms, elevator control rooms, custodial closets or enclosed stairwells. (Example: 1001, 1002, 1003)

3.1.3 Rooms with specific uses and unique spaces may be designated by their room type followed by a number or an alpha numeral per the building user’s request (i.e. “Studio A”). These designations shall be determined in schematic design if possible.

3.1.4 Cubicles should have their distinct room number. Each cubicle within the row is designated using a singular room number followed with a letter. Letters are in alpha order from the main corridor. See Figure 1

Figure 1



3.2. Numbers should flow from one end of the building to the other

In a building with only one dividing corridor, room numbers should flow in ascending order from one end of the building to the other. In a building with a more complex corridor system, numbers should flow in ascending order in a counterclockwise fashion, from right to left, through the corridors from the main entrance, or similar location such as elevator lobby. Any doors that face the Lobby or entry point should be numbered in the beginning sequence.

3.3. Use odd numbers on one side of a corridor and even numbers on the other side

Room numbers shall be coordinated so that even numbers are on one side of a corridor and odd numbers are on the other side. See Figure 2. In more complex designs, or where the availability of numbers is limited, the odd-even format can be abandoned if consecutive numbering results in a more logical scheme.

Figure 2



3.4. Skip numbers to maintain succession of room numbering

In some instances, room numbers on one side of a corridor shall be skipped in order to maintain succession with the room numbers on the opposite side of the corridor. This may occur, for example, when a suite of rooms or large space is accessed through a single door and there are no other doors on that same side until further down the corridor. This will allow for future renovations that may convert suites or large spaces into separate or small rooms with a corridor door. See Figure 2.

3.5. Skip numbers to allow for future renovations

When a corridor contains large rooms such as classrooms, meeting rooms, etc. on both sides of the corridor, room numbers shall be skipped to allow for future renovation of a large space into smaller spaces. Sufficient numbers shall be reserved to allow for the large spaces to be divided into standard size office spaces. See Figure 2.

3.6. Use similar numbering on each floor

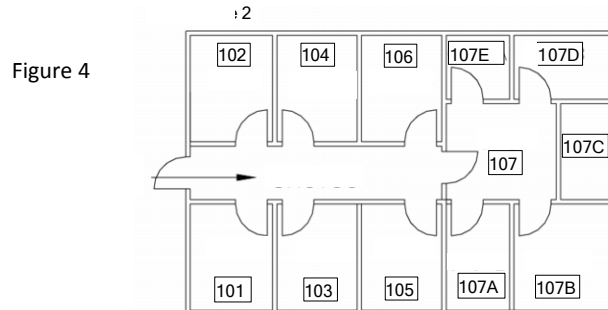
An effort shall be made to maintain consistent room numbers for similar elements on each floor (i.e. for restrooms occurring in the same location on each floor use a common room number format and the same ending digits). See Figure 3



3.7 Use alphabetic suffixes for rooms entered from other rooms (rather than a hallway)

Rooms entered from a main corridor or lobby is numbered with no letter suffix. When rooms open off of another room and not from a corridor (such as in a suite of offices), use the number of the first room with a letter suffix (example: Reception 301, Office 301A, Office 301B, and Office Storage 301C). See figure 4. Assign suffix letters in the order rooms are encountered and, where possible, in the same direction as the overall numbering sequence. Only a single suffix is allowed; thus in the case where the first room already has a suffix, the

next alphabetic designation shall be used. Avoid the letters “I” and “O” which may be interpreted as numbers. Large suites with many rooms can use non-suffixed numbers if it makes the numbering scheme more understandable.



3.8 Each room should have only one number

Each room should have only one number regardless of the number of doors opening into it. Exceptions can be made where a particularly large room is subdivided into different areas of use, such as by cubicles. In these cases, one-character letter suffixes are added to create unique numbers. Where the number of areas exceeds the suffixes available, additional sequential numbers should be used.

3.9 Number all accessible spaces

In addition to rooms, all interior spaces that can be directly accessed, such as corridors, vestibules, stairwells, elevator shafts, and accessible pipe spaces shall be numbered in a manner as consistent as possible with standard room spaces. Where doors or walls separate different areas of these spaces, each area shall receive its own unique number.

3.10 Public Circulation

In a building with only one dividing corridor, public circulation numbering should flow in ascending order from one end of the building to the other. In a building with a more complex corridor system, numbers should flow in ascending order in a counterclockwise fashion, from right to left, through the corridors from the main entrance, or similar location such as elevator lobby. Numbering should begin with the floor number followed by 00 and an alpha character. (Example: 100A, 100B, 200A, 200B)

1. Standards for Parking Decks

Standalone parking decks are considered buildings and will have a building number and room numbers to cover all usable space within the structure. This also includes the top uncovered level.

2. Conflicts and Special Cases

In the case of conflicts or questions, Space Management should be consulted and will provide a room numbering scheme to be used.

Existing building as of December 31, 2013 have numbering systems established at the time of construction. All new construction starting January 1, 2014 must adhere to the new guidelines.

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Appendix A: Room Numbering Guidelines

Room Number	Formula	Example	Brief Description
Typical Rooms	Room Number	101,112,224	Group of rooms that are entered from a corridor
Suites and Sub-Rooms	Room Number + Letter	101A, 134A, 134B	Group of rooms that can be entered from a main "lobby" like space
Rooms within Sub-Rooms	Room Number + Letter + Letter	104AA, 245AA, 245AB, 245AC	Typically small closets within a sub-room
Wings	Letter + Room Number	A101, B101	Unique leading letter assigned to all rooms within a wing
Cubicles	Room Number + Letter	101A, 112A	Assigned distinct number grouping and in alpha order from main corridor
Building Common Areas	4 digit room number	1001, 2001, 3002	Numbers assigned in areas such as; Mechanical, Electrical, Janitorial, and Restrooms
Circulation	Floor Number + 00 + Letter	100A, 100B, 100C	Assigned to public circulation areas that are not independent rooms

6. STORM WATER DRAINAGE DESIGN & SURFACE WATER PROCEDURES

DESIGN INTENT

In the Southwest and at Northern Arizona University, attitudes toward storm water drainage is changing. Previous efforts to manage site storm water drainage have consisted of collecting and channeling storm water as quickly and efficiently to drainage ways to remove any water from a site. Water was metered into drainage ways to minimize flooding with flows limited by the calculated predevelopment peak flows for the site. Large storm water drainage ways were constructed and during storm events, these drainage ways flow swiftly and remove potentially useful water from the campus.

Now storm water is considered a resource. The new goal is to provide the structures necessary to make use of storm water through harvesting; and infiltrating water, keeping water onsite wherever possible.

Storm water drainage management also includes the LEED goals of water collection and onsite reuse. The entire project area needs to be considered for opportunities to collect and store storm water for irrigation. These features must also be designed to withstand the stress of freezing and thawing that are a reality on our Flagstaff Mountain campus.

Within a project's design process, managing the storm water drainage should be a key part of the integrated site design promoting proactive solutions that are consistent with or exceed regulatory standards. Given current limited storm drain and land capacities, some of the mitigation of past and future storm water drainage issues at the Northern Arizona University should occur on a project by project basis.

Projects will be expected to include retention and infiltration facilities to contain the first inch of precipitation at a minimum. Additional retention may be added to address problems elsewhere on campus. The designer is to consult with the Northern Arizona University Facility Services Director of Utilities for guidance on providing retention on a site by site basis.

Ways to store and reuse storm water may include such elements as mini retention basins or large retention basin, designed as landscaped areas to promote students gathering and shall not include any concrete.

GENERAL STORM WATER GUIDELINES

Preliminary siting studies for the project shall consider information related to the existing drainage conditions of the site, using the most recent campus-wide drainage study as a reference. The preliminary siting studies shall consider, at a minimum:

- The existing site area and adjacent areas within 500 feet of the project, and include all areas which may contribute storm water (watershed) to the proposed site.

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- The general area where the site is located, for example, the campus historical core, North Campus, South Campus, etc.
- Evaluation of existing landscapes, plant palette, formal, informal, historic, ornamental and introduced plants.
- Evaluation of the contextual setting of the site.
- Utility (below/at grade) corridors, emergency routes, pedestrian and automobile core circulation routes.
- Identified project building expansion and proposed expansion adjacent to the project site.
- Evaluation of adjacent facility parking, vehicular and service accesses.
- Whenever possible, site development should not diminish the quality or increase the quantity or rate of storm water drainage flow that leaves the site in its existing condition. Potential increased storm water drainage flows should be mitigated on-site if possible.
- Downstream conveyance impacts must be evaluated and mitigated to prevent the hazards associated with overflows, pounding and ice formation.
- Wherever possible, site development should include strategies such that the storm water flow does not diminish in quality or increase in quantity when compared to the level of the original natural condition of the site. This can be achieved through the use of landscape features and water harvesting.
- Opportunities for water harvesting should be specifically discussed in conceptual narratives in early design stages. **“The City of Flagstaff Low Impact Development: Guidance Manual for Site Design and Implementation, 2009”** should be used for the design basis. (<http://www.flagstaffstormwater.com/index.aspx?NID=8>).
- Site development should meet or exceed all applicable regulatory standards. The intent is to meet at a minimum the current City of Flagstaff storm water drainage standards and exceed them where possible, and to demonstrate innovative techniques for which the City may not have applicable standards.
- Retention of storm water: the conveyance and retention capacity shall be sufficient to collect and store the first inch of precipitation that falls onsite for a typical rainstorm.
- Plans will incorporate: conservation of natural areas, minimizing disturbance of natural drainages, minimizing and disconnecting impervious surfaces, and minimizing soil compaction. Many of these points require consideration of construction methods, site access and control of the site areas that are not intended for development, during construction.
- All project sites shall include areas designed to collect and infiltrate water which may include swales, buffer strips, porous pavements, bio-retention, sedimentation and extended detention basin designs.
- Provide a Storm Water Drainage Report. This report, to be prepared for each project will be based on the format and technical standards of the City of Flagstaff Engineer’s Design Report.

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- Wherever possible, site development should occur such that all flows exiting the project site remain in the current watershed sub-basin so as to not impact drainage patterns in adjacent watershed sub-basins.
- Flood Prevention: Proposed building ground floor elevations and any apertures into the building should be 1' or more above the 100 year flood plain. Sunken access ways or patios leading to building levels below the natural grade of the site are not permitted when adjacent to a 100 year floodplain, and discouraged in other areas. Soil should be graded so that water drains away from the building at a minimum of 2%, subject to other site criteria, such as accessibility. Elevations of underground utilities shall be considered in the grading layout.
- Design and construction activity must be in compliance with the current Northern Arizona University Master Plan Update, located at [http://nau.edu/uploadedFiles/Administrative/Finance and Administration/Facility Services/Folder Templates/2010 MasterPlan.pdf](http://nau.edu/uploadedFiles/Administrative/Finance_and_Administration/Facility_Services/Folder_Templates/2010_MasterPlan.pdf)

Site development must be done in a way to avoid the following conditions:

- Pounding of a duration that may allow mosquito breeding, in access ways which may create a nuisance for pedestrians, or within 10' of building foundations (to prevent infiltration that may cause indoor mold or structural problems).
- Any water catchment not draining within 24 hours
- Retention (groundwater infiltration) facilities not draining within 12 hours.
- Surface water that is wasted, e.g., by running down the street.
- Surface water that is routed in a way which inappropriately distributes sediment or chemicals.
- Channelized or concentrated water conveyed over sidewalks
- Water running off of irrigated turf areas.
- Water that puddles in areas where freezing may cause a pedestrian or vehicular hazard or damage to hardscape.

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

- All projects will have a Storm Water Pollution Prevention Plan (SWPPP) no matter what their acreage. If a project is less than one acre of disturbed area, an AZPDES permitting will not be necessary. On all project, Best Management Practices shall be followed by the contractors to ensure that existing storm water drainage systems are not polluted during construction.
- If 1 acre or more is disturbed a Storm Water Pollution Prevention Plan (SWPPP) will be required and an Environmental Protection Agency AZPDES Storm Water Construction General Permit must be secured. The Northern Arizona University Office of Regulatory Compliance may be contacted (<http://www.orc.nau.edu/>) for guidance in securing this permit and filing the associated EPA Notice of Intent (NOI). A copy of the permit shall be provided to NAU Office of Regulatory Compliance and NAU Facility Services Project

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Manager prior to any construction work on site. (A copy of the SWPPP Guidance Checklist can be found at

<http://www.azdeq.gov/environ/water/permits/download/cswppp.pdf>.)

- All SWPPPs shall be prepared by the Civil Engineer of record.
- The General Contractor shall secure permits with ADEQ.

STORM DRAIN DISCHARGES

- Water discharged (e.g., storm water drainage, condensate) from sources that must be pumped to a location for conveyance/disposal should not be directed to roadways/hardscape. Such discharges should be directed to planted areas except when the water quality would be detrimental to plants.
- Storm water drainage shall not be directed into the sewer collection system. Use of the sewer system in this way is considered a prohibited discharge by City of Flagstaff.
- Sewer manholes are not allowed in low lying areas and/or known watercourses to prevent waters from infiltrating through perforations in the manhole cover.

ROOF DRAINAGE

- Roof drainage outlets and landscape surface materials must be designed to prevent landscape erosion.
- Pounding within 10' of the building edge is prohibited.
- Roof leaders/scuppers should be of a small enough diameter so as to divide roof runoff into a series of outlets with a low enough volume/velocity that will allow water to be harvested equally throughout the site (i.e., broken into small volumes for smaller basins/swales). Large diameter outlet pipes convey too much water at too high velocity to capture in small-scale landscape swales. Proper clean outs should be provided to allow necessary maintenance of smaller diameter pipes.
- Roof Drain pipes are prone to freezing during the winter.
- Roof drainages should flow freely even under freezing conditions, new construction shall include interior or insulated and heated roof drains with temp sensor switches to prevent warm weather operation. Renovations of roofing where roof drains are a problem will include correction of the problem through similar design solutions.
- Depending on the project site, the Design Professional should review with NAU Manager of Utilities the strategies to drain the roof (day-lighting versus tie-in to storm water drainage underground).

ANCILLARY WATER SOURCES AVAILABLE ON OR NEAR SITE

- Water sources such as mechanical condensate, process water, gray water, drinking fountain water, and other sources identified shall be considered as part of passive and active water harvesting systems.
- Such water may be used, if deemed appropriate, for landscape irrigation, return to central plant for other uses, supplementing water for pools or water features, or other uses to be determined.

SOILS

- Site soils need special consideration during the design process for effective use of LID technologies.

PLANNING

- Soils evaluation should begin with planning for site areas where soils are to be used for structural and vegetative support and for water collection and infiltration. Areas considered for infiltration should be evaluated for soil characteristics especially percolation rates, prior to designating these areas for natural infiltration. If soils are suitable, these areas need special planning and protection because construction activities will change the nature of the soils and potentially destroy their useful characteristics.
- Site planning for soil protection should be treated with the same level of attention as protection of existing vegetation and provision of structurally appropriate soils for building support. Soils that are to be used in the final LID structures or in landscaping must be protected from contamination and compaction by construction equipment. Evaluation of the trade-offs between removal and replacement of soils, gravels and non-structural earth and protection of this resource onsite shall be part of the design.
- Cost effectiveness of different solutions should be evaluated and presented as part of the design effort.

TESTING

- If possible, soils testing should be conducted at the time of or prior to preparation of the initial draft of the Storm Water Drainage Report that will be prepared for a project. Such reports should investigate not only structural characteristics but also percolation rates.
- A soil percolation test is required after rough grading of major/regulatory detention and retention facilities to verify that site development activities have not negatively impacted percolation rates. If reduction in percolation rate is identified, mitigation may be required.

SUBSURFACE PREPARATION

- Structural soils should be explored for use under large expanses of hardscape or other areas with limited percolation.
- Soils beneath/adjacent to French drains, and other sub-surface structures should be over-excavated and replaced with an engineered soil designed to absorb or accept water.

COMPACTION

- Soil beneath the bottoms of all water harvesting areas should be loosened to a depth of at least 18" prior to trenching and installation of irrigation lines.

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- Specified compaction required for buildings, streets, and other structures shall be maintained within specified distances around such structures. Beyond these compaction zones, soil should be loosened to a depth of at least 1' prior to planting within all landscaped areas.
- All construction debris and waste material must be removed from the soil within landscape and basin areas.
- Once compaction is achieved and completed, soils should not be disturbed as to not affect soil compaction.
- Acceptable limits of compaction must be maintained through completion.

SOIL GRADING

- The finished grade of all landscaped areas that are designed for use as catchments should be recessed downward from adjacent paved surfaces. Maximum reveal at edge of pedestrian circulation paving shall be 1/2" to minimize the risk of injury. Shoulders are to be consistent with the landscaping portion of Division 32 00 00 Northern Arizona University Technical Standards.

GROUND COVER MATERIALS

- All materials shall be consistent with landscaping standards 32 90 00 and approved for use by the Facility Services Project Manager through reviews by the Facility Services Grounds Department.
- Within areas conveying significant storm flows, ground surfacing should consist of a material that is able to withstand scouring. This includes hardscape paving, rock mulch, graded or sized rock, riprap, fractured rock, and turf in some situations. Bare soil, decomposed granite, or other loose forms of mulch are not suitable for this application. Filter fabric placed with 12" minimum toe downs at edges shall be used under all rock, mulch, and riprap within conveyance areas.
- Fine grades of decomposed granite should not be used within or adjacent to basins or water harvesting areas. Landscape areas which shed water rather than capture it should receive 1/2"+ crushed gravel with no fines, preferably with a mixture of sizes and some color variation to reflect the native desert surface.
- The bottoms of landscaped basins should receive 1/4" pea gravel or 1/2"-1" sized/graded crushed rock that has been washed to remove all fines or organic mulch.
- Colors samples of all proposed rock types shall be submitted for approval.
- Organic mulch is encouraged in locations where the vegetation, water collection, erosion, and slope characteristics make it appropriate.
- Turf, as a surface material in large regulatory basins, is only permissible when combined with a low-flow landscaped area which allows a majority of the turf to drain within a short time. It is preferable to utilize turf predominantly on the bottom rather than sides of large basins for ease of irrigation and mowing and to allow the turf to be watered by sheet-flow runoff. Based on project-specific considerations, turf panels may include a shallow retention catchment (6" or less) which shall include a prepared

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soil bed that will rapidly absorb retained rainfall. Extensive subsurface soil preparation will be required for turf in basins which collect greater volumes.

RIP-RAP

- Where required, utilize rough, non-angular, owner approved stone (samples should be provided by Contractor for size verification by Design Professional/ Civil Engineer). Filter fabric should be included under riprap used for erosion protection in a conveyance channel, and any gaps in riprap shall be fully filled with pea gravel or sized/graded rock that is swept in the gaps to prevent erosion.
- Rip-rap to be sized per City of Flagstaff Storm Water Management Manual and Civil Engineer shall include calculation in report.

SNOW MANAGEMENT

In all designs and site planning, snow management must be considered and provided as follows:

- Parking areas need to allow for efficient snow removal operations and include appropriate turning radii for snow plows and heavy equipment.
- Snow storage areas adequate for a typical winter storm (2 feet of snow in 24 hours) shall be included in parking lot design.
- Snow melt drainage from the storage areas and for areas around the building will be designed with special consideration for access to snow melt drainage conveyances for maintenance activities as needed.
- Evaluation and design of areas that are prone to collect snow or ice with special attention to the areas on the north side of buildings and structures where refreezing of melted snow or ice causes hazardous conditions to pedestrian and maintenance vehicle traffic.
- Evaluation of snow melt and melt storage shall include coordination with Facility Services Grounds Department to determine if deicing materials or chemicals are being used on snow and ice and if runoff will need special handling to prevent damage to landscaping through use of the water or clogging of infiltration systems by cinder fines or other materials.

STORMWATER EVALUATION PROCEDURES

Depending on the nature of the project and site, an independent Storm Water Drainage study (as a precursor to the Storm Water Drainage Report described below) may be required and completed prior to the start of the project for the purpose of understanding site issues, budgeting, or other needs. Facility Services will determine if an independent study is required and contract for this initial work if necessary. This independent study could be part of the programming and sustainability evaluation.

Project Design Process

The Design Professional's scope of work will require compliance with the storm water drainage

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standards found above. As a result of project-specific design guidelines identified in the independent storm water drainage study, storm water requirements may be developed which call for unique conveyance features or other special requirements.

The project design should be informed by project-specific site development guidelines, The Northern Arizona University Design Guidelines and Technical Standards, site soils tests, and other regulatory considerations. For projects located in South Campus, review the *NAU Assessment of South Campus Storm Drainage*. These resources shall guide the preparation of a Storm Water Drainage Report and design solutions, as required in the project scope of work and described below.

The Northern Arizona University Director of Utilities is available to the Design Professional throughout the project to review these standards and guidelines and to discuss and provide guidance on detailed storm water drainage design solutions.

The Design Professional is responsible for insuring that all applicable sub-consultants understand the studies, plan sets, details, and specifications each sub-consultant will need to prepare in order to meet these standards. Sub-consultant fees should appropriately reflect the work necessary to meet these standards.

During the first design stage where site development concepts are being investigated there should be a demonstration of how existing drainage impacts the site along with conceptual options for how storm water drainage may become an integral part of the project design. At each subsequent plan review phase the submittal set shall include designed storm water drainage elements which are responsive to the Concepts and Mitigation section of the Storm Water Drainage Report described below and are developed to a level of design commensurate with the rest of the project.

Appropriate soils tests will be completed as early in the design process as possible to inform the final storm water drainage design solutions. These tests shall include measures needed to understand the suitability of the soil for the infiltration needed for retention/detention, in addition to structural and other characteristics as described in Sections above.

Storm Water Drainage Report

During the first design stage where site development concepts are being investigated, a draft Storm Water drainage Report will be prepared by the Design Professional. The report will have two main components: an Existing Conditions Analysis section, and a Concepts and Mitigation section.

Existing Conditions Analysis: this report section analyzes and documents existing storm water drainage conditions on the project site. The form and methods used for this report should conform in general to City of Flagstaff standards, e.g., use the format of the City of Flagstaff

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Storm Water Management Design Manual to create a Drainage Report.

South Campus technical analyses shall be built on the *NAU Assessment of South Campus Storm Drainage*.

Concepts and Mitigation: each subsequent draft of this report section should include increasing specificity and technical documentation on proposed storm water drainage features and mitigation which emerge from the initial vision/concepts. This report section shall include, at a minimum, the following two elements:

- Storm water drainage vision and concepts for the project, presented in narrative and graphic form, conveying how storm water drainage may be incorporated in the project design. Include specific concepts such as existing drainage patterns and proposed pathways, infiltration, detention, and storage. Evaluation of required, recommended, and anticipated storm water drainage features shall be included, along with topics such as defining finished floor elevations relative to flood levels and evaluating other storm water drainage sources in the vicinity for potential use within the project site. The final Report shall include a water budget for the proposed landscape, including an analysis of water sources available to meet the budget. Proposed concepts and features shall come from a collaborative process involving all applicable team members. At a minimum this should include the project's Landscape Architect, Civil Engineer, and the Project Architect.
- Assessment of anticipated storm water drainage impacts of the project on the surrounding area including the watershed above the site, adjacent storm water drainage relationships and downstream areas potentially affected and likely mitigation needed. Maps should indicate how the site/project interfaces with its own and adjacent watersheds.

Storm Water Drainage Report Submittals

Each draft of the Storm Water Drainage Report will be reviewed by the Northern Arizona University Facility Services Director of Utilities. Following is a summary of each report draft:

- First Draft: The first draft of the Storm Water Drainage Report shall be included with the project's programming design submittal. The storm water drainage conditions, concepts, features, and mitigation described within the report are to be included in the presentation. All subsequent project presentations and submittal sets shall include these storm water drainage elements developed to a level of design commensurate with the rest of the project.
- Second Draft: A second draft of the Storm Water Drainage Report shall be due with the schematic and design document phase submittal set. This draft shall include

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updated/refined graphic and narrative descriptions of storm water drainage concepts, features, and mitigation.

- **Final Report:** The final version of the Storm Water Drainage Report shall be submitted with the construction document submittal and will include updated modeling and analysis of designed features and mitigation. It shall be sealed by a registered Civil Engineer and shall include calculations, model outputs, assumptions made, and any other relevant information to provide a comprehensive report. An executive summary is to be provided which includes, among other information, a statement from the project Civil Engineer noting in both technical and layman's terms ways in which the project design varies from and/or meets NAU Standards.

REFERENCES:

¹ NAU Design Guidelines and Technical Standards (latest revision).

² The City of Flagstaff Low Impact Development: Guidance Manual for Site Design and Implementation (latest revision).

<http://flagstaff.az.gov/index.aspx?NID=1464>

³City of Flagstaff Stormwater Management Design Manual (latest revision).

<http://www.flagstaffstormwater.com>

7. CAMPUS SUSTAINABILITY

Northern Arizona University is committed to a leadership role in promoting sustainability on our campus and in our design and construction practices. The University is actively pursuing policies that provide for a sustainable future.

In February 2004, President Dr. John Haeger approved the Northern Arizona University Campus Environmental Sustainability Plan.

<http://www.environment.nau.edu/CampusSustainability/NAUCampusEnvironmentalPlan.pdf>.

The plan includes a description of the goals for advancing sustainable building including “providing incentives to use Leadership in Energy and Environmental Design (LEED) standards and other green building practices in the development of facilities”.

The University recently adopted a *Carbon Neutrality Climate Action Plan* (2010) for reducing emissions of carbon dioxide to neutrality by 2020 (<http://home.nau.edu/sustain/>)

Much of the reduction in emissions is proposed to come from energy conservation efforts and improved efficiency of new and renovated buildings. These Design Guidelines are part of the effort described in the Sustainability Plan to “phase in a high performance facilities program that makes energy and water conservation objectives and green building design services part of planning all new or renovated facilities.”

The NAU Campus Sustainability Design Guidelines have been created to assist in advancing sustainable design on all Northern Arizona University campuses. The guidelines are intended to be applied to new construction and major renovation projects. Design Professionals, Contractors, and third party Developers of NAU projects shall be required to incorporate the guidelines into their projects. The goal is to meet as many of the guideline objectives as possible. Deviations shall be identified by the project team for review and discussion with the University (NAU PM). Where applicable, a Total Cost of Ownership (TCO) analysis may be required, to include environmental, economic and social costs and benefits. Project teams are encouraged to submit a TCO analysis with their initial review package for any proposed design elements with an initial first cost greater than a conventional solution.

The DP team shall also provide the following items:

- Simple, bulleted list of the sustainable design features (upon completion of construction documents)
- One-year post occupancy report (indicating how sustainable design goals have or have not been met; what worked and what didn’t work; hindsight evaluation - what would you do differently, etc.)

The ability to achieve NAU’s sustainability goals as delineated in the guidelines shall be a significant factor in the selection of Design Professionals, Contractors and Developers for NAU work.

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Design Professional teams are expected to incorporate the development sustainable systems within the context of construction and renovation to meet the goals of the University.

This is a suggested process for meeting the goals and requirements.

- Establish project-specific benchmarks:
Discuss, record, and document the specific goals for the project during programming and during all phases of design. Most projects will adhere to the benchmarks provided herein but in some cases projects may have more stringent requirements or focus on a certain area. Include the benchmarks selected in the Programming documentation.
- Model the building energy and site systems:
During programming and schematic design, the project team will develop a baseline energy model to identify key areas for focus during alternative evaluation. The baseline energy model will be used for alternative evaluation. An update to the model will be provided with each design submittal along with a summary report indicating assumptions, changes from the previous models, and a monthly consumption estimate for each utility along with peak flow rate.
- Develop and compare alternatives:
During Design Development, the project team will test alternative systems using Life Cycle Cost Analysis . Proposed alternatives will be presented, recommended alternatives discussed, and selected alternatives documented in an energy model report included in the design development documents.
- Sustainable Construction:
Construction will be monitored and documented per the LEED certification process to assure that the methods used during the construction and all project changes are consistent with sustainability goals and requirements of the construction documents.

7.1 DESIGN CRITERIA

General: sustainable design precepts appropriate for the Northern Arizona mountain environment should be incorporated – water conservation, building orientation, sun exposure, and snow and ice accumulation are issues of special concern in mountain environments.

- Appropriate passive solar design techniques should be incorporated and where the project scope and budget support it, solar water heating and photovoltaic systems should be considered if determined to be economically viable.
- Landscape design will be in compliance with the 2015 NAU Landscaping Master Plan, water harvesting techniques and use of the University's reclaimed water system is required. Protect significant natural and historic landscaping and incorporate those elements into the new landscape design aligned with the 2015 NAU Landscaping Master Plan.

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- Appropriate day lighting design should be considered to minimize the requirements for artificial lighting and to promote the interior/exterior connection of the building.

Innovation and Creativity in achieving the sustainable design goals are encouraged. Additionally, design aesthetics shall be considering in all aspects of the building design, including sustainable design components. The State of Arizona mandate for all state facilities to achieve LEED Silver certification is the minimum standard for NAU. NAU's goal is to excel in sustainable design in as many ways as possible.

General Project Planning & Design: The design shall manifest NAU's commitment to sustainability to the greatest extent possible. Sustainability shall be addressed comprehensively as an integral aspect of the design philosophy and in all aspects of the building design.

Building Size & Footprint: Minimize the overall building size (square footage and footprint) while meeting the building program requirements. The goal is efficient use of space to reduce overall resource consumption; including embodied energy, operational energy, and building materials.

Design for Future Use: Plan for a "100-year Building" through flexibility of use and future reuse; no "throw away" buildings. Design interior spaces that are flexible and allow for changes in use. Use standard furniture wherever possible. Minimize use of custom millwork, custom building systems (door frames, doors, interior windows etc.) to maximize reuse in the future. For retrofits, analyze current space requirements for space efficiency, function, and use proximity.

Building Life Expectancy: Appropriate use of construction materials, mechanical, electrical and plumbing systems should be selected that result in a building with an intended useful life of 100 years, and also respond to the attributes of the Northern Arizona mountain environment.

Programming & Space Planning: Group spaces or activities with similar energy requirements and times of use to allow for zoning efficiency of passive and mechanical energy systems. The goal is to reduce demand and optimize operational efficiency.

Service Areas: Service areas shall support efficient operations, program, and building management for NAU sustainability initiatives; such as recycling collection, trash compaction, water capture, service vehicle access, etc.

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Transition spaces: Provide sufficient exterior screening, transition courtyards, exterior atrium spaces, shade trellises, etc., to allow the building occupant the opportunity for eye adjustment from bright to low light and from low to bright light.

Landscape Maintenance: Reduce maintenance and potential problems caused by landscape debris. Specify plants appropriately for their purpose and location. Avoid overplanting. Consider mature landscape growth potential to insure appropriate integration with lighting, underground utilities and other site systems.

Waste Management: Northern Arizona University is working to quantify waste and recycling rates for all ongoing and any future projects on campus. Contractors are asked to identify waste diversion opportunities and track waste and recycling figures for each of their respective projects. Waste and waste diversion totals should be tracked on a monthly basis and entered into the project-specific spreadsheet.

User Involvement: Survey building occupants/users for sustainable design, maintenance and operations suggestions; utilize the recommendations in the design as practicable.

Carbon Neutrality: A zero carbon emission campus is the NAU goal.

Building Envelope: Design the building envelope to minimize heat loss and gain. Exceed the current ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) building envelope performance baseline standard by 30% or more. Avoid thermal bridging by providing thermal breaks in the exterior building envelope.

Climate-Responsive and Passive Systems Design: Design buildings in a climate-responsive manner to reduce energy demand, maximize passive heating and cooling, and minimize mechanical HVAC requirements (through building form, orientation, articulated shading, natural ventilation, glazing, interior thermal mass, blinds, controls, geothermal energy, earth tempering, etc.)

Window Glazing: Select glazing size and materials appropriate for the orientation of the windows. Use double or triple glazing wherever possible. Thermal breaks shall be included in window frames at all exterior glazing.

Window Shading: Every exterior window shall be shaded appropriately for the window orientation. Consider cleaning and maintenance of windows and shading devices in the design. Provide a shading analysis for review. Insure that operable interior shading is accessible to the building occupants.

Mechanical Systems: Specify HVAC and electrical systems that find a balance between energy efficiency and maintainability. Coordinate systems and controls with other

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building systems to optimize building operation and reduce energy consumption on a Total Cost of Ownership basis. Motion sensors and daylight-responsive dimming will be evaluated on a project needs basis. Provide electronic ventilation controls. Connection to the Central Plant heating and cooling systems is to be evaluated on every project. Consider extended life cycle maintenance and material costs in MEP systems design. Use heat recovery systems wherever possible to minimize energy usage.

The DP shall include a written description of how the mechanical systems are to operate and interface with other systems within the BOD. A detailed written sequence of operations is to be included within the plans at the Design Deliverable submittal.

Energy Commissioning & Monitoring: Provide clear building energy commissioning requirements beginning in schematic design to establish energy goals, and ending with a post-occupancy energy analysis. Provide permanent energy metering on all buildings utilizing the NAU Campus metering standards for every utility connected to the building. Metering of building sub systems may be needed based on project or LEED requirements. Provide the capability to monitor and analyze post-occupancy performance in comparison to energy analysis predictions. Provide a 1-year and 2-year post occupancy energy/carbon use analysis.

Preliminary Water Budget Analysis:

Perform a preliminary water budget analysis before the completion of schematic design that explores how to reduce potable water loads in the building and accomplish related sustainability goals. Assess and estimate the project's potential non-potable water supply sources and water demand volumes, including indoor water demand, outdoor water demand, process water demand, and supply sources. Non-potable water source evaluations can include on-site rainwater and/or graywater, and HVAC equipment condensate.

Document how the above analysis informed building and site design decisions in the project's BOD. Demonstrate how at least one on-site non-potable water supply source other than reclaimed water was analyzed to reduce the burden on municipal supply or wastewater treatment systems by contributing to at least two of the water demand components listed above.

Climate-Responsive Materials: Specify materials that are durable under desert climate conditions (UV radiation exposure and extreme heat).

Embodied Energy: Minimize the use of high embodied-energy materials.

Reused & Repurposed Materials: Present opportunities for installation of reused and repurposed materials, including the building shell, structural materials, finishes, fixtures, etc. Utilize Green Globes³ reference guidelines for baseline standard.

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Maintenance: Specify low maintenance materials. Material and building maintenance, and special cleaning procedures, shall be reviewed with NAU Trades in the design development phase for integration into the NAU sustainable cleaning program standards.

Building Construction Supervision: Schedule on-site quality control inspections to check for/assure freedom from heat bridges.

- Assure that insulation layers are continuous, and without air pockets.
- Check joint details for air tightness while they are accessible.
- Have a building shell pressure test performed as part of the building commissioning.

7.2 ASHRAE 189.1

New construction must adhere to the American Society of Heating, Refrigeration, and Air-conditioning Engineers (ASHRAE) ASHRAE 189.1 and provide the minimum requirements for site planning, design, construction, and operational planning for green commercial and institutional buildings.

Design elements include site sustainability, water use and management, energy use, indoor environmental quality, plus the building's impact on the atmosphere, materials and resources. Under energy: mechanical equipment performance, insulation, controlling air leakage, day-lighting, solar gain, occupancy-controlled lighting and ventilation, as well as on site renewable energy are included.

The designs presented and approved must meet or exceed the ASHRAE 189.1 requirements and incorporate the LEED requirements as listed below.

Following these Design Guidelines and ASHRAE 189.1 Standard, should lead to achieving LEED Gold Certification. The DP should do their best to design a building that will be as sustainable as possible when taking into account life cycle cost analysis, total cost of ownership, and energy consumption. The University is relying on its DP to do what is right for the environment and what will benefit the overall University Maintenance and Energy budgets. As decisions are being made, the University requires to be involved (through its Project Managers) in all material selections and the DP might be requested to provide justification of their selections (carbon impact, maintenance and energy costs)

USGBC LEED CERTIFICATION

The University has established a goal, wherever appropriate, to acquire LEED Gold Certification as established by the United States Green Building Council on all projects as defined below:

- **New Buildings** - A minimum of LEED Gold Certification for all new construction.

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- **Building Expansions** - Major building expansions should achieve LEED Gold Certification for the expansion, and if the project scope and budget support it, for the entire building. This goal will be established during project programming phase.
- **Renovations** - Renovation projects are defined as those projects involving the alteration of a portion of an existing building. Renovations range from simple aesthetic improvements to complex physical reconfigurations and systems' replacement. Due to the potential range of existing conditions – and the ability of a renovation project to address such conditions – it is incumbent that each renovation project undergoes an evaluation early in the budgeting and programming phases to determine if LEED certification can be achieved.

All projects will adhere to the most recent version of USGBC LEED standards as of date of DP contract. Projects will use the most recent LEED project management software to register, document and certify projects.

In general, for minor renovations or room specific renovations, requirements for LEED Certification will not be part of the project scope. For projects where major renovation is part of the scope, inclusion of LEED Gold Certification should be anticipated. For example, in major renovation projects that affect entire floors or buildings, LEED Gold Certification should be anticipated.

When considering which points will be required to obtain University LEED objectives, the Design Professional should be aware of the potential design impacts carried across the major design disciplines. At the time of this revision for these guidelines, the following list was compiled of potential design issues that may carry over to the Mechanical, Electrical, and Plumbing disciplines and is based on the potential LEED credit categories defined in LEED-v4 version. While these issues may not apply to all projects and there are obviously more coordination and design issues involved with a LEED design, the following list is provided to spur awareness of design elements and coordination effort that may be required. In addition, the following list is not intended to limit the Design Professional's responsibility or creativity in providing a successful and functional LEED design.

The University has identified the following LEED points (LEED Gold certified) for mandatory inclusion:

NEW CONSTRUCTION

INTEGRATIVE PROCESS

- **Credit – Integrative Process**
Perform a simple box energy modeling analysis and a preliminary water budget analysis before the completion of schematic design. Use the analyses to inform the basis of design (BOD), design documents, and construction documents.

LOCATION AND TRANSPORTATION

- **Credit – Surrounding Density and Diverse Uses**
Development Density and Community Connectivity consistent with the campus Master Plan.

- **Credit– Access to Quality Transit**
Due to the fact that NAU operates a bus system throughout Campus, and local bus system (NAIPTA) has several bus stops located nearby Campus, this credit should be achievable on all projects.

- **Credit – Bicycle Facilities**
Public transportation access should be consistent with the Campus Master Plan. Provide ample bike rack space to accommodate both staff and student use of the building. Consider need for roof, area drains and lighting for bicycle storage areas/racks. Consider snow removal and bike storage. Faculty, Staff and Students will continue to ride their bikes in the winter if they have good access to bike storage and if it is somehow protected from the elements.
Consider special requirements for changing rooms:
 - a. Showers
 - b. Lavatories, urinals, water closets,
 - c. Domestic water heater,
 - d. Toilet room and shower exhaust

SITE DEVELOPMENT

- **Prerequisite - Construction Activity Pollution Prevention**
Prepare a Storm Water Pollution Prevention Plan regardless the size of the site (under or over 1 acre), to ensure that construction debris and earthwork will not be infiltrate the Campus existing storm water drainage system.

- **Credit - Open Space**
Consider open space percentages for the project boundary. Ensure that the percentage of outdoor space on campus is not decreased below 30%. Consider building heights greater than 3 stories.

- **Credit - Rainwater Management**
Consider stormwater collection for non-potable uses such as Landscape irrigation, flushing urinals and/or toilets, cooling tower makeup (incorporate with existing fin water recovery system). Design collection systems with enough capacity to maintain volume of existing stormwater system. Consider volume of water collection and storage location. If multiple tanks are utilized, special consideration of the following will be required:
 - a. Inlet pipe size,

- b. Tank arrangement,
- c. Pipe materials,
- d. Tank equalization
- e. Access for cleaning

Consider required treatment:

- a. Settling area to remove heavy solids
- b. Cyclone filters to remove lighter solids
- c. UV lights to prevent bacterial growth

Credit - Heat Island Effect: Roof and/or Non-Roof

Coordinate with project Architect to establish roof requirements. Material/product selection should be accounted for in load and energy models. Material/product selection may place limitations on equipment locations and roof penetrations.

And/Or

Consider compliance options such as the use of paving materials with a three-year aged solar reflectance (SR) values of at least 0.28, and/or providing shade through the use of architectural structures, vegetated structures, or energy generation systems.

- **Credit - Light Pollution Reduction**

Consider public safety requirements. Comply with the City of Flagstaff Dark Sky Ordinance. Consider requirements for unexpected lighting fixture layouts in perimeter areas within the building. Lighting layout within the building may affect layout of air distribution.

WATER EFFICIENCY

- **Prerequisite– Outdoor Water Use Reduction**

Landscaping: Reduce demand on all systems. Utilize appropriate low water use desert and indigenous landscaping materials, balancing that with the creation of shaded micro-climate areas and comfortable, usable outdoor spaces. Utilize dense canopy trees for shading walkways and creating desert “oasis” areas utilizing captured water.

All emitters for trees and landscape shall be designed for easy modification to reduce the amount of water used (to initially establish a desert landscape) over time to conserve water as plants become established; and to be easily modifiable to move the system farther out over time to encourage root spread. Reduce landscape water use from calculated baseline by 30% using EPA’s WaterSense Budget Tool

- **Prerequisite– Indoor Water Use Reduction**

Use a modified waterless urinal (water urinal with removable handle to allow occasional cleaning flush by Custodial crews only), low flow toilet, and low-flow

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showers as applicable, non-potable water use for toilets. WaterSense label is required for applicable fixtures and fittings.

Appliance

Install appliances and equipment within the project scope that meet the requirements listed below:

Residential Clothes Washers: ENERGY STAR or performance equivalent

Residential Dishwashers (standard and compact): ENERGY STAR or performance equivalent

Ice Machine: ENERGY STAR or performance equivalent and use either air-cooled or closed-loop cooling, such as chilled or condenser water system

- **Prerequisite– Building-Level Water Metering**

Install permanent water meters for total potable water use for the building.

- **Credit– Outdoor Water Use Reduction**

Coordinate with Landscape Architect to verify water quantities (impact to water service). Consider impact to storm water collection system.

Reduce outdoor potable water use by 50% from calculated baseline using EPA's WaterSense Budget Tool.

Irrigation: Maximize gray water use for landscape irrigation and other purposes as the law allows. Consider use of captured rainwater or gray water for landscape irrigation. Use irrigation cisterns for water features in lieu of continuous potable water fountains.

- **Credit– Indoor Water Use Reduction**

Consider use of "recycled" water sources (condensate water), lavatory and shower drainage (onsite grey water). Consideration of treatment, storage, and separate waste piping. Provide opportunities for rainwater harvesting and condensate collection. Refer to Division 22 Plumbing Technical Standards for low-water usage plumbing fixtures.

- **Credit– Cooling Tower Water Use**

Any buildings requiring air-conditioning should be connected to the chilled-water distribution systems. NAU exceeds the min. 10-cycles

- **Credit– Advanced Metering**

Coordinate with Associate Director of Utilities to identify the benefit of installing permanent water meters for **two or more** of the following water subsystems, as applicable to the project: irrigation; indoor plumbing fixtures and fittings; domestic hot water; reclaimed water; boiler; and/or other process water.

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In addition, coordinate with Associate Director of Utilities to identify the benefit of metering for individual energy end uses that represent 10% or more of the total consumption of the building.

ENERGY & ATMOSPHERE

- **Prerequisite - Fundamental Commissioning and Verification**

Coordinate closely with the Commissioning Agent. Commissioning Agent will require assistance with developing the Basis of Design. Document that the Commissioning Agent will provide specifications to incorporate in the Construction Documents and will be involved in design reviews. Create an Operations and Maintenance Plan.

- **Prerequisite - Minimum Energy Performance**

Must comply with prerequisite for minimum energy performance.

- **Prerequisite - Building-Level Energy Metering.**

Provide measurement and verification for energy consumption through the installation of on-site meters. The Owner will commit to sharing with USGBC the resulting whole-project water usage data for a five-year period beginning on the date the project accepts LEED certification or typical occupancy, whichever comes first.

- **Prerequisite - Fundamental Refrigerant Management**

No use of CFC refrigerants.

- **Credit - Enhanced commissioning**

Coordination required for additional design document reviews by Commissioning Agent. Coordination required for additional reviews by Commissioning Agent of submittals, RFI's, change orders. Commissioning Agent may require assistance with development of a Systems Manual.

- **Credit - Optimize Energy Performance**

34 % Improvement in building performance beyond ASHRAE 90.1-2010 requirement is the preferred minimum level for new University facilities. Additional improvements may be required based on LEED objectives.

- **Credit - Renewable Energy Production**

Incorporate solar and renewable energy systems into the building design, such as photovoltaic panels which replace other building materials such as roof and wall finishes and shading elements; and/or prepare the building to receive solar equipment (conduit stub-outs, grouping of other rooftop equipment, space for solar equipment in the building, etc.). Ensure that the building and roof are "solar ready." Investigate and propose all possible viable options for renewable energy generation.

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Consider impact to electrical distribution/service & to mechanical systems.
Use of onsite renewable energy - 5 % min or minimum 4-6 kbtu/sf to meet ASHRAE 189.1 requirements.

- **Credit– Enhanced Refrigerant Management**
Select refrigerants that do not deplete ozone or increase global warming
Perform maximum threshold calculation

MATERIALS & RESOURCES

- **Prerequisite - Storage & Collection of Recyclables**
Specialized equipment may be implemented such as crushers/compactors, consider requirements for water and waste services for area washdown and power requirements.
- **Prerequisite - Construction & Demolition Waste Management Planning**
Create a waste management plan that identifies 5 materials (both structural and non-structural but excluding debris cover) targeted for diversion.
- **Credit– Building Life-Cycle Impact Reduction**
Consider performing a whole building life-cycle assessment of the project’s structure and enclosure.
- **Credit– Building Product Disclosure: Environmental Product Declarations**
Regional materials - extracted processed and manufactured regionally (100 miles).
Select materials that are readily serviceable from the USA (parts available locally).
Select materials that are manufactured as close as possible and avoid materials coming from overseas with long procurement lead-time. Think globally about the total carbon footprint of the selected materials.
- **Credit– Building Product Disclosure: Sourcing of Raw Materials**
Consider not only where the finished materials are manufactured but also where the raw materials are coming from and how they are sourced.
Select certified wood products. And rapidly renewable materials.
Consult with University prior to incorporating organic insulation materials for approval. Treatment and prevention of mold growth in and on organic insulating materials will need to be provided.
- **Credit– Building Product Disclosure: Sourcing of Raw Material Ingredients** Consider the use of products with ingredient reporting programs such as “Cradle 2 Cradle”.
- **Credit– Construction Waste Management**
Divert 50% of construction from disposal, consisting of three of the five previously

defined waste streams, as designated in project planning.

Collect weekly waste reports for the waste stream of the three specified materials, as well as the total weight of all materials recycled or sent to disposal for a particular project.

INDOOR ENVIRONMENTAL QUALITY

- **Prerequisite– Minimum Indoor Air Quality Performance**

ASHRAE 62.1-2010 minimum requirements must be met.

Requires system percentage of outside air high enough to meet requirements of the “critical” zone. Requires direct measurement of outdoor air quantities serving non-densely populated spaces.

- **Prerequisite– Environmental Tobacco Smoke Control**

The entire building shall be designated as “Smoke Free” area

- **Credit– Enhanced Indoor Air Quality**

Requires monitoring of CO₂ concentrations within densely populated spaces. Control system must be capable of taking corrective action when necessary. Requires isolation of pollutant rooms: laundry rooms, janitor’s closets, printer rooms, etc. Negative pressure (exhaust) will be required in such spaces. Will required printers to be in dedicated rooms. MERV 13 filters will be required for these spaces.

- **Credit– Low-Emitting Materials**

Consider use of alternate adhesive & sealant products for items such as ductwork, insulation, pipe dope, etc.

Consider low-emission alternatives for paints and coatings utilized with mechanical and electrical equipment, piping, insulation, etc.

Consider low-emission alternates for ceiling, walls, acoustic, and thermal insulation.

- **Credit– Construction IAQ Management Plan**

Requires the protection of all ductwork during construction to stop dust from collecting inside the ductwork and utilizing MERV 8 filters on AHU’s operated during construction. These filters shall be replaced prior to occupancy and shall be MERV 13.

- **Credit–IAQ Assessment**

Requires flush of building (14,000 cf per sf), or baseline air testing.

HVAC system must be designed to accomplish the flushing (via air economizer cycle).

Either flushing or air testing requires schedule time for the contractor.

- **Credit–Thermal Comfort**

Meet requirements of ASHRAE 55-2010 Thermal Comfort Conditions for Human

occupancy and demonstrate design compliance.

Controllability of Systems:

Requires individual HVAC controls for minimum of 50% of the occupants.

Consider impact to HVAC system zoning (e.g. terminal box placement for VAV systems). Provide opportunities for reasonable individual control of thermal comfort, including lighting, heat, shading, and natural ventilation within the parameters established for the space by Facility Services. Insure that controls are such that occupants have a sense of and understand the control of their thermal and visual environment.

HVAC zoning coordination required for commonality of control interface locations (alignment of HVAC zones with lighting zones preferred).

- **Credit– Interior Lighting**

Implement special requirements for controllability for all shared multi-occupant spaces. Allow individuals to adjust the lighting between three predetermined lighting scenes (ex: on, off, and midlevel). Consider interior lighting quality strategies such as luminesce, lighting positioning, and color rendering index (CRI).

- **Credit– Daylight**

Provide daylight to 75-95% of spaces within the building. Utilize natural daylight and views to enhance building occupant comfort.

Provide adequate operable shading where necessary to reduce heat and glare. Will require coordination with HVAC air distribution layout, light fixture placement and lighting controls.

- **Credit– Acoustic Performance**

Integrate stringent requirements for room noise levels, speech privacy, sound isolation, reverberation time, and paging, masking, and sound reinforcement systems.

EXISTING BUILDING RENOVATION:

- **Optimize energy performance by 34%**

- a. Lighting retrofit and motion detection switching
- b. Evaluation of existing building insulation and addition of insulation
- c. Replace windows
- d. Replace roofing
- e. HVAC upgrades with better air handling units (AHU)

- **HVAC upgrades to cover the following:**

- f. Enhanced commissioning
- g. Enhanced refrigerant management
- h. Building management systems
- i. Measurement and Verification

- **Controllability of systems – lighting**

- j. Individual lighting controls

7.3 ENERGY MODELING

Energy modeling is essential to understanding the contribution of an element to the system function efficiency. Energy modeling captures the advantages of certain materials in reduction of energy during facility operation. The systems included are primarily mechanical, electrical and plumbing as well as heating, ventilation and cooling (HVAC). For the elements included in the building envelope: subflooring, walls, roof, insulation, and glazing the cost/benefit is realized in energy savings due to better performance of the material for insulating, moisture management, and heat transfer. The energy model provides information that the building owner needs to properly evaluate different design alternatives.

The energy model will be based on LEED requirements for the baseline building.

The HVAC system described in Specification Section 23 00 00 (variable air volume, single duct, with terminal reheat) must be modeled. Any additional alternative to the LEED baseline HVAC system will be modeled and evaluated based on efficiency and maintainability. The University requires the energy savings data to be compared between the LEED baseline HVAC system, the University preferred HVAC system and any proposed alternative HVAC system. The model inputs and reports will be submitted at each stage of design and with every design submission. Modeling based on ASHRAE 189.1 is required.

The energy model should capture the role of components in the system performance. A Total Cost of Ownership analysis of components that are part of an energy system without an appropriate model included will be deemed incomplete and inconclusive. Providing a complete energy model and Total Cost of Ownership report is a requirement for progress payment to the DP.

7.4 BUILDING LIFE CYCLE COST (BLCC) ANALYSIS AND BUILDING COMPONENT SELECTION

- **“Total Cost of Ownership”**

Throughout the process of scoping, design, and sometimes during construction, building components are selected and included in the building design. Rather than base decisions for inclusion of components in the project solely on the construction budget and initial installed cost, elements included in the project must be evaluated for building life cycle cost (BLCC). The BLCC analysis includes the costs and benefits for the lifetime of a building for a product or a system including but not limited to: the initial cost of material and installation, energy savings, maintenance costs, and product life. BLCC analyses provide the owner with a true cost of alternatives under consideration. These analyses

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can then be used to compare acceptable construction materials and to differentiate the actual cost of materials to the building owner.

- **Building Life Cycle Evaluation Process and Procedure Guidelines**

The project team will identify the elements to be evaluated for BLCC Analysis based on the performance goals established for the building and the available options. Any alternatives considered shall be viable options acceptable to NAU Facility Services. BLCC Analysis shall be formally documented in the reports as required in the project development, schematic design and design development. Final selections will be made by the project team as part of construction plan completion and BLCC may not be the sole criteria used to perform selection of building systems and building materials.

Energy escalation rates and the discount factor will be derived from the latest *Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis, Annual Supplement to NIST Handbook 135*, or as directed by the University's Manager of Utilities. The University recognizes that proposed alternatives may not prove cost effective based on Life Cycle Cost Analysis but the alternative may be deemed necessary to meet the energy reduction goal and minimize the carbon footprint of the building. This situation occurs predominately in the Optimize Energy Performance credit of the LEED certification process. The Life Cycle Cost Analysis and LEED energy savings impact will be evaluated on a case by case basis.

The following building systems shall be considered for BLCC Analysis:

1. Energy systems
2. Electrical Systems
3. Building Envelope
4. Sitting/Massing Strategies
5. Structural Systems
6. Mechanical Systems
7. Water Systems
8. Interior Materials

Goals shall be established for each of the systems as listed. Each project requires that at least six life cycle comparative studies be presented and updated for each design phase. Specific required studies include: roofing alternatives within the building envelope category, HVAC system alternatives within energy systems, and flooring as part of interior materials. No more than three studies shall be completed within the same category.

- **Resources**

The following resources were identified as potential methods for BLCC Analysis:

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- The US Department of Energy provides a life cycle cost analysis program through The National Institute of Standards and Technology (NIST) and provides a program to assist in BLCC Analyses.
- BLCC conducts economic analyses by evaluating the relative cost effectiveness of alternative buildings and building-related systems or components. Typically, BLCC is used to evaluate alternative designs that have higher initial costs but lower operating costs over the project life than the lowest-initial-cost design. It is especially useful for evaluating the costs and benefits of energy and water conservation and renewable energy projects. The life-cycle cost (LCC) of two or more alternative designs are computed and compared to determine which has the lowest LCC and is therefore more economical in the long run. BLCC also calculates comparative economic measures for alternative designs, including net savings, savings-to-investment ratio, adjusted internal rate of return, and years to payback.
- The software can be used to evaluate projects for both new and existing buildings. While BLCC is oriented toward construction-related decisions, it can be used to evaluate alternative designs for almost any project type in which higher capital investment costs lead to lower future operating-related costs (NIST website, 2009).

Designers are expected to be well versed in modeling and to have the ability to demonstrate the accuracy of the proposed model using existing facilities and locally and regionally appropriate data.

7.5 OPERATION & MAINTENANCE

- **Building “Owner’s Manual”:** Provide a Building Owner’s Manual (in digital format) on how to operate and maintain the building and site to optimize the building systems and design.
- **Operation & Maintenance Education:** Conduct a building owner/user/Facility Services workshop prior to occupancy to review the “Building Owner’s Manual” and direct building users on how to optimize the building systems and design.
- **Post-Occupancy Evaluation:** Post-occupancy evaluations will be performed by the Design Professional (DP) or a consultant retained by the DP at the end of the first year of occupancy. The evaluation shall include performance and satisfaction assessments of building comfort, HVAC systems operations & controls, water and energy use, lighting, etc.

7.6 BUILDING EDUCATION

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- **Resource Usage Information Display:** Buildings are not static in nature and therefore it is important to provide feedback to the users on their effect on energy, water and other resource consumption as they use the buildings. Provide smart meters to educate and influence user behavior with the goal of reducing energy consumption.
- **Interpretation:** Buildings should be an educational opportunity for the users, to educate the users on energy savings and resource saving features of buildings. Provide innovative ways to educate users about the sustainable building design, through the use of signage, displays (green screen or other form) and any other appropriate communication device to explain design strategies, techniques, technologies, etc.

8. CAMPUS METERING

Utility metering is required for all new construction and renovation projects that include energy or water consuming components. Utility meters shall be designed and specified by the Design Professional. Contractor shall furnish and install all utility meters. Utility meter commissioning shall be a joint effort between the Contractor, Design Professional, Commissioning Agent (where applicable), and the University. The University will not accept any utility meter until it has been shown to be fully functioning and operational. Refer to section 23 05 19 for Mechanical Meter Standard and 26 09 13 for Electrical Power meters.

Utility meters shall communicate with the University's campus EMS system. Specify all necessary components and communication protocols to assure meter information can be mapped to campus Building EMS Web Page.

9. CAMPUS ACCESSIBILITY AND UNIVERSAL DESIGN

Northern Arizona University is committed to universal design (UD) in all construction projects whether they are new facilities or facility renovations. The University is committed to providing equitable access to its working, learning and cultural activities for all individuals. Universal Design serves to create usable and sustainable spaces which are usable by all members and guests of the University community.

Universal design “is not a design style, but an orientation to any design process that begins with a responsibility to the experience of the user” (Institute for Human Centered Design, 2010). It is a proactive approach to design considerations in the physical environment, as well as the information, policy, and learning environments. Considering the experience of the user prior to making design decisions can create long-term efficiencies for the institution by minimizing the need for future adaptations and retrofitting. In recognition of this potential, Northern Arizona University has established its commitment to universal design within its 2010 Strategic Plan under goal 5, which states “Foster and support universally-designed environments,” and goal 7, which states, “Design products and environments to be usable by all people, to the greatest extent possible.”

The Center for Universal Design at North Carolina State University has defined universal design as “the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design” (Center for Universal Design, 1997). In supporting this definition, it has identified seven primary principles of universal design for products and environments.

(see http://www.ncsu.edu/www/ncsu/design/sod5/cud/about_ud/udprinciples.htm)

These principles are:

- Principle 1: Equitable use
- Principle 2: Flexible use
- Principle 3: Simple and Intuitive Use
- Principle 4: Perceptible Information
- Principle 5: Tolerance for Error
- Principle 6: Low Physical Effort
- Principle 7: Size and Space for Approach and Use

These principles are described in detail at the Center for universal Design website listed above. This information, and other reference material, can also be found on Northern Arizona University’s Commission on Disability Access and Design website at <http://nau.edu/cdad/>.

Projects involving building/sites on the National Register of Historic Places must comply with the UD Accessibility Standards in such a way that impact is minimized and a building/site’s historic integrity and character defining features are maintained. The determination of

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building/site's historical integrity and character defining features shall be made by an individual meeting the Secretary of the Interior's Professional Qualification Standards for Historic Preservation.

Due to potential range of existing conditions – and the ability of renovation (or historic renovation) project to address such conditions – it is imperative that each project involving an existing building undergo evaluation early in the design process to outline the scope of accessibility compliance which can be achieved.

All construction projects – new, renovation and historic renovation – must comply with the ANSI 117.1 accessibility requirements (as a referenced standard in the IBC). In addition, must comply with the 2010 ADA Standards, as adopted by the Department of Justice (DOJ) in September 2010 and their related standards as they apply. Compliance shall also conform to the requirements of the latest editions of all state regulations and the various codes which have been adopted by the University at the time of bid.

New construction projects must comply with mandatory standards throughout both the building and site. Additions to existing buildings must comply with mandatory standards throughout the building and – if provided with new building entrances from the exterior – the site. Renovation projects must comply with mandatory standards within the physical boundaries of the renovation.

In regards to achieving accessibility as part of renovations, the University recognizes that there are some challenges renovation projects cannot overcome, such as:

- Conditions physically beyond the limits of the renovation
- Spatial/structural/technical conditions which make accessibility infeasible to achieve, and/or
- Conditions which cannot be addressed within a defined project scope or budget.

Many of the UD Accessibility Standards become preferences – rather than mandatory – when there are significant constraints to achieving accessibility. However, the University expects Design Professionals to bring an innovative and resourceful approach to renovation projects on campus, and strive to achieve compliance with the UD Accessibility Standards.

International Symbol of Accessibility

In lieu of utilizing 2010 ADA Figure 703.7.2.1 “International Symbol of Accessibility” for all accessibility signage; the following likeness and description of the “International Symbol of Accessibility” will be utilized, as found at the following website:

<http://www.accessibleicon.org/icon.html>.

The use of this International Symbol of Accessibility is mandatory on all new construction and major renovation projects, as well as for all parking facilities. Small renovations would

continue to use the current 2010 ADA Figure 703.7.2.1 symbol as to maintain signage consistency within a building.



Sample Icon

NAU’S Equivalent Facilitation Notes: NAU has agreed that slight variations on the historical “International Symbol of Accessibility” could be generally permissible as long as the symbol clearly displays a wheelchair and signifies accessibility. Please reference 2010 ADA section “**103 Equivalent Facilitation**. Nothing in these requirements prevents the use of designs, products, or technologies as alternatives to those prescribed, provided they result in substantially equivalent or greater accessibility and usability.”; and 2010 ADA “**Advisory 103 Equivalent Facilitation**. The responsibility for demonstrating equivalent facilitation in the event of a challenge rests with the covered entity. With the exception of transit facilities, which are covered by regulations issued by the Department of Transportation, there is no process for certifying that an alternative design provides equivalent facilitation.”

Section 1 - Building Basics

Reach Ranges

- The operable portion of building equipment and controls (such as electrical switches, fire alarm pull stations, above-work-surface telephone and data outlets, thermostats, elevator call buttons, etc.) shall be located no higher than 44 inches above the finished floor.
- Proximity door access card devices shall be used in areas where required for security. They will be centered no higher than 38 inches above the finished floor.
- Control plates for automatic door openers shall be centered 36 inches above the finished floor.

Section 2 - Accessible Routes

During Construction

- Renovations that temporarily eliminate building-wide accessibility accommodations (i.e. change of building entrance, access through building, accessible restrooms,

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elevators, etc.) shall provide comparable, temporary replacements-including temporary directional signage-for said accommodations.

- Construction fencing/staging, earthwork, temporary drainage conditions shall be designed to maintain existing accessible routes or alternative, temporary accessible routes-including temporary directional signage-shall be provided.
- Temporary ramps used during construction must comply with ADAAG regulations.

Surface Materials

- Decorative ground surface treatments (i.e. exposed aggregate concrete, unit pavers, stone paving, etc.) shall not be on an accessible route.
- Granular surface materials used to create exterior paths of travel shall provide a stable surface that is usable during all weather conditions.
- Changes in surface material-both inside and outside-shall be provided with a durable transition/threshold that will meet the change in elevation height requirement throughout the life of the building/space.
- Granular surface materials may not be used on path of travel surfaces with a slope greater than 1:20.
- The University's standard for detectable warning surface is truncated domes pavers.

Building Entrances

- The main entrance of a building shall be universally accessible via a single route.
- All building entrances shall be accessible-including employee entrances or entrances other than the main entrance.

Doors and Doorways

- Kick-plates shall be provided on non-latching/push-pull hardware-type doors.
- All latching door hardware shall be lever handle type.
- In the case of Revolving doors shall be used, an adjacent single door, minimum 36 inches wide, mechanically operated, shall be provided.

Ramps

- Where changes in elevation are encountered (including courtyards and open spaces) full consideration shall be given to university accessible design that addresses elevation change.
- Where grades/space allow, sloped sidewalks (slope 1:20 or flatter) shall be used to overcome changes in elevation.
- Ramps (defined as anything steeper than 1:20 slope) shall have a maximum of 1:16 slope.

Curb Ramps (curb cuts)

- Curb ramp slopes shall be 1:12.

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- Concrete aprons shall be provided at the bottom of the curb ramps.
- Curb ramps within sidewalks (parallel to the path of travel) shall be provided with a 1:16 slope.
- The University's standard for detectable warning surfaces is truncated domes in a contrasting color.
- The depth of detectable warning surface in the direction of travel shall not exceed 24 inches.

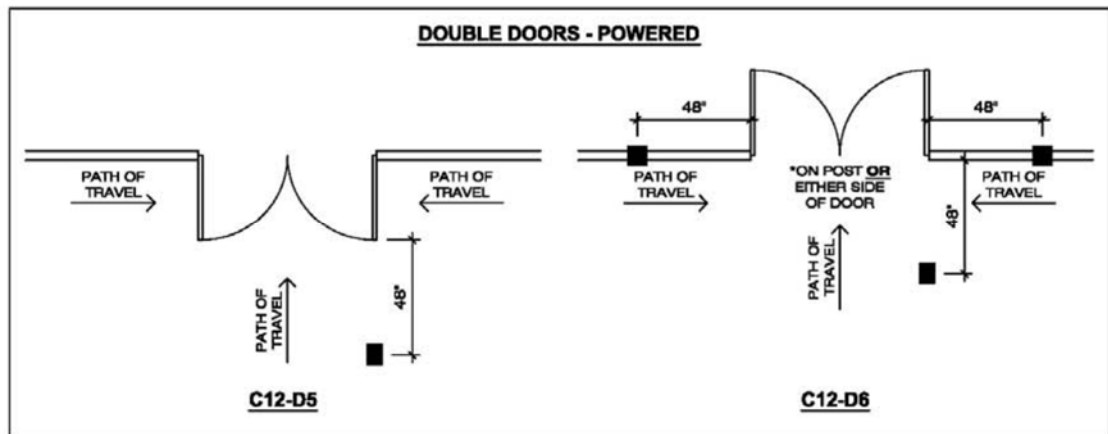
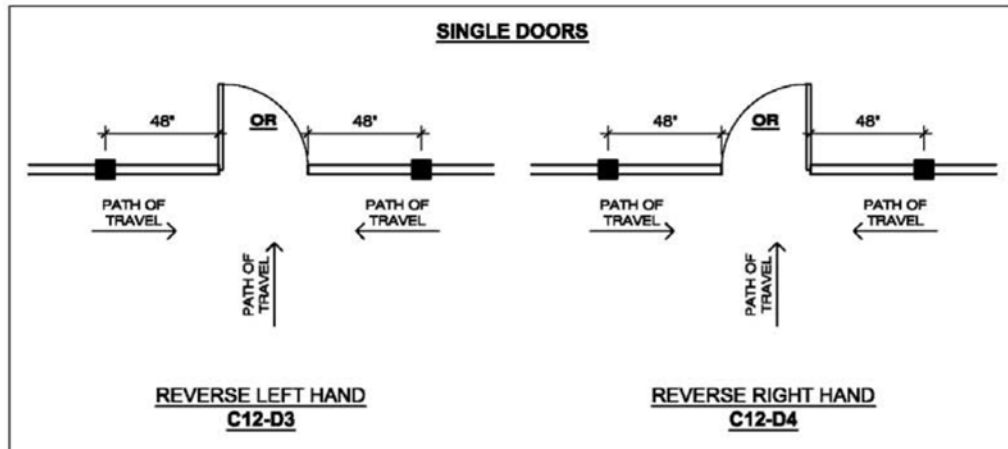
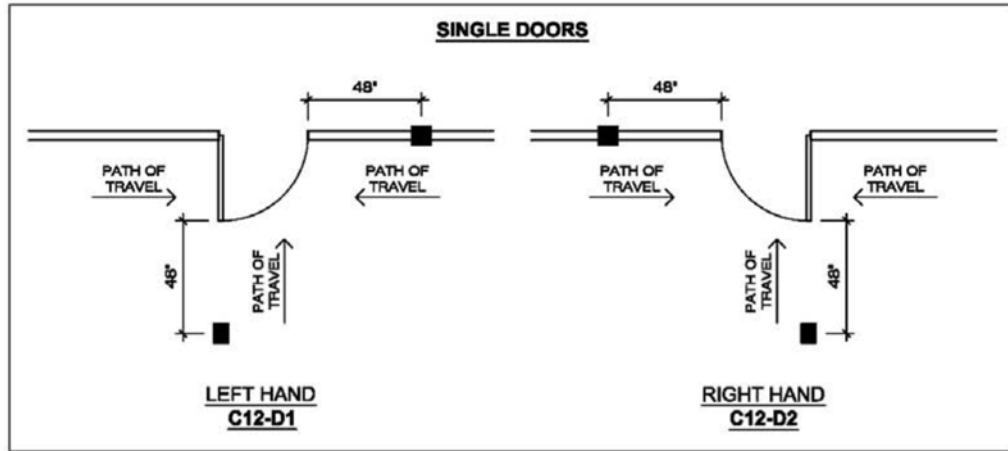
Automatic Door Operators

- Automatic door operators shall be installed at each entrance to a building.
- For guidance on horizontal placement of control plates for Automatic Door Operators, refer to diagrams C-12-D-1 through C-12-D-6 on next page. For vertical placement of control plate for Automatic Door Operators, refer to Section 1-Building Basics-Reach Ranges. (ADAAG 404.3).

Elevators and Lifts

- Elevator cabins shall be accessible.
- Platform lifts shall not be used.

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Section 3 - General Site and building Elements

Parking Spaces

Intent, Purpose and Goals: The intent and purpose of these NAU technical requirements is to establish minimum requirements to safeguard the public health, safety and general welfare of those individuals making use of “Accessible Vehicle Space(s)” and “Accessible route(s)” at vehicular traffic areas. They are not intended as a complete set of specifications for their construction.

It should be noted that the following items are in addition to NAU adopted Codes and mandatory ADA requirements (see NAU Technical Standards Division 1, section number 01 41 13, “Codes”). For the purpose of clarity, additional items such as code & ADA requirements may have partially been replicated within these NAU technical requirements. However, the provisions of these guidelines shall not be deemed to nullify any provisions of local, state or federal law. In the event that any part or provision of these guidelines is held to be illegal or void, this shall not have the effect of making void or illegal any of the other parts or provisions.

General And NAU Technical Requirements: Accessible parking spaces and required accessible routes shall at least comply with NAU adopted Codes and mandatory ADA requirements. Additionally, it shall comply with the following NAU technical requirements:

Exception - NAU technical requirements: Where NAU determines that compliance with any section/item of the NAU technical requirement(s) would create an unreasonable hardship, a variance or waiver may be requested in writing and granted when equivalent facilitation is provided. Approval must be granted by the enforcing organization. The enforcing organization shall at least include the NAU Project Manager, NAU Parking Services, NAU Affirmative Action, NAU Disability Resources, and NAU Building Official (Additional approvals may be required, as determined by NAU Project Manager.)

Location of “Accessible Vehicle Spaces” and “Accessible route(s)” at vehicular traffic areas:

Accessible parking spaces shall be located so that persons with disabilities are not compelled to wheel or walk behind parked cars other than their own.

Exception: Parking spaces may be provided which would require a person with a disability to wheel or walk behind a parking space other than that person's own accessible parking space when the NAU enforcing organization determines that compliance with these regulations or providing equivalent facilitation would create an unreasonable hardship. The enforcing organization shall at least include the NAU Project Manager, and NAU Parking Services, and NAU Affirmative Action, and NAU Disability Resources, and NAU Building Official (Additional approvals may be required, as determined by NAU Project Manager.)

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Crosswalk At Hazardous Vehicular Areas. When practical, the accessible route shall not cross lanes for vehicular traffic. When crossing vehicle traffic lanes is necessary (for example, such as but not limited to the following situations: Local fire engine access requirements prohibit parking immediately adjacent to a building. etc.) then the accessible route shall be designated and marked as a crosswalk. The crosswalk shall run perpendicular to the vehicular route.

Accessible Routes Located Alongside Hazardous Vehicular Areas. If an accessible route adjoins a vehicular way, and the walking surfaces are not separated by curbs or other elements (e.g. planters or other streetscape designs, parking spaces, etc.) between the pedestrian areas and hazardous vehicular areas, the boundary between the areas shall be defined by an approved continuous railing or other approved type of vehicle barrier.

Advisory note: Please be advised that as per the "Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way" R208: "Detectable warning surfaces are not intended to provide way-finding for pedestrians who are blind or have low vision."

Dimensions, Marking and Identification of Surfaces, located at Accessible Parking Space(s) and Access Aisle(s):

Width (Preferred By NAU): Accessible car parking space(s) shall be 108 inches (9 ft) wide minimum and van parking spaces shall be 132 inches (11 ft) wide minimum. Access aisles serving car and accessible van parking spaces shall be 60 inches (5 ft) wide maximum.

Non-Accessible parking spaces shall be 102 inches (8 ft 6 inches) wide minimum and 108 inches (9ft) maximum. The objective is to minimize the width of parking spaces, and maximize the total number of parking spaces in the space available.

Length: The minimum length of each Accessible parking space shall be 18 feet (216 inches).

Marking of Ground or Surface at Accessible Parking Space: The accessible parking space shall be marked by a border painted with lines in Yellow. The Yellow painted lines shall be at least 4 inches wide, and shall be one consistent color.

Each accessible parking space shall have a surface identification duplicating the following scheme: By outlining an International Symbol of Accessibility on the ground in the space in Yellow on blue background. The International Symbol of Accessibility shall be a minimum 36 inches high by 36 inches wide (3 ft x 3ft) and shall be aligned with the end of the stall or space adjacent to the traffic aisle so that it is visible to a traffic enforcement officer when a vehicle is properly parked in the space.

Marking of Ground or Surface at Access Aisle: The accessible loading and unloading access aisle shall be marked by a border, whereas the painted lines are Yellow and at least 4 inches wide. Within the border, hatched lines a maximum of 36 inches on center shall be at least 4 inches wide and painted Yellow. The words "NO PARKING" shall be painted on the ground

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within each 5-foot wide loading and unloading access aisle. This notice shall be painted Yellow in UPPERCASE letters, no less than 10 inches high, and clearly identifiable as written, and located so that it is visible to traffic enforcement officials.

Identification Signs: Marking symbols & wording (as noted above) painted over parking surfaces / access aisles must also be used to supplement the following identification sign requirements. Parking space identification signs shall include the International Symbol of Accessibility (please reference adopted codes and ADA for further requirements), and shall be installed in front of each accessible parking space. The signs shall be displayed on fixed mountings in an area where they are not hidden from view, and so they cannot be obscured by a vehicle parked in the space. An additional sign or additional language below the International Symbol of Accessibility shall state "NAU PERMIT REQUIRED".

Directional Signage, Located between Accessible Parking and Building Entrances: Where there are inaccessible building entrances and inaccessible exterior routes, directional signage should be provided, indicating the nearest available accessible route to the nearest accessible building entrance or like accessible element. These directional signs shall include the International Symbol of Accessibility and directional arrow.

Approvals & Permit Requirements:

Building permits and plan review approvals are required for all new and existing "parking facilities" on campus, and under any one or more of the following circumstances:

- Re-striping, New striping.
- Resurfaced, Resealed, Newly surfaced, Newly sealed.
- Addition or deletion of parking spaces.
- Newly installed or altered or changes to signs (those signs required by ADA, codes and these requirements.)
- Newly installed or altered or changes to accessible routes (those routes required by ADA, codes and these requirements.)
- As per ADA, the term "parking facility" is used instead of the term "parking lot" so that it is clear that both parking lots and parking structures are required to comply.
- Please be advised that all of the above circumstances trigger ADA mandatory requirements. It should also be noted that what some may consider as "only maintenance" may trigger ADA mandatory requirements.

Re-Striping and new striping: When a new or existing parking facility is striped or re-striped, all work must comply as required by the ADA requirements and applicable codes as well.

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Re-striping (without resurfacing or resealing) also requires a permit from the NAU Building Official. The new striping must exactly match the old striping. However, if the old striping and/or the sloped surfaces did not meet the current code and ADA requirements, then the new striping and/or the sloped surfaces will have to be modified to meet current code and ADA requirements. Plans submitted for permits shall identify whether any changes will have to be made to the current striping and/or the sloped surfaces to meet current code and ADA requirements.

Resurfacing and Resealing: Parking facility resurfacing and resealing requires a permit from the NAU Building Official.

Parking Facility Layout: Fire lane requirements may need to be updated. Parking facility layout and aisle widths may be contingent on or determined by fire apparatus access route requirements. The location of fire hydrants shall also not be obstructed. Therefore, prior to striping and/or re-striping of any parking area, the requirements for fire apparatus access routes and location of fire hydrants shall be taken into consideration and approved as determined by the NAU Fire Marshal.

Before allowing striping and/or re-striping of any parking facility on campus, an accessible route must be installed as required by the ADA requirements.

Although not a complete list of ADA scoping and technical requirements, here are a number of items to keep in mind. For a comprehensive and up to date list of requirements, please reference applicable NAU adopted codes and ADA mandatory requirements.

- There is no "grandfathering" for the required number of disabled parking spaces at existing or new parking facilities. The number of accessible spaces required is regulated by the ADA.
- Where more than one parking facility is provided on a site, the number of accessible spaces provided on the site shall be calculated according to the number of spaces required for each parking facility.
- Where parking spaces are marked with lines, width measurements of parking spaces and access aisles shall be made from the centerline of the markings. EXCEPTION: Where parking spaces or access aisles are not adjacent to another parking space or access aisle, measurements shall be permitted to include the full width of the line defining the parking space or access aisle.
- Accessible parking spaces and access aisles are required to be nearly level in all directions, except slopes not steeper than 1:48 shall be permitted for drainage purposes.
- Access aisles shall not overlap with the vehicular way. For safety reasons, it is important that the access aisle not overlap the road or driveway where vehicles could possibly strike the person emerging from their vehicle. This is especially important when parallel parking is provided.

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- Two accessible parking spaces shall be permitted to share a common access aisle, and placed on either side of the car or van parking space. Except where Van parking spaces are angled, access aisles shall be located on the passenger side of the parking space.
- Access aisles shall adjoin an accessible route. Accessible routes must connect parking spaces to accessible entrances. Accessible routes shall consist of one or more of the following components: walking surfaces with a running slope not steeper than 1:20, ramps and/or curb ramps not steeper than 1:12 (unless very specific exceptions are applicable), etc. In any event, cross slopes shall not be steeper than 1:48. Ramp runs shall always have landings at top and bottom, and in most cases curb ramps will require the same. Handrails and guard rails must also be considered.
- Parking spaces that serve a particular building or facility shall be located on the shortest accessible route from parking to an entrance.
- Where parking serves more than one accessible entrance, parking spaces shall be dispersed and located on the shortest accessible route to the accessible entrances.
- In parking facilities that do not serve a particular building or facility, parking spaces shall be located on the shortest accessible route to an accessible pedestrian entrance of the parking facility.
- Parking spaces shall be permitted to be located in different parking facilities if substantially equivalent or greater accessibility is provided in terms of distance from an accessible entrance or entrances, parking fee, and user convenience. Factors that could affect "user convenience" include, but are not limited to, protection from the weather, security, lighting, and comparative maintenance of the alternative parking site.
- In residential parking facilities, the requirements differ, therefore please reference NAU adopted codes and ADA for these particular requirements.

Section 4 - Plumbing Elements and Facilities

General

- No vestibule (i.e. doors in series) entries into restrooms.
- All gender restrooms shall be accessible for the purposes of privacy and/or assisted use.
- Mirrors shall be full length or no more than 40 inches from floor to bottom of mirror.

Toilet and Bathing Rooms

- Single occupant public/employee restrooms shall be fully accessible.
- Private toilet rooms for employees shall be accessible for approach, entry and exit, and provided with a 5 foot turning radius.
- An all gender restroom shall be provided in all facilities as reasonably feasible (refer to Chapter 9 of this Design Guidelines Manual)

Water Closets and Toilet Compartments

- A side approach toilet with a 5 foot turning radius located completely in the compartment shall be provided.
- Toilet paper dispensers shall be located:
 - With the front edge of the dispenser no further than 32 inches from the rear wall of the compartment.
 - Centered 26 inches above the finished floor
 - Below the side grab bar
- Toilet paper dispensers in accessible toilet compartments shall be continuous feed type dispensers; no separate sheet, controlled feed, or large roll dispensers shall be used.
- Flush valves for toilets shall be automatic.
- A coat hook 44 inches above the floor must be provided in the accessible toilet compartment.
- For wheelchair accessible door, door shall open in.
- Latching mechanism for accessible toilet compartment doors shall be operable with a closed fist.

Lavatories and Sinks

- The operable portion of soap dispensers, paper towel dispensers, and electric hand dryers shall be not more than 44 inches above the finished floor.
- Soap dispensers shall be operable with one hand, located within an appropriate reach range, and provided with clear floor space.
- A 29 inch knee clearance shall be provided under accessible sinks. "Extended" sinks (those with a deep front to back dimension) shall not be used to achieve the 29 in knee clearance.

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- Sink faucets shall be automatic (preferred) with delayed shut-off, or lever operated. Faucet must extend over the sink so there is sufficient space for hands to get wet.
- Adaptable sinks with accessible cabinetry (such as sinks found in employee kitchen areas, laboratories, dwelling units, etc.) shall be provided with a finished flooring surface in the under-cabinet space.

Shower Compartments

- In non-residential conditions, accessible showers shall be:
 - At least 60" X 36" with 60" X 60" being ideal
 - Transfer type entry
 - Provided with padded, fold down bench with integral support legs that extend the full width of the stall and located on the wall opposite of the controls/shower head
 - In communal showers, all the showering areas will be accessible to include hand-held showers, grab bars and fold out shower benches.

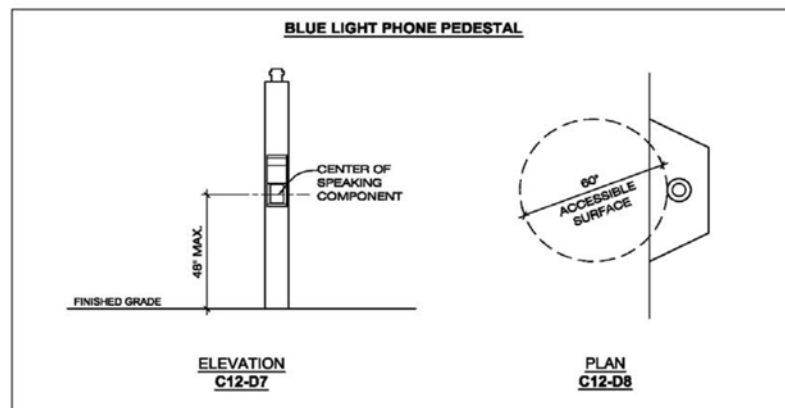
Section 5 - Communication Elements and Features

Assisted Listening Systems

- For ANSI or ADAAG required assisted listening system installations, consult with Disability Resources on the appropriate type of system for the building/space.

Emergency "Blue Light" Phones

- Access shall be provided to the emergency "blue light" phones. There should be an accessible approach and clear ground space in front of the phone with a 60 inch turning radius.
- Pedestal mounted emergency "blue light" phone shall be installed such that the center of the speaker is no higher than 48 inches above the surface of the clear ground space.



Section 6 - Rooms and Spaces

Signage

- All permanent rooms and spaces shall be identified with visual and tactile signs mounted 60 inches above the floor on the latch side of the door.

Auditoriums, Classrooms, Tiered Classrooms, and Assembly Areas

- A minimum 10% of total seating shall be accessible.
- Wheelchair accessible seating and companion seats shall be provided in a variety of locations throughout the seating area.
- Wheelchair access shall be incorporated in the primary access route to the stage/teaching station areas.
- In fixed seating situations, seats with fold up arms shall be provided.

Office Spaces

- Each individual office space in new facilities shall have sufficient clear floor space to accommodate a 5 foot turning radius.

Academic Laboratories

- Academic (teaching) laboratories shall be accessible. The accessible work stations shall provide, or have the capacity to provide, those elements of laboratory furnishings and equipment specific to the type of teaching expected to be conducted in the laboratory in question.
- Provide at least one wheelchair accessible workstation in each lab. The workstation shall include:
 - A bench space which is 7 feet long, adjustable in height.
 - A sink with faucet controls located on the side with single action lever controls or wrist blade handles.
 - Lab gases and power outlets located on the side of the bench or within 18 inches of the front edge of the bench with single action lever controls or wrist blade handles.
 - Storage facilities (for lab equipment/materials to be utilized by students in the lab) within ADA reach ranges.
- Where academic laboratories utilize fume hoods, provide at least one accessible fume hood with:
 - An adjustable height work surface.
 - Gas/services within the hood located on the side of the hood or within 18 inches of the front edge of the hood, with single action lever controls or wrist blade handles.

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- Eyewashes/safety showers shall be independently accessible and operable by a wheelchair user.
- Aisles 42-48 inches wide are required for accessible benches and fume hoods.
- Where non-laboratory teaching amenities (writing surfaces, lecture areas, etc.) are provided within academic laboratories, at least one accessible workstation which includes such amenities shall be provided.
- Specific purpose teaching facilities (balance or tissue culture rooms, etc.) shall provide a wheelchair accessible space with:
 - A 5 foot diameter radius within one room.
 - An adjustable bench space.

Research Laboratories

- Research laboratories shall have provisions for wheelchair accessibility. The accessible workstation(s) shall provide, or have the capacity to provide, those elements of laboratory furnishings and equipment specific to the type of teaching expected to be conducted in the laboratory in question.
- Individual research laboratory rooms assigned to specific employees are considered employee work areas. For employee work areas, basic access is required for approach, entry, and exit.
- Research laboratory rooms with open assignment workstations/bench space shall be provided with at least one accessible workstation with:
 - A bench space 7 feet long, adjustable in height.
 - A sink with faucet controls located on the side (not rear) with single action lever controls or wrist blade handles.
 - Lab gases and power outlets located on the side of the bench or within 18 inches of the front edge of the bench with single action lever controls or wrist blade handles.
 - Aisles 42-48 inches wide for accessible bench space/hoods.
 - Storage facilities within ADA reach ranges.
- Shared, specific purpose research laboratory rooms in open assignment research laboratories shall be provided with at least one wheelchair accessible workstation/hood with a 5 foot turning radius and an adjustable table.
- Shared fume hoods in open assignment research laboratories shall provide at least one accessible fume hood with:
 - A maximum of 32 inches high work surface with 29 inch clearance below.
 - Gas/services within the hood located on the side of the hood or within 18 inches of the front of the hood, with single action lever controls or wrist blade handles.

Section 7 - Built-in Furnishings and Equipment

General

- When unfixed furniture may be moved into the path of travel, 42-48 inches aisles for clearance/maneuvering shall be provided.

Seating at Tables, Counters and Work Surfaces

- The top of built-in work surfaces which are used for extended periods of time (computer tables, study carrels, etc.) by transient populations shall be a maximum of 32 inches above finished floor. There should be at least one height adjustable table in each area.
- The minimum clearance below built-in furniture shall be 29 inches above finished floor.
- Accessible height service/reception counters-34 inches above finished floor-shall be located at the primary queuing point or staffing location.

Section 8 - Dwelling Units

General

- Residence Halls shall provide all residents and visitors access to all publically accessible areas of the facility.

Entrances

- All accessible building entrances to residence halls shall be provided with the infrastructure to permit unlocking the doors with a proximity card and permit opening with an automatic door operator.

Paths of Travel

- Stairs and elevators shall be located on a common route within the building.
- Interior doors along the path of travel to accessible rooms and those to building-wide amenities/services (i.e. kitchen, laundry, study/common rooms, etc.) shall be prodded with automatic door operators.
- The location of accessible rooms¹ in residence halls shall be:
 - On a convenient path of travel from the main entrance and elevator.
 - Close to building-wide amenities/services.

Doors

- Accessible rooms on all floors of a residence hall shall be provided with the infrastructure for automatic door operators.

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- If “peep holes” are provided to residence rooms, provide an additional “peep hole” at 48 inches above the finished floor in the doors of accessible rooms.
- Infrastructure of door knock signalers (i.e. strobes) shall be provided for the entry doors to accessible rooms and the doors to bathrooms attached to accessible rooms.

Bathrooms

- Shower compartments in residential condition accessible bathrooms shall be:
 - Roll in showers
 - Specifically a 60” X 60” dimension
 - Provided with a padded, fold down bench with integral support legs installed on the wall adjacent to the controls/shower head.
- Accessible lavatories in residential condition accessible bathrooms shall be provided with counter top space (to accommodate personal care items).

CODES AND STANDARDS

It is the intent and purpose that all construction projects conform to the requirement standards for persons with disabilities as set forth in the 2010 ADA Standards, as adopted by the Department of Justice (DOJ) in September 2010 and their related standards as they apply. Compliance shall conform to the requirements of the latest editions of all state regulations and the various codes which have been adopted by the University at the time of bid.

10. ALL GENDER RESTROOM REQUIREMENTS

The University is committed to designating and maintaining a minimum of one *all* gender restroom (AGR) in as many of its buildings as reasonably feasible. Therefore the following criteria should be followed:

WHERE REQUIRED

- **New Buildings** - A minimum of one AGR *shall* be provided in each new building.
- **Building Expansions** - Major building expansions should include an AGR unless it is determined that the existing facility has a restroom that can be designated or converted *as part of the project scope*.
 - *If only one AGR can be provided in an existing building, that AGR must meet all ADA code and regulations.*
- **Renovations** - Renovation projects are defined as those projects involving the alteration of a portion of an existing building. Renovations range from simple aesthetic improvements to complex physical reconfigurations and systems replacement. Due to the potential range of existing conditions – and the ability of a renovation project to address such conditions – it is incumbent that each renovation project undergoes an evaluation early in the design process to outline the scope of compliance which can be achieved.
 - *If only one AGR can be provided in an existing building, that AGR must meet all ADA code and regulations.*

In general, addition of AGRs should be considered for all projects including minor renovations. For projects where major bathroom renovations are part of the scope, addition of one AGR, should be included. For major renovation projects affecting entire floors or buildings AGRs should be provided if reasonably feasible.

- **Residential Facilities** - Because of the variety of facilities that Residence Life *manages*, the Design Professional shall discuss with the User specific project requirements and criteria.

DESIGN CRITERIA

- An AGR consists of a single room with its own door *and shall have a privacy latch*.
- Accessible AGRs shall not be used as a substitute for providing accessibility to multi-stall restrooms.
- The plumbing fixtures in AGR restrooms shall count towards the total fixture counts required by code. Only (1) toilet (no urinals) shall be provided.
- In new construction, **all** AGRs must be ADA compliant.
- In new construction, each AGR shall include one (1) baby diaper changing table. ADA clearance is required even with baby changing station down (clear floor space).

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- In a renovation where a single gender restroom is converted to an AGR, new construction standards shall be followed.
 - i. If there is only one AGR in a building, it needs to be ADA compliant.
 - ii. If there is more than one AGR in a building, AGRs beyond the first ADA compliant do not have the requirement to be ADA accessible.
- Refer to other sections of these Design Guidelines as applicable for plumbing and bathroom accessory criteria, but at a minimum must follow the following:
 - i. All gender restrooms shall contain not more than one lavatory, and two water closets without urinals or or water closet and one urinal.
- All other applicable codes and regulations shall be incorporated.

SIGNAGE

All AGRs will be designated as “ALL GENDER RESTROOM” with the following standards:

- There shall be no male or female symbol.
- If the AGR is ADA accessible, the ADA wheelchair symbol shall be used.
- A baby changing station symbol.
- All Gender Restroom in Braille.

Below is a sample of an acceptable sign for the door and the baby diaper changing station:



11. LACTATION ROOM REQUIREMENTS

A lactation room is a non-bathroom space allocated for the privacy of expressing breast milk.

WHERE REQUIRED

- **New Buildings** - Must have one lactation room.
- **Building Expansions** - Major building expansions should include a lactation room unless it is determined that the existing facility has a room that can be designated or converted as part of the project scope.
- **Renovations** - Renovation projects are defined as those projects involving the alteration of a portion of an existing building. Renovations range from simple aesthetic improvements to complex physical reconfigurations and systems replacement. Due to the potential range of existing conditions – and the ability of a renovation project to address such conditions – it is incumbent that each renovation project undergoes an evaluation early in the design process to outline the scope of compliance which can be achieved.

DESIGN CRITERIA

- The room shall be fully ADA accessible.
- It shall be a private room, free from intrusion of co-workers, students, the public, etc. This shall be achieved through:
 - SCHLAGE CO-200 Series (code access) on the outside entrance of the room.
 - Lock from the inside of the nursing mother's room to be able to lock it from inside.
 - Occupation signage on the outside of the room to indicate if the room is in use or not.
- It shall be located in a safe area accessible to all. It should not be located in areas that would not be suitable for the preparation and storage of food.
- A flat surface or table (not the floor).
- A place to sit (not the floor).
- A sink with hot and cold running water
- A refrigerator
- Access to electricity
- When possible, the design should provide:
 - Soft and/or natural lighting
 - Calming décor

SIGNAGE

The room shall be designated as “Lactation Room” with braille and the international symbol of accessibility.

12. CUSTODIAL PLANNING AND DESIGN

Custodial Services are inherent to the operations of buildings and proper service areas must be considered with all other areas during the programming and planning stages of each building.

Universally accepted standards have yet to be set for custodial closets and storerooms. Certain criteria however, for size, shape, location, and special appurtenances, have been developed which are compatible with present cleaning procedures and today's cleaning equipment.

Comprehensive custodian operations encompass four major areas:

- Custodial Closets
- Custodian Storage Areas
- Recycling and Solid Waste Disposal Systems
- Vertical transportation of Custodial equipment

CUSTODIAN CLOSETS

The custodial closets should be planned to function primarily as the workrooms of men and women responsible for cleaning the interior surfaces of the building.

CO-LOCATION OF UTILITIES NOT ALLOWED: Telephone switching gear, elevator controls, electric panels water heaters, pipe chases or other service functions are not compatible with custodian operations, and should not be located inside custodian closets. Openings to pipe chases or mechanical equipment areas should also not be located inside custodian closets.

Northern Arizona University has developed the following criteria for custodian closets:

- Size should be a minimum of 92 square feet, with an eight foot minimum width.
- Recessed light fixtures (to allow for clearance of long broom and mop handles) providing 75 foot candles of light.
- Adequate ventilation.
- Pegs for storage of rotary brushes.
- Hangers for wet mops over the sink.
- Hangers and wall space for dust mops and brooms.
- Hard surface walls impervious to water. Floors of sealed concrete or epoxy flooring.
- Shelves in closet to accommodate supplies in case lots, and to allow for storage of liquids in original 5 or 6 gallon containers. Additional shelving (minimum 11 inches deep) shall be mounted at five feet high to accommodate light containers and provide clearance for machines storage.
- A 36 inches wide door that swings out, not into the room.

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- Reinforced hot and cold water outlets shall be provided with institutional grade hardware and shall be mounted not less than 24 inches above a floor type basin. Basin curb should be 8 inches minimum above the floor.
- A minimum of 5feet x 2 feet open area to allow for the vacuum unit storage.
- A grounded 20 Amp. Duplex outlet in open wall space, not behind shelves, for recharging battery operated equipment. A minimum of three GFI duplex electrical outlets shall be provided.
- Floor drains for the closet, all floors sloped to drain at a minimum $\frac{1}{4}$ inch per foot to the drain.

Location of custodian closets is very important. They should be centrally located with multiple closets as needed so that no area in a building is more than 150 feet in walking distance from a “wet” closet. Each closet should not serve in excess of 15,000 square feet.

Buildings should have custodian closets on every floor. Good locations for secondary custodian closets are:

- Close to elevators
- Close to main pedestrian areas
- Between two restrooms

It is considered poor planning to locate a custodian closet:

- At the dead end of a corridor. A situation such as this results in many unnecessary steps for the custodian.
- On a stair landing. A stair-landing closet would cause the custodian to always carry utensils and equipment up and down stairs.
- Inside another room (unless that closet serves only that room).
- Under stairs. Low ceilings and narrow dimensions are hard to ventilate.
- In narrow spaces. The custodian must move his equipment into the hall to utilize a narrow room. Square shaped closets are most efficient.

VERTICAL TRANSPORTATION

- There should be an elevator in every multi-storied building.
- The elevator should land on every floor including the basement.
- The elevator should be available to custodian and maintenance personnel.

CUSTODIAL STORAGE ROOMS

- Every large building should have a storeroom for custodian equipment, bulk supplies and custodian lockers. Buildings larger than 150,000 sq.ft. should contain two such rooms. Storage areas should be designed specifically for custodian storage, not for dual usage. Planning should be done in consultation with those who will be responsible for maintaining the building.

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- Locking cabinets should be provided for supplies.
- Dock or elevator facilities must be provided.
- Doors should be no less than 36 inches wide and open out. Storage areas should contain a minimum of 144 square feet. 12 feet x 12 feet are good dimensions.

RECYCLING AND SOLID WASTE DISPOSAL SYSTEMS

Northern Arizona University Maintenance is responsible for disposal of the solid waste collected by custodial staff. Custodians throw all of the material into a co-mingled dumpster for physical removal by truck and separation by hand for reclamation and disposal. As a matter of practice, recycling is collected separately from wet waste by the custodians, but the disposal is by the same method. No special waste management rooms or areas are required for gathering or sorting materials.

The design of areas adjacent to the source of recyclable waste generation shall include additional space for collection of recyclable materials as follows:

- Copy Rooms: Paper from copy rooms: 24 inches deep x 22 inches wide minimum
- Common Areas: Newspaper collection bins: 24 inches deep x 22 inches wide minimum
- Vending Areas: Aluminum collection bins: 22 inches deep x 12 inches wide minimum
- Restrooms, break rooms, lounges, and vending areas: Wet waste collection bins: 24 inches deep x 22 inches wide minimum

SUMMARY

Proper custodian closets carefully planned and sized storage rooms or custodial supplies, and consideration of solid waste and recyclables collection and disposal requirements are prime ingredients in any efficient housekeeping program.

13. CLASSROOM AND OFFICE DESIGN GUIDELINES

This section is divided into the following areas:

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Overview

The intention of the *Classroom and Office Design Guidelines* is to regard these spaces more judiciously, to ensure that new construction and renovation is planned realistically, efficiently, carefully and conservatively. Promoting optimum use and conservation of these spaces in existing and renovated buildings is imperative to the overall mission of Northern Arizona University. These guidelines are intended to help create a dialog during the early planning process and assist in determining the most important criteria that should be addressed during classroom and office design. It is also important for these guidelines to remain flexible for the needs of Northern Arizona University in the future.

There are three types of guidelines that impact the programming, design, and construction/renovation of a classroom or office: *NAU Design Guidelines*, *Space Management Guidelines*, and *NAU Technical Standards*. The *NAU Classroom & Office Design Guidelines* are overarching principles to create functional, flexible and aesthetically pleasing classrooms and spaces. The *NAU Technical Standards* are a roadmap to planning, designing and constructing NAU facilities. The *NAU Classroom & Office Design Guidelines* are part of the *NAU Design Guidelines*.

Design Review and Approval

1. Approvals

All classroom and office designs must be approved in writing by Northern Arizona University's Planning, Design and Construction group (PDC). Reviews by PDC will be required at each step of the planning, design, and construction process (conceptual design, schematic design, design development, construction documents, and any value engineering or changes). A project must be initiated in order to seek approval for designs.

If classroom or office designs change the square footage of the space, what the room is used for, or it changes who is occupying the room, prior approval from the Space Management Committee is required. A "Space Allocation Request" form is available online at http://www4.nau.edu/vpadmin/space_management.html. Approval from the committee must be given before renovation or construction can begin.

1.1. Discrepancies

Any discrepancies between these *Classroom Design Guidelines* and the *NAU Technical Standards* or the *ADA Standards for Accessible Design*, shall be resolved with NAU PDC & Facility Services.

Classroom Space Design

1. Classroom Space Utilization

University classrooms are rooms used for scheduled classes that are not limited in their use to a specific subject or discipline. University classrooms include general purpose classrooms, lecture halls, seminar rooms, auditoriums, and computer classrooms. In the calculation of space utilization, classroom space is defined as the square footage within the walls including the seating area, the circulation space, any instructor/demonstration area, and storage/service area associated with the room.

Utilization of classrooms is defined by the student station size, room use in terms of hours per week, and station/seat occupancy rate. Spaces can vary by institution or campus, depending upon the existing or desired mix of classroom capacities, size of the institution, hours of use and types of programs. The station/seat space factor includes an allowance for students, instructor, internal circulation and 5% service. It can vary by room subtypes and type of seating, and depends upon the desired mix of room capacities. Architects should take into consideration the geometry of the room, since form can also impact the capacity of the room rendering a less efficient space.

2. Pedagogy and the Learning Environment

Technological advancement and accessibility of mediation at a lower cost, and subsequent changes in pedagogy all place demands on the physical space. There is still a need for lecture type rooms where seat count can be maximized by the nature of the learning method (instructor in front with presentation area, rows of seats). Yet, there is also an increasing need for rooms that can accommodate a variety of teaching methods, quick reconfiguration, and technology.

Recent programming exercises for new buildings and subsequent feedback on the use of the current classrooms have rendered the following valuable information:

- Faculty demand for flexible space in classrooms
- Faculty and student demand for collaborative work spaces
- Faculty and student demand for technology-mediated classrooms
- Ever increasing demand for special needs student furnishings.

3. Room Definitions – Space Standards

Different pedagogical techniques require different types of learning spaces. NAU has defined six basic classroom types that are prevalent on its campuses. The recommended square footage requirements reflect the pedagogical style, and take into consideration the diversity of cultural values regarding personal space.

3.1. Classroom: Traditional, Loose Seating

Traditional classrooms are our most common learning spaces. They have movable furniture, and are very flexible. Furniture can be rearranged to allow for lecture, seminar, group work, or anything else the instructor might require.

- Traditional classrooms contain 25 to 60 non-fixed seats.
- Flat floors are required.
- The first row of student seating should be a minimum of 1.5 times the width of the projection screen from the front of the room. Example: projection screen size 90”H x 120”W, first row of student seating would be 15’-0” from front of room. If not possible to maintain formula outcome, allow a minimum of 9 feet from the front of the room to the first row of seats.
- The instructor’s station will require 10 square feet.
- 20 - 22 square feet per student accommodates some collaborative functions.
- *10% of seats must accommodate a left handed student and should have a variety of locations available throughout the space*

3.2. Classroom: Traditional/Collaborative

Collaborative classrooms are a subset of traditional classrooms in which the teaching methods require group work. The furniture is movable and flexible.

- Traditional/collaborative classrooms contain 25 - 40 non-fixed seats.
- Flat floors are required.
- 25 - 30 square feet per student accommodates flexibility in furniture arrangement to meet most types of pedagogy.
- Larger, flat work surfaces (sometimes achieved by pushing desks together)
- *10% of seats must accommodate a left handed student and should have a variety of locations available throughout the space*

3.3. Classroom: Seminar

Seminar rooms generally accommodate smaller numbers of students seated in any number of seating configurations.

- Seminar rooms contain 19 - 25 seats.
- A face-to-face seating arrangement is possible.
- The instructor sometimes sits with students.
- 25 - 30 square feet per student accommodates this type of pedagogy.
- 10% of seats must accommodate a left handed student and should have a variety of locations available throughout the space.

3.4. Lecture Halls

Lecture halls are larger tiered classrooms, usually with either fixed seating or fixed tables and movable chairs.

- Lecture Halls contain 50 - 150 seats
- Tiered floors (aisles may be sloped but seating areas must be tiered)
- The dimensions of the seating tier or tray must easily accommodate movement behind seats
- Theater-style seating with attached tablets (preferably retractable) or fixed tables with free-standing chairs.
- A curved configuration is preferred where possible
- 18 - 20 square feet per student overall, but at least 10.5 square feet per students for the seating area, allows for ample circulation amongst the seats.
- The square feet per student ratio is proportionate to the space associated with the podium/front of room, and amount of circulation space required. If the function of the room requires a large stage area or specific circulation pattern, the overall square feet per student may be over guideline.
- *10% of seats must accommodate a left handed student and should have a variety of locations available throughout the space.*

3.5. Auditoriums

- Auditoriums contain more than 150 seats, with a practical upper limit of...~300
- Aisles may be sloped but all seating areas must be tiered
- Theater-style seating with attached tablets (preferably retractable) are allowed
- A curved configuration is optimum
- 18 square feet per student overall, but at least 6.5 square feet per student in the seating area, allows for ample circulation amongst the seats.
- The square feet per student ratio is proportionate to the space associated with the podium/front of room, and amount of circulation space required. If the function of the room requires a large stage area or specific circulation pattern, the overall square feet per student may be over guideline.
- *10% of seats must accommodate a left handed student and should have a variety of locations available throughout the space.*

3.6. Computer Classroom

Computer classrooms are specific to the prescribed instruction mode.

- 32 square feet per student accommodates the larger station sizes for equipment and writing space, and generous aisle widths to allow unobstructed instructor movement behind seated students.
- Design for future, and current cabling and electrical requirements.

- Design space for alternative technology set ups:
 - Desktop computer provided where furniture is typically fixed and technology secured, software is necessary.
 - BYO (bring your own) technology where the furniture is flexible and the room supports mobile technology.
- Rooms may need additional HVAC, because of the added heat from numerous machines. This can be reduced if using energy saving designs and software settings.
- *10% of seats must accommodate a left handed student and should have a variety of locations available throughout the space.*

3.7. Vocational & Laboratory Spaces

Reference Section #13 of the *NAU Design Guidelines* for design specifications for this space type.

Additional space allocation information and room definitions are available in the *Space Management Guidelines*.

4. General Application

4.1. Locations

- Classrooms should be located no more than one floor up or one floor down from the main entrance to the building.
- In some urban buildings, classrooms may be placed on upper floors, but the building design shall provide for ease of access and for convenient vertical mobility of students. In such cases, elevator studies must be provided to satisfy movement requirements especially between class changes.
- Classrooms should be located away from noise generating areas such as mechanical rooms, elevators, vending machines, and restrooms. If physical separation is not feasible, increased acoustical treatments may be needed.

4.2. Hallways/Corridors

- Hallways should not only be part of the building design and aesthetics, but should also be viewed as an extension of the learning environment. They should always be as visually interesting as possible.
- Egress hallways should be sized to accommodate at least double the loads identified in code due to the large number of students leaving and entering the rooms, and gathering space should be provided in the hallways for in between classes.
- Hallways should be viewed as an opportunity to improve classroom acoustics.
- Non-recessed doors that open into the hallways are to be avoided.
- Hallways should also be seen as opportunities to incorporate built in seating for waiting space outside of large auditoriums or lecture halls.

4.3. Informal Interaction Spaces

The design of adjunct teaching/learning space for small or one-on-one collaborative and instructional interaction is encouraged. Small spaces can be incorporated within lobbies, hallways or any other architectural opportunities that might be present.

- Touch down space: these can be café height surfaces with a public access computer to briefly check email or to surf the web. Typically they are not designed to encourage the user to stay for any extended period of time. This can be done by not providing a chair or by providing a high stool.
- Space for quiet study: Table space to spread out work, wireless and /or wired internet connection, plentiful outlets for power, comfortable ergonomic furniture, quiet surroundings, appropriate ambient temperature, natural light when possible, and location should be separated from busy areas but not “cloistered”, access to refreshments.
- Group study area: Moveable furniture including tables, white board, wireless and/or wired internet connection, plentiful outlets for power, comfortable, ergonomic furniture, appropriately quiet (no loud HVAC or other environmental noises,) appropriate ambient temperature, natural light when possible, location should be separated from busy areas but not “cloistered,” access to refreshments. There is a greater need for trash collection in these areas with the increased accessibility to food and beverage.
- Informal meeting area - includes areas outside of classrooms where students can continue classroom conversations with faculty: Some degree of privacy for conversations, white board, natural light when possible, comfortable, ergonomic furniture, appropriate ambient temperature. Ideally these areas should also have power outlets, wireless internet, and either projectors or large display screens to plug into.

4.4. ADA

- Design all classrooms to comply with ADA Standards for Accessible Design. Any discrepancy between the ADA Standards and this document shall be resolved in design review.
- Provide accessible wheel chair seating positions distributed in each room according to ADA Standards.

4.5. Universal Design Considerations

4.5.1. Principle One: Equitable Use

The design is useful and marketable to people with diverse abilities.

- Provide the same means of use for all users: identical whenever possible, equivalent when not.
- Avoid segregating or stigmatizing any users.
- Provisions for privacy, security, and safety should be equally available to all users.
- Make the design appealing to all users.

4.5.2. Principle Two: Flexibility in Use

The design accommodates a wide range of individual preferences and abilities.

- Provide choice in methods of use.
- Accommodate right- or left-handed access and use.
- Facilitate the user's accuracy and precision.
- Provide adaptability to the user's pace.

4.5.3. Principle Three: Simple and Intuitive Use

Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

- Eliminate unnecessary complexity.
- Consistency from one room to the next.
- Be consistent with user expectations and intuition.
- Accommodate a wide range of literacy and language skills.
- Arrange information consistent with its importance.
- Provide effective prompting and feedback during and after task completion.

4.5.4. Principle Four: Perceptible Information

The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

- Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information.
- Provide adequate contrast between essential information and its surroundings.
- Maximize "legibility" of essential information.
- Differentiate elements in ways that can be described (i.e., make it easy to give instructions or directions).

4.5.5. Principle Five: Tolerance for Error

The design minimizes hazards and the adverse consequences of accidental or unintended actions.

- Arrange elements to minimize hazards and errors: most used elements, most accessible; hazardous elements eliminated, isolated, or shielded.
- Provide warnings of hazards and errors.
- Provide fail safe features.
- Discourage unconscious action in tasks that require vigilance.

4.5.6. Principle Six: Low Physical Effort

The design can be used efficiently and comfortably, and with a minimum of fatigue.

- Allow user to maintain a neutral body position.
- Use reasonable operating forces.
- Minimize repetitive actions.
- Minimize sustained physical effort.

4.5.7. Principle Seven: Size and Space for Approach and Use

Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.

- Provide a clear line of sight to important elements for any seated or standing user.
- Make reach to all components comfortable for any seated or standing user.
- Accommodate variations in hand and grip size.
- Provide adequate space for the use of assistive devices or personal assistance.

4.6. Applicable Procurement Requirements

Classroom design and product specification must conform to procurement requirements set by the NAU Purchasing Department.

4.7. Classroom Storage

There is often a need for a small storage room for classroom supplies that is separate from the audio/visual storage. It should be approximately 100 square feet to store board supplies, movable lecterns and additional chairs. This space requires lighting, a lockable door, conditioned air, power, and a few shelving units for small supplies. It should have no window and needs to be equipped with a storeroom function lock. Classroom storage should be accessible from outside the classroom.

5. Classroom Interiors

5.1. Design

Classrooms should be developed and designed from the “inside out”. The following items should be considered when creating a new classroom:

- The optimum orientation and shape of the classroom should be determined by the primary expected teaching style, the capacity of the room, and the level of mediation.
- Designing for the flexibility of room use is strongly encouraged. The more square footage allotted to each student, the greater the opportunity for flexibility.
- The total square footage of each room is to be based on the type of classroom, the specific capacity and the type of seating, as specified in Room Definitions.

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- Classrooms with a capacity of 49 or less are to be as square as possible to allow for greater flexibility in furniture arrangement, and better sight lines.
- Generally, classrooms should be sized in a 2:3 or 3:4 width to length ratio. Long, narrow, “railcar”-style rooms are not acceptable.
- Lecture halls with capacities above 60 require tiered seating. A curved configuration improves visibility and student/instructor connectivity.
- Every seat must have an unobstructed view of the teaching wall. No columns or other visual obstructions are allowed in Northern Arizona University classrooms.
- In classrooms where the instructor’s workstation is movable, adequate space must be provided to allow the workstation to be positioned at least three feet away from the teaching wall. In classrooms with fixed tables and/or fixed seating, the front edge of the instructor’s workstation must be at least six feet from the front row.
- Thoughtful placement of utilities (lectern umbilical cord, power outlets, room controls, network jacks, etc.) based on anticipated use and room flow patterns may be in the floor, on the walls, or mounted to fixed furniture. Should be designed with consideration to possible spills, dirt, tripping hazards.

5.2. Door/Room Security

5.2.1. Door Hardware

All classroom doors shall conform to Division #8 of the *NAU Technical Standards*. Additionally classroom doors should have the following:

- Concave wall bumpers installed at an appropriate height to assure wall protection.
- Door silencers to muffle the noise of the door closing.
- Card readers when applicable(see NAU Building Access Services specifications)
- ADA accessible doors and hardware as specified in *ADA Standards for Accessible Design*.

5.2.2. Doors

- Doors should be located at the back of the classroom to ensure that students who are entering or exiting the space will not disrupt instruction. Exceptions include large tiered classrooms or auditoriums, since those kinds of spaces can require multiple doors. In rooms that require two or more egress points, the doors should be located as far from the presentation area as possible while still meeting current building codes.
- Each door leaf to be a minimum of 36” wide, including those used in pairs at double doors.
- No strike mullion on double doors. Where exit, double doors require a strike mullion the mullion must have the ability to be removed.
- Door opening force, hardware, width, thresholds and maneuvering clearances should comply with ADA Standards.

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- Occupancy within the classroom should be clearly (but discretely) visible from the hallway. Any viewing device must be positioned to meet ADA standards. Door shall be equipped with a vision panel made of shatterproof glass and tinted to reduce light transmission. The area of the glass shall not exceed 100 square inches and should be double-paned with acoustically rated seals. Doors without vision panels shall have either a viewer peep hole installed to provide a view into the room to check activity or have a separate sidelight.

5.3. Windows

Daylight is an important part of most learning environments. Windows should be included in classrooms whenever possible. Windows must comply with the “Glass and Glazing” specifications in Division #8 of the *NAU Technical Standards*.

- For window covering specifications reference Division #12 of the *Technical Standards, section 12500*.
- Interior windows should also be considered during the design phase of learning spaces in order to provide a sense of openness.

5.4. Flooring

- When selecting flooring finishes; refer to the specifications in Division #9 of the NAU Technical Standards.
- If carpet cannot be installed underneath fixed seating, all aisles and other open areas must be carpeted.
- All aisle risers must be of contrasting color to the remaining floor to highlight level change.
- Aisle riser nosings are preferred to be vinyl, metal or rubber.

5.5. Wall and Ceilings

5.5.1. Walls

- Refer to the specifications in Division #9 of the NAU Technical Standards.
- Internal classroom walls shall run deck-to-deck, with a Sound Transmission Coefficient (STC) rating of 50 minimum.
- Folding or moveable walls must meet the STC rating of 50 and should be specified for unique use only.
- Walls in lecture halls should be designed to provide the optimum acoustical environment. (See Acoustical Section 9)

5.5.2. Walls Protection

- Apply chair rail on the rear and side walls of university classrooms that contain movable student furniture.
- Chair rail material should be wide enough to work with tables and chairs of varying proportions and must be mounted at a height that will prevent damage to wall

surfaces. Typically, the chair-rail will be 6" - 10" wide and the bottom edge will start approximately twenty-five inches above the finished floor. Approved rails include Inpro Corp #1800 Silhouette 8" wall guard or approved equal rails shall match the design of the room.

- Outside wall corners (such as entry recesses) shall receive corner guards 4'-0" A.F.F. applied so that students cannot work them loose.

5.5.3. Ceilings

- Refer to the specifications in Division #9 of the NAU Technical Standards.
- To accommodate classroom lighting and technology requirements, the ceiling height of all classrooms should be no less than twelve feet above the finished floor.
- In large sloped or tiered classrooms, the ceiling height is directly related to the distance from the front of the room to the last row of seats. Ceilings in lecture halls should be at least nine feet high at the rear, and the ceiling height at the front of the room must accommodate the appropriate screen size.
- The ceiling should act as a sound mirror, reflecting sound downward to blend with direct sound.
- Access for the maintenance of technology, power, etc. must be included where applicable. (Consult the Electrical and IT departments for current specifications.) Running wide low-voltage cable conduits inside the drywall with regularly spaced access points can assist in rewiring.

5.6. Vertical Writing Surfaces

- For specifications for vertical writing surfaces reference Division #10 of the NAU Technical Standards.
- Multiple boards may be required depending on programming.
- Boards should be located on at least two different walls. A board must always be installed on the front teaching wall; the other wall/walls should be selected as appropriate to the layout of the room.

NOTE: *Single boards may not be longer than 12 feet (accessibility to classrooms through doors and elevators)*

5.7. Signage

5.7.1. Room Identification Sign

Each room will have a standard room identification sign mounted near the door on the lockset side (exterior of room), mounted at a height as indicated by The ADA Standards for Accessible Design. Braille lettering is required on the sign to identify the room as well. Standard room ID sign is a modular sign produced by NAU Sign Shop consisting of (3) 3" x 9" panels and (1) 9" x 11" clear plastic page holder. For signage guidelines reference Section #10

of the NAU Design Guidelines. Signage needs to be legible from a distance and while moving in the traffic flow. It should be of high contrast and self-explanatory. For Room Numbering guidelines reference Section #4 of the NAU Design Guidelines.

5.7.2. Bulletin Boards

- Provide at least one 48" x 48" bulletin board in each room.
- Location and finishes of the bulletin boards will be determined at design.
- The department reserves the right to review all posting and remove anything they deem inappropriate; such as postings for other universities, non-NAU sponsored events & for profit business advertising.

5.7.3. Maximum Occupancy Sign

Provide maximum occupancy sign to be mounted in rear of room at a height high enough to discourage students from removing it. Size to be 8" x 11" minimum.

5.8. Colors/Finishes

- Accent walls are desired. Avoid using accent color on walls that might reflect onto projection screen.
- Specify highly durable finishes that are easy to maintain.
- Use of approved "green" products in all applications is required (See NAU Purchasing Department specifications)

5.9. Reflectance Values

The Engineering Society of North America recommends the following reflectance values for finish materials.

- Ceilings - 80% or higher
- Non-accent walls - between 50% and 70%
- Floors - between 20% and 40%

Reflectance values of paints, laminate and other finish materials should be selected to enhance ambient illumination and the illumination at the instructor's and student's work areas.

Recommended value - between 40% and 60%.

5.10. Display of US Flag, US Constitution, and US Bill of Rights

In accordance with ARS HB2583, "All classrooms in the State of Arizona are to be equipped with a United States flag and copies of the Constitution of the United States and the Bill of Rights."

United States flags must be manufactured in the United States and be at least two feet by three feet. Hardware must be provided to appropriately display the United States flag. Flags in classrooms shall be displayed in accordance with Title 4 of the United States Code. The legible copy of the Constitution of the United States and the Bill of Rights must be manufactured in the United States, and shall be displayed adjacent

to the flag.

5.10.1. Flag Location

- Flags should be hung in the front of each room in a holder attached directly to wall.
- The flag should not interfere with the screen, the writing surface, or any other classroom activity.

5.10.2. Constitution/Bill of Rights

- The Constitution and the Bill of Rights are two separate documents, which are produced in-house by NAU.
- Install the documents next to the writing surface in the front of each room, behind the instructor, adjacent to the wall mount flag or as appropriate for the layout of the room.

6. Furniture

Consult the NAU PD&C Interiors Department for all current furnishing specifications.

6.1. Tables/Work Surfaces

6.1.1. Design Standard

- Tables can be for 1, 2, or 3 students allowing a minimum of 30" per student. The number of students per table is flexible and is determined by the type of classroom and the configuration of the classroom.
- To allow for note taking and reference materials the minimum work surface area should be 3.75 square feet per occupant.
- Depths of tables can vary from 18"-30" based on room layout.
- Modesty panels are allowed and encouraged when applicable.
- Fixed tables with cantilevered pivot arm seats are not allowed (because they are wheelchair inaccessible). If fixed tables are installed, provide loose seating with casters.
- Furniture must be able to interface with technology (i.e. pathway for power/data), based on PD&C and Electrical department specifications.
- When tablet arms are specified the following criteria must be met:
- Provided tablet size should be equal to or larger than 12 inch x 15 inch (1.25 square feet).
- 10% - 15% of the tablet work surfaces should have a left-handed orientation or be left-right reversible.

6.1.2. Construction/Fabrication

- Laminated work surfaces shall be constructed of plastic laminate applied to MDF (Medium-Density Fiberboard) or hardwood plywood. Tops shall have a non-glare, medium tone surface to reduce eye strain.
- The legs of fixed tables should not block the student's knee space within the 30-inch work space allotment. Table legs should not impede configurations that allow additional students to work collaboratively.
- Table edge to be a heavy-duty extremely durable material.
- Tables to withstand loading of 300 lbs. of applied load (people sitting on table) per linear foot.
- Rounded corners preferred over sharp 90 degree corners

6.1.3. Clearances

Widths between aisles of tables to be 36" or greater depending on room layout and number of students serviced per aisle.

6.1.4. ADA

In cases where fixed tables and loose chairs are used or where fixed seating with tablet-arms is used, adjustable-height ADA tables must be provided according to *ADA Accessibility Standards*. Insure that 72" clearance behind table is maintained for access.

6.1.5. Replacement Availability/Warranty

- Work surfaces/Tables shall be procured from "name brand manufacturers that demonstrate proven track records in the marketplace, and maintain stock levels that insure replacement can be made without backorder delays.
- Provide written warranty for all proposed furniture. NAU prefers 10 year or longer warranty on all furniture items.

6.2. Seating

Seating should be selected that will meet minimum passive ergonomic standards and still satisfy the requirements of Uniform Building/Fire Codes, durability, functional comfort, appearance/finish, and performance over time. Chairs should accommodate both left and right-handed individuals. Chairs should be comfortable for use by people ranging in size from the 5th percentile (4'-11" tall, approximately 113 lbs.) to the 95th percentile male (6'-2" tall, approximately 246 lbs.).

6.2.1. Design Standard

When selecting seating in order to achieve minimum standards of comfort, aspects such as width of seat, type of lumbar support, appearance, versatility of seating, replacement availability/ease of maintenance and cost should be considered.

6.2.2. Seating Width

- The selection of seating width should be based upon the criteria set forth for the type of seating utilized.
- Seat width comfort will range from 18 to 22 inches for loose seating such as stackers, sled base chairs & chairs with casters (4-leg or star-base).
- Auditorium fixed seat width to be at 24 inches unless restricted by row curve.

6.2.3. Seating Back Support

All seating shall have proper lumbar support.

6.2.4. Seating Clearances

To ensure adequate circulation through the learning spaces, minimum clearances must be maintained as referenced in Room Definitions and Space Standard of this Classroom & Office Design section.

6.2.5. Appearance

- The appearance shall be coordinated with the interior of the classroom and meet the acoustical requirements for the space. Light colors are discouraged.
- Upholstered seating is recommended in large auditoriums or lecture halls only where reverberation of sound is a problem.
- The construction and materials should be selected so that their color and surface are consistent with the other furnishing within the classroom.
- For material specifications reference Division #12 of the *NAU Technical Standards*.

6.2.6. Replacement Availability/Ease of Maintenance and Warranty

- Chairs shall be procured from name brand manufacturers that demonstrate proven track records in the marketplace, and maintain stock levels that insure replacement can be made without untimely backorder delays.
- Chairs shall be selected that facilitate easy cleaning of the floor surface, and require minimum maintenance of the seat covering (if applicable).
- Provide written warranty for all proposed furniture. NAU prefers 10 years or longer warranty on all furniture items.
- When casters are specified on seating, insure that the casters are the correct type for the floor finish (carpet, VCT, etc.)

6.2.7. Quality

High quality seating shall be purchased to minimize the long term life cycle costs since funding for equipment replacement, repair, and maintenance are becoming increasingly difficult to obtain.

6.2.8. ADA

All ADA accessible seating in classrooms should comply with ADA Standards for Accessible Design. We require that Universal Design be applied when possible.

- In Classrooms with loose tables and chairs, NAU standard prefers at minimum 10% of seats to have height adjustable tables.
- In classrooms or lecture halls with fixed seats with or without tablet arms, minimum required accessible locations to be per 2012 International Building Code.
- In lecture halls with fixed tables and loose seats, the accessible locations are required to have height adjustable tables that coordinate with the fixed tables.

6.2.9. Versatility

- Fixed seating shall be provided in all large lecture halls, and shall be constructed of cast iron or steel frames. Auditorium seating shall have retractable tablet arms.
- Non-fixed lecture seating requires free-standing chairs with casters.
- In lecture rooms where programs will typically exceed 2 hours, padded seats and backs can be selected and passive ergonomic considerations should be made.
- Fixed auditorium seating may require electrical/data outlets, based on programming needs.
- *10% of seats must accommodate a left handed student and should have a variety of locations available throughout the space*

6.3. Computer Workstations

Computer workstations are used for teaching methods which require University-procured computers/laptops. Computer workstations should accommodate computer equipment, plus the necessary space for student materials.

6.3.1. Design Standard

- Allow for a minimum surface area of six and one quarter (6.25) square feet to be provided.
- Furniture selection for computer workstations shall have provisions for securing the equipment and the furniture in the room.
- Computer workstation classrooms shall have provisions for increased ventilation and conditioned air supply due to the increased heat load produced by the computers.
- Provisions to prevent or mitigate electrical fires should be considered for computer workstation equipped classrooms.
- Furniture may be arranged in a row or in collaborative pods.
- ADA tables must be provided according to ADA Standards.
- Computer classroom furniture is an extension of the programming requirement and should conform to the department's needs.

6.4. Instructor Classroom Furniture Accessories

When providing additional equipment, attempts should be made to maintain aesthetic and functional compatibility with the overall decor of the room.

6.4.1. Design Standard

For all rooms: Provide an adjustable height, instructor's lectern, a height adjustable table and a stool.

6.5. ADA Table Mediation

All tables and lecterns must comply with the *ADA Standards for Accessible Design*.

6.6. Miscellaneous Classroom Items

Recycling and trash receptacles are required in all rooms. See NAU Purchasing Guidelines. Containers shall not encroach on circulation path.

6.7. Lighting and Electrical

6.7.1. Lighting Zones

As a rule, all classroom spaces will have lighting organized into a number of zones. These zones can be combined and dimmed to create any number of different lighting scenarios. Classroom lighting should include day lighting, multi-modal lighting, controllability, and optimize energy performance. A room can be zoned based on the amount of day lighting available, with each fixture responding to the amount of light at any time and location. For lighting specifications refer to Division #26 of the *NAU Technical Standards*.

The zones described below are functional zones. There are five functional lighting zones in most classrooms:

- Zone 1 — Main classroom lighting (student seating area) this zone services students and allows them to read and take notes in class. Use multi-directional recessed (lay-in) fixtures that cast a modest amount of light downward (35%) and a larger amount of light toward the ceiling (65%), provides a comfortable overall lighting with relatively high efficiency. Avoid pendant mount fixtures.
- Zone 2 — Instruction area (front of classroom and lectern area). Design whiteboard and demonstration table lighting to provide visibility when the room lights are at full intensity. The foot candles in this area should be consistent with the overall lighting of the room.
- Zone 3 — Non-projection white board (board that is not obscured by a lowered projection screen). Lighting of white boards during concurrent AV presentations allows instructor to write on the board while in projection, without light bleeding over onto the projected image.
- Zone 4 — Projection white board (board that is obscured by a lowered projection screen) Use the same requirements as Zone 3 during non-projection mode.
- Zone 5 — Instructor workstation. The instructor should be able to read notes and use AV equipment with low-light conditions of projection mode

Foot Candle (fc) Guidelines*

	Day Lighting Mode	General Mode/Non-Day Lighting	AV Mode
Student desk	30 fc min 150-200 max	30 f min 70 fc max	10 fc min
Whiteboard	30 fc vertical min	30 fc vertical min	Na
Screen	Na	Na	8 fc vertical allow 8:1 video image with 3000 lumen projector
Walls	10 fc vertical	10 fc vertical	Na

* Based on the “IESNA Lighting Handbook Reference and Application”, Ninth Edition

In larger auditoriums, install a down-light in a location that will provide adequate illumination on the face of the sign language facilitator when the AV mode lighting is in place.

6.7.2. Emergency Lights

Isolate emergency light radiation away from the projection screen.

6.7.3. Color Temperature

The color temperature for all light fixtures should be the same. The color temperature goal is 3200 degree Kelvin. Color temperature range of 3000-3500 degree Kelvin is acceptable as long as all of the fixtures are the same.

6.7.4. Motion Sensors

Motion sensors are preferred in all rooms. When installing motion sensors, be sure to set timer to maximum to avoid light shut off during low-motion activities such as test taking. Motion sensors should also be positioned so that they are not falsely triggered by shifting shadows, bulletin board postings moved by ventilation, etc.

6.8. Electrical

For electrical specifications, including outlets refer to Division 26 of the *NAU Technical Standards*.

6.8.1. Wall Outlets

- Place outlets on walls of the classrooms at 6’ intervals or as necessary to allow for 30% student utilization.
- Wall outlet intervals in the lecture halls are not as critical. (adding occasional data and/or power outlets on the vertical surfaces in tiered halls may be useful, if

power and data are not incorporated into the furniture design) Follow code to determine the appropriate number.

- Install one phone jack, one data port, and one electrical outlet adjacent to the instructor's workstation (Figure 1).
- Install one 2-gang AV wall box (min 2 W' D) at least 18 inches above the finished floor.
- Install two 1"- 4" conduit stub-outs above the ceiling (if the existing wall is hollow, conduit may not be necessary).

6.8.2. Ceiling Outlets

- Install one AC power quad outlet attached by flexible conduit to a J-box located above the suspended ceiling to allow for the future installation of a data projector, wireless access point, wireless video receiver, etc. This quad should be sited 12'-15' from the screen.
- Install one single-gang data outlet above the ceiling 12'-15' from the screen.

Provide 120V power capped at a J-box located above the suspended ceiling to allow for the future installation of a low voltage motorized screen controller.

6.8.3. Floor Outlets

- Provide floor outlets for every classroom to ensure optimum flexibility.
- Floor boxes are to accommodate AV, AC power, data.
- The number of floor outlets is determined by the size of the room, the capacity, and the function. Identify the likely furniture layout before placing outlets.

6.9. HVAC & Fire Prevention

6.9.1. Diffuser Location

Diffusers should be located as to avoid any movement of the screens which would be caused by air flow.

6.9.2. Location of Above-Ceiling Mechanical Equipment

Mechanical equipment that requires service shall not be located within classrooms.

6.9.3. Noise

Excessive background noise or reverberation in classrooms interferes with speech communication and thus presents an acoustical barrier to learning. In all phases of the classroom design and construction process, careful attention must be paid to acoustics. Locate all mechanical equipment as far from the classroom as possible. If adjacency is unavoidable, provide for sound attenuation methods at doors, light fixtures, and all other ceiling or wall breaches. System components (fans, ductwork & diffusers) shall be selected to meet sound criteria of NC20 to NC25.

The “ANSI/ASA S12.60-2010 American National Standard Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools (Parts 1 and 2)” sets specific criteria for maximum background noise and reverberation time in classrooms. Consistent with long-standing recommendations for good practice in educational settings, the standard set specific criteria for maximum background noise (35 decibels) and reverberation time (0.6 to 0.7 seconds) for unoccupied classrooms.

6.9.4. Fire Strobes

Locate fire strobes away from projection screen to prevent sightline obstructions when screen is extended.

6.10. Acoustics

When classrooms are located within close proximity to functions that generate significant noise levels, higher STC ratings and special wall-construction details must be included for all interior walls, elevated slabs, floors and exterior walls (including doors and windows). Provide for sound attenuation to contain noise generated from adjacent locations and from both above and below the classroom location.

- The review of acoustical requirements for classrooms by an acoustical consultant is recommended whenever possible.
- Minimum NC ratings: 0-59 seats: NC30-35 or less; 60 to 149 seats: NC 25-30 or less; 150+ seats: NC20-25 or less.
- In all cases, walls in classrooms should have a minimum sound transmission class (STC) of 50 as recommended: ANSI S1.4-1983 (R 2006).
- Individual equipment such as fans, ductwork and diffusers shall have ratings not exceeding NC 25 throughout the load range as recommended: ANSI S12.60-2002.

6.11. Mediation

NAU classroom design continues to evolve as technology enhances teaching and as learning capabilities become available. Aside from actually installing technology in classrooms, NAU strives to ensure proper infrastructure is provided for classrooms in order to service upcoming technologies without incurring future construction costs. NAU specifies room layout, power locations, data connections, and audiovisual infrastructure room layout. This document identifies general elements NAU considers when planning an educational space. NAU recommends providing Basic Mediation (laptop projection) in any classroom.

Recommended Technology Enhanced Formal Learning Spaces

Every classroom at Northern Arizona University should have a minimum configuration for technology enhancement in order to promote and support pedagogical and technological innovations that increase student engagement, learning, and success. The following recommended standards not only

build upon the current University strategic goals, but look into the future as NAU continues to provide outstanding undergraduate, residential graduate, professional programs, and sophisticated methods of distance delivery.

The following two tiers of technology for classrooms and selected enhancements, adopted as classroom standards, will also assist faculty with their expectations of technology as they consider the learning environment in which they teach, and will allow them to intuitively use the technology provided regardless in which building or department they teach.

All configurations included here are considered to be bare minimums, and departments may choose to have additional hardware available in individual classrooms. The listed technology costs are approximate, and cover equipment costs only, without regard to installation, infrastructure, electrical, or additional furniture required in the classroom.

1. Equipment

Consistency of equipment across rooms is very important. At a minimum, colleges should standardize on typical equipment set for ease of training, repair and replacement, and movement between rooms.

1.1. Tier 1 - Minimum Technology Enhanced Configuration

Approximate Technology Cost: \$x,xxx.xx

- A basic push button control system that adheres to ADA accessibility standards
- A lockable lectern that can be adjusted with pneumatic or electronic risers for accessibility. EuroDesigns Lectern MPD48EAR-NAU-CPHR is preferred.
- 3200+ Lumen Ceiling Mounted Projector (or ~60" HDTV 1080p resolution)
- Podium or Desk rack mounted computer with a 17 inch flat panel display, minimum 4 GB RAM and Core i5 or better processor, Windows 7 or MacOS X (where both platforms are in common use, a dual-boot Mac Mini is a practical option. At NAU, this includes A&L, SBS, and Comm.).
- Laptop connection with Ethernet, VGA (or better, HDMI) output, and stereo sound output
- RCA Composite Audio-Video Connection, (Component Video or HDMI for higher quality)
- CD/DVD player (may be part of the computer installation)
- Pull Down or Powered Screen
- Tiered (Staged) Lighting (dimmable) around the front projection screen
- Small 20 watt amplifier and speaker system
- Portable microphone for instructor in classrooms with seating for 40 or more students
- Stereo mini-plug for iPods and other MP3 players
- Dedicated A/C 15amp power for Projector and Instructor Podium/Desk
- Podium task lamp to illuminate presenter materials (optional)

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- iClicker receiver (optional - people who use clickers tend to carry their own)
- Webcam (either integrated or external)
- USB Headset Microphone (for higher audio quality for Camtasia recordings, Skype and Collaborate sessions, etc.)
- Audio System (based on room size)
- Wireless connection for students
- Data on wall or in floor boxes

This configuration of technology includes integrated room control. There will be networking technology for at least the podium computer and Laptop, and standard NAU wifi for student connectivity.

1.2. Tier 2 – Standard Technology Enhanced Classroom Configuration

Approximate Technology Cost: \$x,xxx.xx

Everything in Tier 1 and the following:

- Powered Projection Screen
- Upgraded to a professionally programmed touch screen control system (See example of [Crestron touch screen used in media classroom at SUNY](#))
- Upgraded 4500+ Lumen Projector with power zoom
- Multiple projectors, projection screens, or LCD displays for seminar and auditorium classrooms may be useful; ability to display different content or the same content on each screen
- Sound reinforcement to expand reach of instructor voice in large rooms

Enhancements that will be installed in selected classrooms on an as-needed and strategic basis

Approximate Technology Cost noted for each item.

- Web Conference room: wireless microphone and podium webcam for use with Bb Collaborate (Secondary camera located in the front of the classroom)
- Video in smaller rooms - two or three plasma or LCD 50" to 80" monitors (quieter than projectors, no bulb replacement costs)
- Wireless projection (i.e. Apple TV, Class-spot or Chromecast – allows faculty and students to display from iPads to room display using airplay technology.
- Lecture capture appliance or cloud based such as Echo 360 (appliance) or Tegrity (cloud)
- An interactive whiteboard system, such as [eBeam](#), can be used with a normal dry-wipe board to replace the more expensive electronic writing devices used for front projection, such as a SmartBoard or Sympodium
- Document/Pad camera (as price drops, these might be moved to Tier 1)

Mobile Computer Labs (Technology Carts) can be used as an alternative to an instructional computer lab when computers are not needed every day. A cart that includes a network printer, wireless access point, and stored laptops that are charged when on the cart, allows the mobile lab to be wheeled into a classroom on a scheduled basis. This also eliminates the need to retrofit a classroom with power and data cables. For more information on Mobile Computer Labs, see the [Learning Spaces Study – Fall 2007](#).

2. Instructor Station

Classroom podiums need to allow instructors access to USB and CD/DVD devices along with connecting their own laptop, but should be robust against cable, computer, or peripheral damage. Other A/V equipment may include a microphone, a document/pad camera, and LCD projector controls. Designs with built-in security, such as podiums that house the computer and electrical connections inside a locked (but adequately ventilated) cabinet with rear access, are a must. A phone in the room with departmental technical support contact information is recommended. Remote management software is also recommended.

When designing the room, it is critical to speak with those who will support and use it. Some instructors may prefer to sit and others will want to move around the room while teaching. Tables with a modified or recessed control panel, and electronics housed separately, are alternatives to the standard podium-style instructor station. A remote (wireless) mouse/slide advancer/laser pointer is essential for those who move around, and is recommended for all classroom instructor stations, need will be determined on a per room basis (as battery life and charging can present problems).

3. Network Requirements

Wired data connections are needed at the teaching station area, the projector, and to the fixed student computers if applicable. Wireless networks are considered a supplement to the classroom network. Presently, our wireless networks will not provide guaranteed shared multi-user and rich media over a network. Please refer to *Division 27 of the NAU Technical Standard's* new construction guidelines for current cable specifications.

4. Teaching Station

The teaching station or lectern must be height adjustable to meet the needs of any instructor. The teaching station can be wall fed or floor fed through a floor box depending on room size and requirements. When poke-thru devices are not feasible due to structural limitations or costly abatement, use Extron Electronics AVTrac low profile floor-mount raceway system or equivalent. With the proper conduit infrastructure in place, the teaching station can range from a simple table housing a laptop connection to a permanent PC station offering rack mount equipment, microphone, document cameras, interactive monitor, audience response system, class capture (podcast), and videoconference gear. NAU uses Crestron control systems to standardize and simplify room control as well as provide network administrative functions such as equipment status.

5. Mediation Packages

NAU strives to provide the basic mediation package in each classroom. The level of mediation provided is based on such variables as size and shape of the room, teaching style and discipline-based need. Mediation package options are as follows:

5.1. Capacity and/or Discipline-Specific Requirements may include:

- Microphones for large capacity rooms (over 40 capacity)
- Document camera
- Assisted listening (over 40 capacity)
- Multiple projectors / screens
- Stereo audio
- Video conferencing
- Class capture
- Class streaming
- Annotative monitor

5.2. Screens

5.2.1. Location

- Multiple screens may be required. The type of seating, the capacity, the room configuration and the primary instruction style dictate the optimum number.
- The number of screens required is based on the seating capacity, the configuration of the room, and the primary instruction style.
- Where possible, NAU recommends angling the screen in the corner of the classroom to both maximize the viewing angle to the audience and increase free whiteboard writing space. Angle-mounting the screen must typically be addressed in building planning stages since it usually requires detailing reflected ceiling plan to address ceiling grid and lighting. If angle-mounting the screen is unfeasible, screen placement should still remain opposite from the teaching station area on the teaching wall to maintain whiteboard surface. (Please see Figures 1 and 2). Ceiling height is also critical when planning the layout of a Classroom. NAU recommends a minimum of 12 ft. finished ceiling height to accommodate both lighting and technology.
- The higher the ceiling, the larger the screen and image size it can accommodate. Screens should drop no lower than 48 inches from the floor.
- LCD multimedia projectors and motorized projection screens are recommended for use in all NAU classrooms including computer labs, and wet and dry laboratories. Seminar rooms may opt to use LCD panels for small group presentations, and Video Conference classrooms are configured as per the specifications set forth in the *Room Definitions – Classroom: Traditional Loos Seating section* of this document. Large auditoriums and lecture halls may require a secondary manual projection screen which can be used with an overhead

projector or pad camera. This screen should be located so that the main screen can be used simultaneously. Two or three motorized screens should be used in rooms with over 60 student seats.

- LCD projectors should be mounted from the ceiling and not part of the instructor podium. Selecting an LCD projector that produces adequate lumens for visibility in a well-lit room is important, as is the ability for a projector to be flipped vertically and horizontally to allow for upside down mounting. Lockable security housing that is easy to open for servicing and changing bulbs, and a sturdy ceiling mount, is recommended due to the frequency that projectors are targeted by thieves.
- Lighting controls in all learning spaces are necessary to provide best viewing of electronic images and text. Window treatments and dimmers for lights above screens should be installed wherever LCD projectors or other document cameras are used for presentation.
- Projection screens and whiteboards should be located so they can be used at the same time. All screens should be installed in front of any lighting fixtures that are used to illuminate whiteboards. Control switches should be visibly accessible, and labeled, for ease of operation. Housing for motorized screen units should be recessed into ceilings with the ability to drop out components of the screen and the motor separately for repair and maintenance.
- Projection screens should align with student seating, the screen mounting heights, and screen sizes at NAU should adhere to the following general guidelines:
 - Align screen so that 45-degree sight lines left and right of the perpendicular centerline cover all student seats within the 90-degree cone.
 - The vertical angle for the front seated viewer to the top of the screen should not exceed 35-degree to floor at student viewing height.
 - A/V designs should include sightline diagrams that verify these requirements. Construction Documents should note angle and dimensions on plan to allow exact placement in field.
 - Screen Mounting Height – Set high and fully recess the housing to keep bottoms of viewing area 48 in. (preferably 72 in.) or greater above floor.
 - Screen Size – size screen width to most distant viewer - use a ratio of 1 to 4.
 - Example – 32 ft. to most remote viewer gives an 8 ft. wide screen..
Alternatively, the maximum distance to the back row should be 6X image height, and the minimum distance to the front row should be 2x image height.” (Yale University Classroom Design Review Committee, 2007, p. 8).
 - For more detailed specifications and cost estimate examples, see Appendix C - Learning Spaces Procurement Specifications.

5.2.2. Size and Automation

- To calculate the distance from the projection screen to the seats the following formulas are adequate:

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Minimum distance to front row = 2x the image size

Maximum distance to back row= 6x the image size

- All projection screens must be tab-tensioned with aspect ratios of 16:10 to accommodate high definition format.

6. Wireless Access Points

- Enclosure should be required within ceiling- or wall-mounted enclosure dependent upon room layout and ceiling height access.
- CAT 6 cabling & POE Ethernet according to Division #27 of the NAU Technical Standards.

7. Infrastructure

The AV designer is responsible for reviewing the potential cooling load changes with the NAU PM and Mechanical Engineer.

8. Special Conditions

There may be rooms that will require discipline-based equipment or additional technology, such as media systems, not listed in these guidelines.

9. Floor boxes and Poke-thru devices

- Poke-thru device to be Wiremold/Legrand 8ATCGY (or equivalent) with the following add-on features (required). Interior Device configuration to include #682A (device plate to accept up to 2 ports of communication devices), #68REC (proprietary 20-amp duplex power receptacle), #8AAP (mounting plate to accept up to 4 Extron AAP Series device plates, & #8ACT6A (mounting plate to accept up to 6 ports of communication devices in any one of 3 gang in the center area). Underside Device Configuration to include #5PTHA (1/2 gang pass through housing assembly), #1PTHA (1 gang pass through housing assembly) & #575CHA (1/2 gang ¼" conduit housing assembly). Cover color to be grey.
- Floor box to be Wiremold/Legrand RFB9 (for retrofit floor cuts) and RFB 11 (pre-construction and where depth permits).

Office Space Utilization

1. Office Space Design

1.1. Square Footage Ranges

The square footage ranges are provided to accommodate the varying programmatic needs of these positions across the University. For example, a unit may assign an office on the smaller end of the square footage range to a person who is more likely to spend time working in a research lab than in an office. Conversely, a person may be assigned an office on the upper end of the range to accommodate frequent meetings with multiple individuals.

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1.2. Applying the Guidelines in Shared Spaces

The recommended square footages of shared spaces specify the total amount of office space that should be dedicated to any one person. They do not necessarily indicate the actual size of the office or workspace. For example, a department should designate a cumulative 120-256 square feet for four temporary employees (30-64 square feet per person); this space may or may not accommodate all four persons simultaneously.

2. Private Offices, Shared Offices and Cubicles

General Guidelines: Color selection and finishes in state-owned buildings (carpet, wall covering, demountable wall, vinyl base, paint, fabrics and laminates, etc.) must be approved by Facility Services- Planning, Design, and Construction.

2.1. Private Offices

Private offices are necessary for many positions at the University. The size of the office varies depending on the type of work and the need to meet with individuals or groups frequently and in a private setting. These spaces should be able to accommodate a desk, files, bookshelves, and space to meet with an additional one to six people. The following positions would, in most cases, require private offices:

Executive	Academic	Administrative
President	Dean	Associate or Assistant Vice President
Vice President	Associate or Assistant Dean	Director
	Department Chair	Associate or Assistant Director
	Faculty, Tenure Track	
	Faculty, Research	
	Unit Administrative Manager	

Some positions in a unit or department may require private office space, while a person with similar duties in another unit or department may not. The following positions should be allocated private office space on a case-by-case basis:

Academic	Administrative
Faculty, Non-Tenure Track	Manager
Staff, Professional (Full-time)	Staff, Professional (Full-time)
Faculty, Emeritus (Active)	
Technician, Associate or Specialist (Research)	

2.2. Shared Offices and Cubicles

Shared offices, cubicles, and open workspaces are an efficient use of office space. Shared offices should be assigned to individuals who require a certain amount of privacy or reduced

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noise levels. Cubicles and open workspaces are particularly space-efficient, flexible, and can accommodate additional guests as needed. The following positions would, in most cases, be assigned a shared office, cubicle or open workspace

<i>Academic</i>	<i>Administrative</i>
<i>Faculty, Visiting or Consulting</i>	<i>Manager</i>
<i>Research Fellow</i>	<i>Staff, Professional (Full-time)</i>
<i>Fellow, Lecturer, Visiting Scholar</i>	<i>Staff, Administrative Support (Full-time)</i>
<i>Faculty, Emeritus (Non-active)</i>	<i>Staff, Professional (Part-time)</i>
<i>Staff, Administrative Support (Full-time)</i>	<i>Staff, Administrative Support (Part-time)</i>
<i>Staff, Administrative Support (Part-time)</i>	<i>Temporary or Student Staff</i>
<i>Staff, Professional (Part-time)</i>	
<i>Graduate Student Instructor</i>	
<i>Graduate Student Research Assistant</i>	
<i>Temporary or Student Staff</i>	

3. Space-per-person Recommendations

The following space-per-person recommendations are based on recent construction projects at the University and on space guidelines from other higher education institutions and the private sector. They were developed in collaboration with the Office of the President, Facility Services-Planning, Design, and Construction, and various administrative and academic units.

Type of Room Occupants	Space Type	Recommended NASF per Person
Executive		
President	Private Office	400
Vice President	Private Office	300
Academic Units		
Dean	Private Office	240
Associate or Assistant Dean	Private Office	160
Department Chair	Private Office	160
Faculty, Tenure Track	Private Office	100-160
Faculty, Research	Private Office	100-160
Faculty, Non-Tenure Track ¹	Private Office, Shared Office, or Cubicle	80-100
Faculty, Visiting or Consulting	Shared Office or Cubicle	80
Faculty, Emeritus (Active)	Private Office, Shared	64-140

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	Office, or Cubicle	
Faculty, Emeritus (Non-active)	Shared Office or Cubicle	30-64
Fellow, Lecturer, Visiting Scholar	Shared Office or Cubicle	80
Unit Administrative Manager	Private Office	100-160
Technician, Associate, or Specialist (Research)	Private Office, Shared Office, or Cubicle	30-100
Research Fellow	Shared Office or Cubicle	30-80
Staff, Professional (Full-time)	Private Office, Shared Office, or Cubicle	64-100
Staff, Professional (Part-time) ¹	Shared Office or Cubicle	80
Staff, Administrative Support (Full-time)	Shared Office or Cubicle	64-100
Staff, Administrative Support (Part-time) ¹	Shared Office or Cubicle	64-80
Graduate Student Instructor	Shared Office or Cubicle	30-64
Graduate Student Research Assistant	Shared Office or Cubicle	30-64
Temporary or Student Staff	Shared Office or Cubicle	30-64
Administrative Units		
Associate or Assistant Vice President	Private Office	160-240
Director	Private Office	100-160
Associate or Assistant Director	Private Office	100-140
Manager	Private Office, Shared Office, or Cubicle	80-140
Staff, Professional (Full-time)	Private Office, Shared Office, or Cubicle	64-100
Staff, Professional (Part-time) ¹	Shared Office or Cubicle	80
Staff, Administrative Support (Full-time)	Shared Office or Cubicle	64-100
Staff, Administrative Support (Part-time) ¹	Shared Office or Cubicle	64-80
Temporary or Student Staff	Shared Office or Cubicle	30-64

¹Part-time denotes the room occupant is 50% FTE or less. If the occupant is more than 50% FTE, it is recommended to follow the guidelines for a full-time room occupant.

4. General Applications

4.1. Locations

- Offices should be located to have access to common areas provided for the use of faculty and staff.
- Offices for faculty should be kept near the classrooms used for their associated departments, or near their research labs according to their duty assignments.

4.2. ADA

Design all offices to comply with ADA standards for Accessible Design. We require that Universal Design Standards be applied when possible. Any discrepancy between the ADA Standards and this document shall be resolved in design review.

4.3. Applicable Procurement Requirements

Office design and product specification must conform to procurement requirements set by the NAU Purchasing Department.

5. Office Interiors

5.1. Design

The following items should be considered when creating a new office:

- Designing for the flexibility of office space is strongly encouraged. The more provisions made for flexibility, the more options there are for future use of the space.
- The total square footage of each office is to be based on the type of office, the room occupant and the expectations of that position, as specified in Office Types.

5.2. Door/Room Security

5.2.1. Door Hardware

All classroom doors shall conform to Division #8 of the NAU Technical Standards. Additionally office doors should have the following:

- ADA accessible doors and hardware as specified in *ADA Standards for Accessible Design*.

5.2.2. Doors

- Each door leaf to be a minimum of 36” wide, including those used in pairs at double doors.
- No strike mullion on double doors.
- Door opening force, hardware, width, thresholds and maneuvering clearances should comply with ADA Standards.

5.3. Windows

Daylight is an important part of most environments. Windows should be included whenever possible. Windows must comply with the “Glass and Glazing” specifications in Division #8 of the *NAU Technical Standards*.

- If easily accessible, window coverings can be manually operable; otherwise, coverings must be motorized with controls located at the instructor’s workstation on the AV touch panel. Where applicable, the depth of the window should be designed to allow for the installation of motorized shade tracks.
- Vertical blinds and drapes are not desired. If necessary, they are to have non-plastic, heavy-duty operating components.
- All window treatments are required to have a non-reflective matte finish and unless otherwise specified, the color selection should match or blend with the window frame.

5.4. Flooring

- When selecting flooring finishes; refer to the specifications in Division #9 of the *NAU Technical Standards*.
- Specify an anti-static, high traffic, commercial grade carpet tile. No solid or light colors are permitted.
- All carpet must conform to the NAU Purchasing Department’s “green” guidelines. Carpet shall have a high recycled content. All demolished carpet to be recycled when renovations occur. Contact NAU Sustainability Program Manager for additional information.
- A four-inch or six-inch cove base must be included when carpet is specified.

5.5. Walls and Ceilings

5.5.1. Walls

- Walls to be painted in an eggshell finish.
- No wall coverings should be used.
- To improve Indoor Air Quality (IAQ) no-VOC paint should be used.

5.5.2. Ceilings

- The surface of the ceiling must be designed to accommodate the required acoustical properties of the room. Ceiling panels shall have a Noise Reducing Coefficient (NRC) between .65 and .85, and a STC of 50.
- The ceiling should act as a sound mirror, reflecting sound downward to blend with direct sound.
- Ceiling material to be non-sagging (humidity resistant) lay-in acoustical tile for most ceiling areas. Nominal size 24" x 24" or 24" x 48".

5.5.3. Vertical Writing Surfaces

- If a vertical writing surface is provided it should be a high-fired, ceramic-covered steel, dry marker writing surface.
- Fixed-height whiteboards should be mounted with the bottom edge at 36 inches above the floor.
- Each whiteboard should have a continuous marker tray below each marker board. Do not mount marker holder to wall due to marker bleed ruining wall finish.
- At the top of the whiteboard, a tack board strip and clips for display materials are required.

5.6. Signage

5.6.1. Room Identification Sign

Each room will have a standard room identification sign mounted near the door on the lockset side (exterior of room), mounted at a height as indicated by *The ADA Standards for Accessible Design*. Braille lettering is required on the sign to identify the room as well. Standard room ID sign is a modular sign produced by NAU Sign Shop consisting of (3) 3" x 9" panels and (1) 9" x 11" clear plastic page holder. For Room Numbering guidelines reference Section #4 of the *NAU Design Guidelines*.

5.6.2. Bulletin Boards or Tackable Surface

- A tackable surface should be provided in each office.
- Location and finishes of the bulletin boards will be determined at design.

5.7. Color/Finishes

- If an accent wall is incorporated, avoid using accent color on walls that might overpower the room or be unappealing to future occupants.
- Specify highly durable finishes that are easy to maintain.
- Use of approved "green" products in all applications is required (See NAU Purchasing Department specifications)

5.8. Reflectance Values

The Engineering Society of North America recommends the following reflectance values for finish materials.

- Ceilings - 80% or higher
- Non-accent walls - between 50% and 70%
- Floors - between 20% and 40%

Reflectance values of paints, laminate and other finish materials should be selected to enhance ambient illumination and the illumination at the instructor's and student's work areas. Recommended value - between 40% and 60%.

6. Furniture

Consult the NAU PD&C Interiors Department for all current furnishing specifications.

6.1. Work Stations

Typical work stations should consist of a desk, return, task chair, 2 desk, storage pedestals, and one bookshelf or storage cabinet.

6.1.1. Design Standard

- Desk sizes can range in width from 48" to 72"; and depth can range from 25" to 30"
- Return sizes can range in width from 42" to 60"; and depth can range from 20" to 25"
- Desk storage is required in the form of a "box, box, file" pedestal or "file, file" pedestal
- Additional storage can be provided in the form of a combination cabinet, two door storage cabinet, book shelf, or large lateral/vertical file.

6.1.2. Construction/Fabrication

- Laminated work surfaces shall be constructed of plastic laminate applied to commercial, furniture grade MDF or hardwood plywood. Tops shall have a non-glare, medium tone surface to reduce eye strain.
- The end panels and legs of desks should not block the occupant's knee space within the work space allotment.
- Table edge to be a heavy-duty extremely durable material.
- Tables to withstand loading of 300 lbs. of applied load (people sitting on table) per linear foot.

6.2. Clearances

Minimum of 36" for egress and path of travel throughout office.

6.3. Replacement Availability/Warranty

- Office furniture shall be procured from “name brand manufacturers that demonstrate proven track records in the marketplace, and maintain stock levels that insure replacement can be made without timely backorder delays.
- Provide written warranty for all proposed furniture. NAU prefers 10 year or longer warranty on all furniture items.

6.4. Seating

Seating should be selected that will meet minimum passive ergonomic standards and still satisfy the requirements of Uniform Building/Fire Codes, cost, durability, functional comfort, appearance/finish, and performance over time. Chairs should be comfortable for use by people ranging in size from the 5th percentile (4'-11" tall, approximately 113 lbs.) to the 95th percentile male (6'-2" tall, approximately 246 lbs.).

6.4.1. Design Standard

When selecting seating in order to achieve minimum standards of comfort, aspects such as width of seat, type of lumbar support, appearance, versatility of seating, replacement availability/ease of maintenance and cost should be considered.

6.4.2. Task Seating

Shall be ergonomic to include:

- Pneumatic height adjustability
- 5 star caster base
- Adjustable lumbar support
- Adjustable seat depth
- Arms to be height and width adjustable
- Seat width will range from 22 to 25 inches

6.4.3. Guest Seating

- Seat width will range from 18 to 22 inches.
- If 2 guest seats are provided one should be specified without arms and one with.
- 4 legged chairs with or without casters are preferred.

6.4.4. Seating Clearances

To ensure adequate circulation through the learning spaces, minimum clearances must be maintained as referenced in Room Definitions.

6.4.5. Appearance

- The construction and materials should be selected so that their color and surface coordinate with the other furnishing within the office.
- Light colors are discouraged.
- For material specifications reference Division #12 of the *NAU Technical Standards*.

6.4.6. Replacement Availability/Ease of Maintenance/Warranty

- Chairs shall be procured from name brand manufacturers that demonstrate proven track records in the marketplace, and maintain stock levels that insure replacement can be made without untimely backorder delays.
- Provide written warranty for all proposed furniture. NAU prefers 10 years or longer warranty on all furniture items.
- When casters are specified on seating, insure that the casters are the correct type for the floor finish (carpet, VCT, etc.)

6.4.7. Quality

High quality seating shall be purchased to minimize the long term life cycle costs since funding for equipment replacement, repair, and maintenance are becoming increasingly difficult to obtain.

6.5. Types of Furniture to Avoid

- Furniture not on Tri-University or State contract.
- Furniture that does not meet warranty standards.

6.6. Miscellaneous Office Items

- Recycling and trash receptacles are required in all rooms. See NAU Purchasing Guidelines.
- Containers shall not encroach on circulation path.
- See Manager of Sustainability Program for additional specifications.

7. Lighting and Electrical

7.1. Lighting Zones

As a rule, all offices will have sufficient lighting to provide visibility to the user. Foot Candle Guidelines must be followed for standard offices. For lighting specifications refer to Division #26 of the *NAU Technical Standards*.

7.1.1. Color Temperature

The color temperature for all light fixtures should be the same. The color temperature goal is 4100 degree Kelvin.

7.1.2. Motion Sensors

Motion sensors are preferred in all rooms. When installing motion sensors, be sure to set timer to maximum to avoid light shut off during low-motion activities.

7.2. Electrical

For electrical specifications, including outlets refer to Division #26 of the *NAU Technical Standards*.

7.2.1. Wall Outlets

Place outlets on walls of the offices at 6' intervals or as necessary to allow for multiple desk set ups. It will typically suffice to have an outlet and data location each on opposing walls.

8. HVAC & Fire Prevention

For other HVAC and Fire Life Safety specifications refer to Division #23 of the *NAU Technical Standards*.

8.1. Location of Above-Ceiling Mechanical Equipment

Access to mechanical equipment for the building will not be located within an office.

9. Acoustics

Recommendations:

- The review of acoustical requirements for classrooms by an acoustical consultant is recommended whenever possible.
- Minimum NC ratings: 0-59 seats: NC30-35 or less; 60 to 149 seats: NC 25-30 or less; 150+ seats: NC20-25 or less.
- In all cases, walls in classrooms should have a minimum sound transmission class (STC) of 50 as recommended: ANSI S1.4-1983 (R 2006).
- Individual equipment such as fans, ductwork and diffusers shall have ratings not exceeding NC 25 throughout the load range as recommended: ANSI S12.60-2002.

14. LABORATORY PLANNING AND DESIGN

Pending Issuance

15.KEYLESS ACCESS AND SECURITY

Pending Issuance