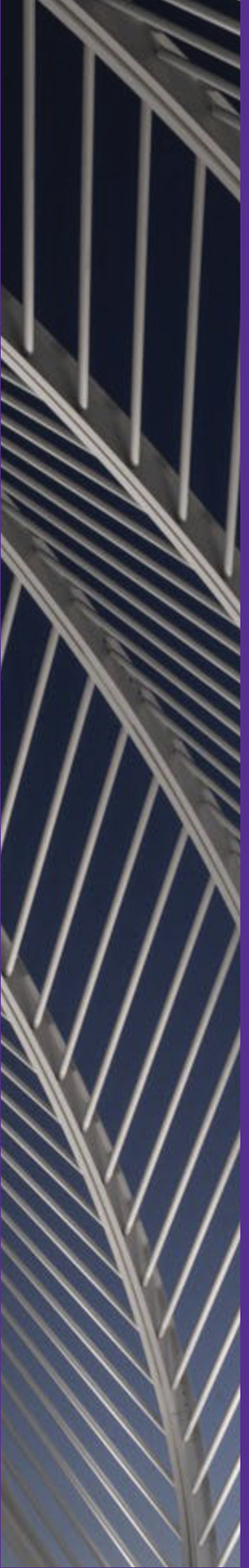

FLORIDA POLYTECHNIC UNIVERSITY

# NEW ENGINEERING BUILDING | DESIGN CRITERIA

LAKELAND, FLORIDA

Basis of Design
10.31.22

IN ASSOCIATION WITH
WALTER P. MOORE | STRUCTURAL
AFFILIATED ENGINEERS, INC | MEP

FLORIDA POLYTECHNIC UNIVERSITY

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FLORIDA POLYTECHNIC UNIVERSITY

# SECTION 01 - EXECUTIVE SUMMARY

Florida Poly University's new Engineering Building will house a variety of Research Labs and Future Laboratory Shell. The building program includes the essential top priority spaces outlined in the Laboratory Narrative, as well as additional highly desirable secondary priority future shell spaces that design-build teams are encouraged to include/integrate in their design solutions to the extent the budget will allow.

The minimum program requirements must include all the Top Priority Net Assignable Square Footage as identified in the program document.

The Engineering Building will include a variety of spaces that support student and faculty research and collaboration with industry partners, this combination shall support FPU's continued dedication towards entrepreneurial scientific research.

Collocated multidisciplinary research program areas will serve as hubs of interdisciplinary and entrepreneurial activity, which showcase the teaching and research mission of FPU, highlight the creativity, research, and development of an idea, and immerse the next generation of engineering leaders and entrepreneurs in the vast possibilities open to those that are willing to take the chance. In addition to serving as an interdisciplinary University the Engineering Buildings components will be available for; continued industry collaboration, other higher education institution collaboration, advising, and student team collaboration. Important constituents will include Florida Poly students, faculty and staff, entrepreneurs, student engineering teams, and Polk County area industries, research institutes and associations.

FLORIDA POLYTECHNIC UNIVERSITY

# SECTION 02 - ARCHITECTURAL PLANNING

# 02. ARCHITECTURAL PLANNING

## 02.1 PROGRAM SUMMARY AND NARRATIVE

### LABORATORY PROGRAM NARRATIVE

In this section you'll find a list of spaces required in the building. A suggested list of spaces for a future shell build out on the second floor is also included. Each programmatic space is assigned a Room Data Sheet (found in the Appendix) outlining various HVAC and Finish requirements among other attributes. To assist in reading the Room Data Sheets a conceptual Plan and 3D Image is provided. Additional notation on key laboratories is provided below.

**Experiential Lab:** The Experiential Lab is an electric vehicle research bay. Materials and flooring shall be static dissipative and robust enough to withstand regular vehicle movement and testing. Key equipment and features include direct exhaust and point exhaust, safety features for battery storage and usage, a structural grid with the ability too hold a 1Ton point load. Roll up door as indicated on plan shall be translucent or transparent in material to maximize natural light into the space.

**Mechanical Engineering Lab:** This Lab is two rooms combined by a moveable wall. This Lab will experience regular turnover by University Students and requires a variety of storage solutions. One side will be lockable and securable after hours while the other will be available to students and faculty after regular working hours. Large cubbies to accommodate "Lab in a Box" style usage should be accessible fulltime. Any potentially dangerous equipment should be located behind the lockable barrier. One wall should be dedicated to white boards or projection for collaboration and demonstration.

**Environmental Engineering Lab:** The Environmental Engineering Lab is BSL II Laboratory with adjacent support laboratory. This is wet lab and all casework and fumehoods shall be comparable or identical too The ARC Building on campus. Building supplied compressed air in this room will require desiccant drying and reduced PSI.

**Civil Engineering Lab:** This laboratory should be capable to support large machinery, vibration creating equipment and outside soil samples and heavy water use. Floor drains throughout the lab will be required. Roll-up doors should be accessible by service drives on campus. Roll-up doors as indicated on plan shall be translucent or transparent in material to maximize natural light into the space. A slab isolation is recommended to mitigate any vibration created in lab. Floor anchors and wall anchoring required for future planned equipment.

# 02. ARCHITECTURAL PLANNING

## 02.1 PROGRAM SUMMARY AND NARRATIVE

### MODULAR LAB PLANNING

The following space program was developed around a 10’-6”x31’-6“ lab planning module. While these dimensions are not intended to be prescriptive, design teams are encouraged to utilize modular lab planning principles to provide construction efficiency, future flexibility, and the integration of robust mechanical, electrical and lab utility infrastructure necessary to support current and future teaching and research needs. Design teams are also encouraged to look for square footage efficiencies and opportunities for space reduction while maintaining the minimum room requirements

### EQUIPMENT

Equipment List Clarifications: The intent of the Equipment Listed in the Room Data Sheets is to make the Design/Build Team aware of the type, quantity, and requirements of the equipment that will be used within the space. The Design/Build Team should infer from the equipment identified and any associated cut sheets the installation requirements, including any HVAC, piping, or electrical work required for a fully functioning system, and should assume the listed equipment is in good working condition. Equipment noted as Owner Furnished Owner Installed is listed for reference, building design must accommodate equipment needs. The Design/Build Team’s proposal should include access for moving the listed equipment in and out of the building. Facilitate access for FPU vendors for owner provided FFE.

# 02. ARCHITECTURAL PLANNING

## 02.1 PROGRAM SUMMARY AND NARRATIVE

### *02.1a PROGRAM LIST*

| Program Level 1 | Program Level 2 | Name | Prog Quantity | Prog NSF | Comments | Sum of Prog Total NSF |
|---|---|---|---|---|---|---|
| Commmon | Admin Suite | Shared Conference Room - 12 Seat | 1 | 300 | | 300 |
| | | Work Room/Copy Room | 1 | 50 | | 50 |
| | | Department Chair Office | 2 | 150 | | 300 |
| | | Storage (Industry Partner) | 1 | 150 | | 150 |
| | Admin Suite Total | | | | | 800 |
| | Faculty / Staff Office | Faculty/Staff Office | 17 | 120 | | 2040 |
| | Faculty / Staff Office Total | | | | | 2040 |
| | Public Space | Lobby | 1 | 800 | | 800 |
| | | Quite Room/Mothers Room | 1 | 90 | | 90 |
| | | Vending | 1 | 50 | | 50 |
| | | Faculty Lounge - Break Room | 1 | 200 | | 200 |
| | | Faculty Informal Collaboration Space | 2 | 170 | | 340 |
| | Public Space Total | | | | | 1480 |
| | Shared Conference / Seminar Rooms | Shared Conference Room - 6 Seat | 2 | 150 | | 300 |
| | Shared Conference / Seminar Rooms Total | | | | | 300 |
| Commmon Total | | | | | | 4620 |
| Environmental and Civil Eng | Research Lab | Environmental Lab | 2 | 900 | | 1800 |
| | | Research Lab | 2 | 1500 | One requires access to a rollup door. | 3000 |
| | Research Lab Total | | | | | 4800 |
| | Research Lab Support | Environmental Lab Support | 1 | 500 | | 500 |
| | Research Lab Support Total | | | | | 500 |
| | Research Office | Research Office | 2 | 120 | | 240 |
| | | Research Office (Lab Tech) | | | | 120 |
| | Research Office Total | | | | | 360 |
| Environmental and Civil Eng Total | | | | | | 5660 |
| Research Environments | Research Lab | Experiential Lab (Vehicle Bay) | 1 | 1000 | | 1000 |
| | | Mechanical Engineering Lab | 2 | 1200 | | 2400 |
| | | Civil Engineering Lab | 1 | 1100 | | 1100 |
| | Research Lab Total | | | | | 4500 |
| | Student Commons / Study Space | Student Collaboration | 2 | 200 | | 400 |
| | Student Commons / Study Space Total | | | | | 400 |
| Research Environments Total | | | | | | 4900 |
| Support | Building Support Spaces | Recycling | 1 | 50 | Included in BOH Services | 50 |
| | | Attic Storage | 1 | 300 | Included in BOH Services | 300 |
| | | Custodial Storage | 1 | 50 | | 50 |
| | | Custodial Closet | 2 | 50 | | 100 |
| | | Hazardus Storage | 1 | 100 | One Room should be classified H and located at exterior wall | 100 |
| | | Chemcial Storage | 1 | 100 | | 100 |
| | Building Support Spaces Total | | | | | 700 |
| Support Total | | | | | | 700 |
| Grand Total | | | | | | 15880 NSF |
| | | | | | Efficiency Target | 55% |
| | | Total Gross Assignable Area | | | | 28873 GSF |
| | | | | | Grossing Factor | 1.82 |

# 02. ARCHITECTURAL PLANNING

## 02.1 PROGRAM SUMMARY AND NARRATIVE

### *02.1a PROGRAM LIST*

| Program Level 1 | Program Level 2 | Name | Prog Quantity | Prog NSF | Comments | Sum of Prog Total NSF |
|---|---|---|---|---|---|---|
| **Shell Strategy** | **Future Industry Partner Research** | **Directors Office** | 4 | **150** | 2nd Floor | 600 |
| | | **Student Workstations** | 4 | **30** | 2nd Floor | 120 |
| | | **Industry Partner Office** | 3 | **150** | 2nd Floor | 450 |
| | | **Lab Support** | 4 | **240** | 2nd Floor | 960 |
| | | **Analytical Lab** | 1 | **2000** | 2nd Floor | 2000 |
| | **Future Industry Partner Research Total** | | | | | **4130** |
| | **Shell** | **Building Shell** | 1 | **4000** | 2nd Floor | 4000 |
| | **Shell Total** | | | | | **4000** |
| **Shell Strategy Total** | | | | | | **8130** |
| **Grand Total** | | | | | | **8130** NSF |
| | | | | | Efficiency Target | 50% |
| | | **Total Gross Assignable Area** | | | | **16260** GSF |
| | | | | | Grossing Factor | 2.00 |

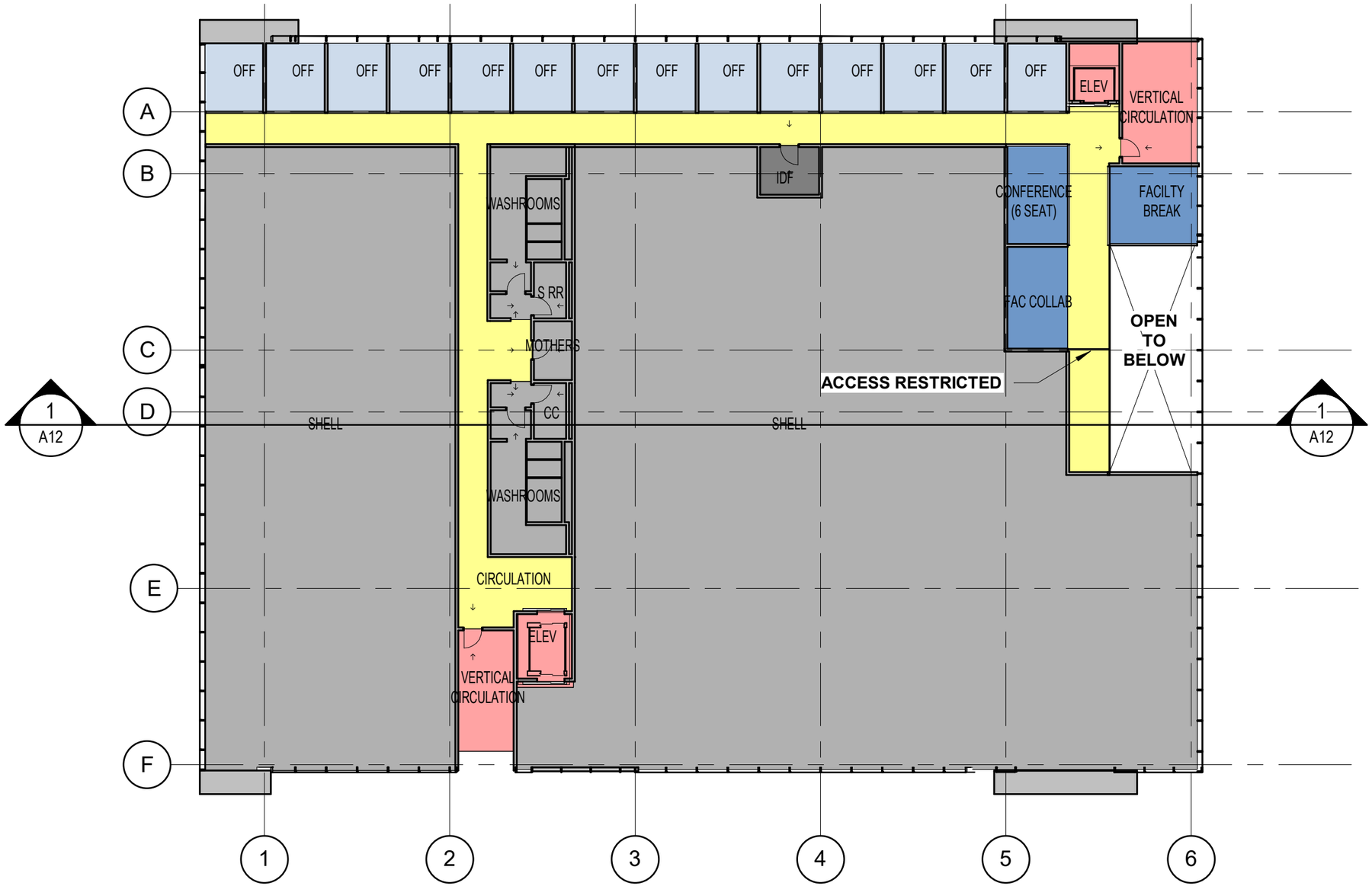
# 02. ARCHITECTURAL PLANNING

## 02.2 FLOOR PLANS


*LEVEL 1*

# 02. ARCHITECTURAL PLANNING

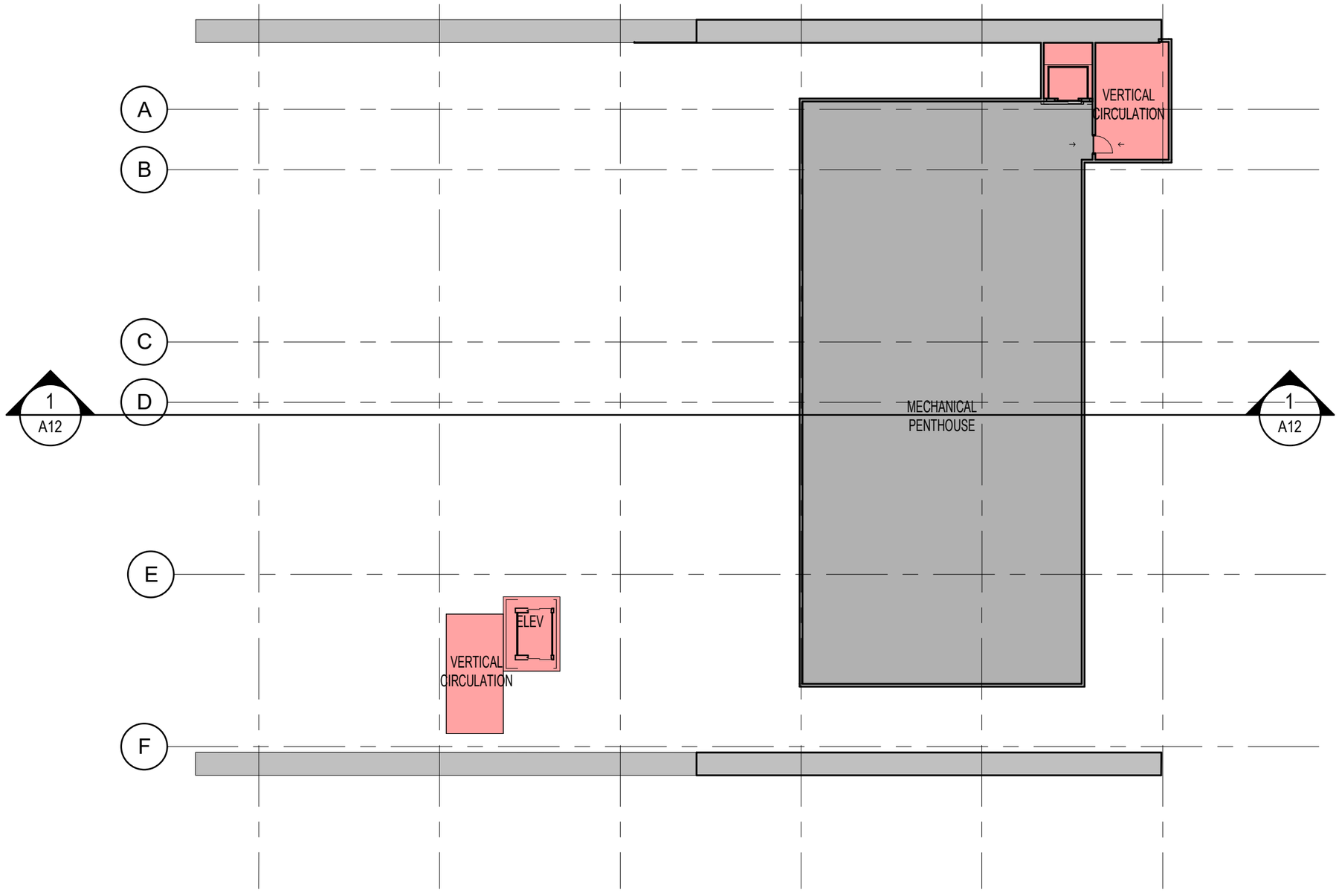
## 02.2 FLOOR PLANS




LEVEL 2

# 02. ARCHITECTURAL PLANNING

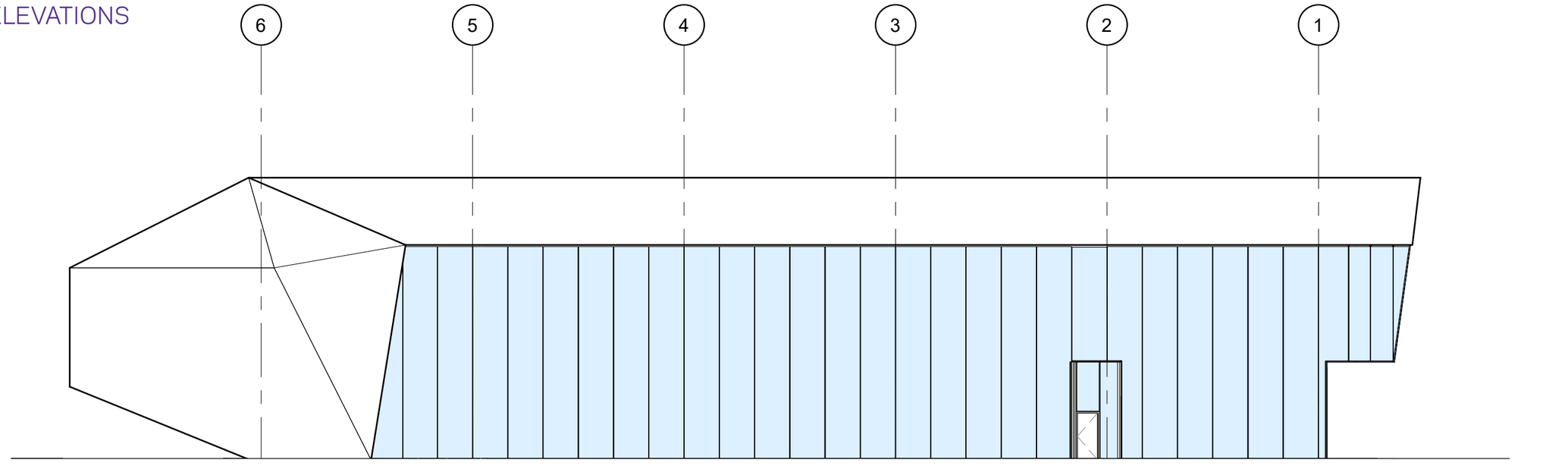
## 02.2 FLOOR PLANS



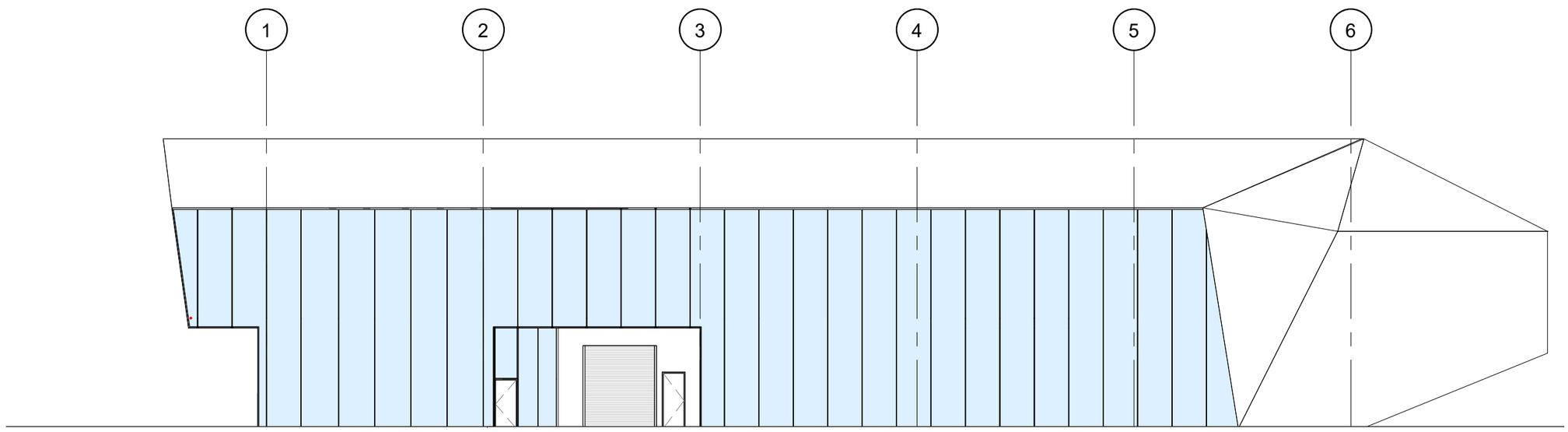

*PENTHOUSE*

# 02. ARCHITECTURAL PLANNING

## 02.3 ELEVATIONS



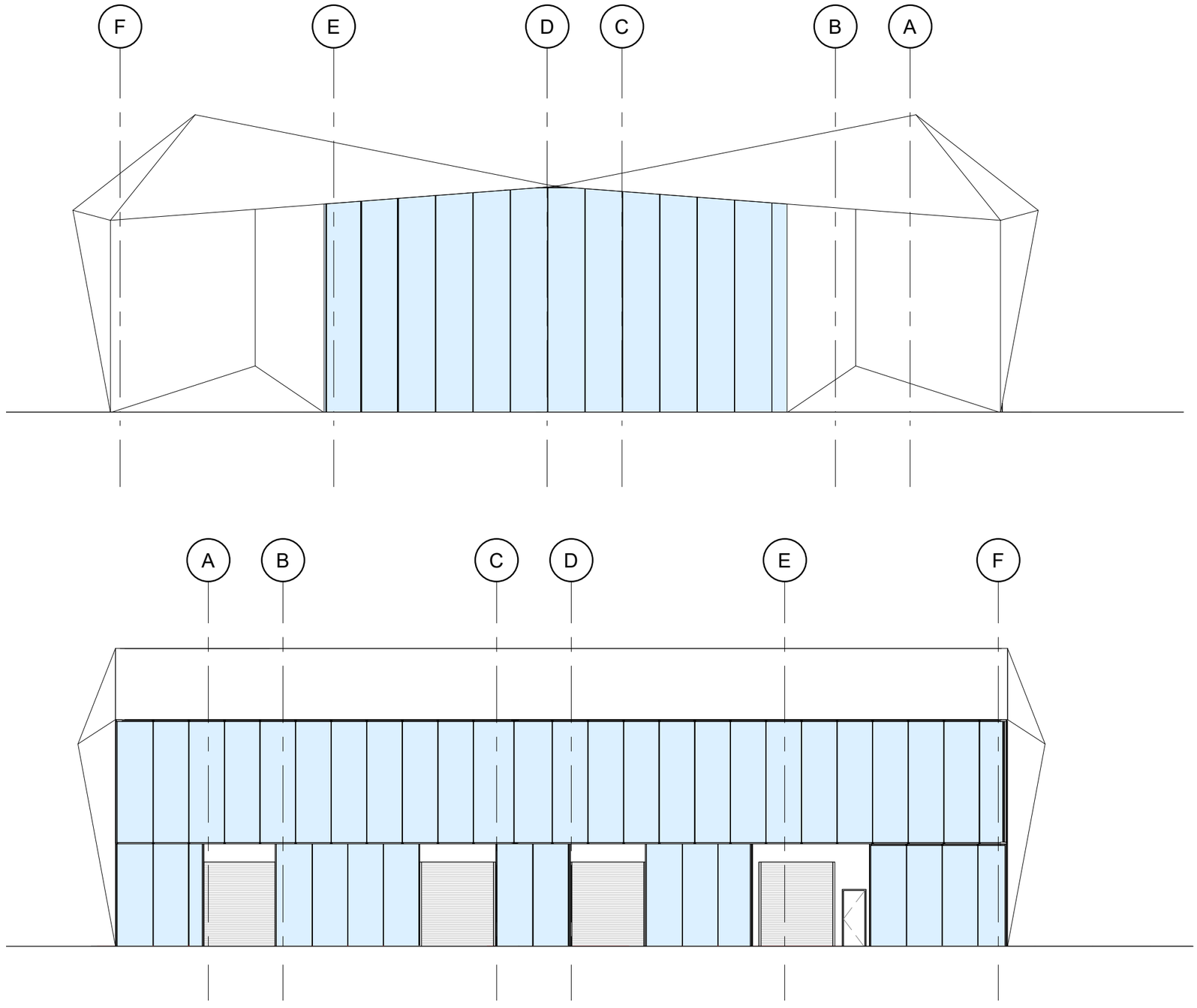

NORTH




SOUTH

# 02. ARCHITECTURAL PLANNING

## 02.3 ELEVATIONS



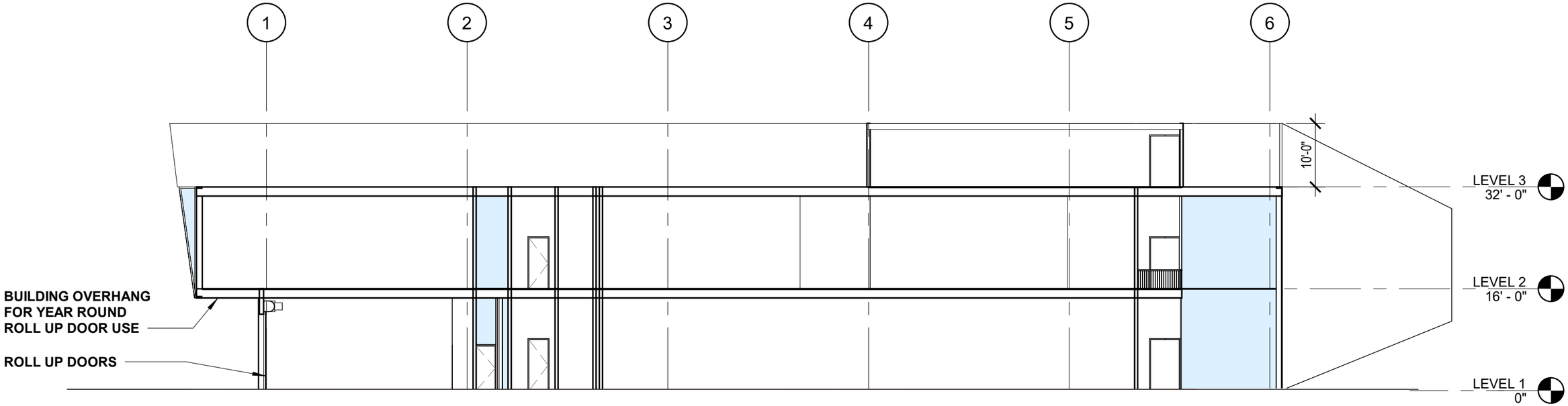

EAST




WEST

# 02. ARCHITECTURAL PLANNING

## 02.4 SECTION



# 02. ARCHITECTURAL PLANNING

## 02.5 SUSTAINABILITY SUMMARY

*The new engineering building at Florida Polytechnic University is located within an environmentally friendly campus within Lakeland, Florida. This campus strives to preserve and enhance the local landscape. The sustainable design strategies of the new building will further reinforce their commitment to the environment and sustainable development. Some of the goals that will define that process include:*

- *Establish a vision statement that embraces sustainable principles and an integrated design approach.*

- *Establish the project LEED Silver building goals developed from the vision statement. Set priorities for project design criteria.*

- *Set specific budgets and goals for energy and water usage. Educate the project team about sustainable design issues and opportunities.*

- *Develop Partnering Strategies to include all design team members, the Owner, the Project Users, and any relevant Government and private authorities. Investigate availability of utility rebates and other financial incentives for green building technologies.*

- *At each stage of the design process, engage in design optimization: Evaluate solutions to sustainable design goals so that the best may be distinguished from other, less promising options; the best solutions will contain synergies where a single strategy provides benefits between multiple goals and disciplines.*

# 02. ARCHITECTURAL PLANNING

## 02.6 OWNER'S STANDARDS, BY REFERENCE

### *02.6b PRELIMINARY BUILDING CODE REVIEW*

**APPLICABLE CODES**

THE FLORIDA BUILDING CODE, 7TH EDITION (2020)
- ACCESSIBILITY
- ENERGY CONSERVATION
- FUEL GAS
- MECHANICAL
- PLUMBING

THE FLORIDA FIRE PREVENTION CODE, 7TH EDITION (2017)
  - NFPA 1 - Fire Code 2018 Florida Edition
  - NFPA 101 - Life Safety Code 2018 Florida Edition
  - REFERENCES
- NFPA 30, NFPA 45, NFPA 55

NATIONAL ELECTRIC CODE (NEC) 2020 Edition - NFPA-70

ENVIRONMENTAL & OTHER CODES
- FLORIDA ELEVATOR SAFETY CODE, CURRENT STATUTORY REQUIREMENTS. (ASME A17.1)
- RULES OF THE DEPARTMENT OF HEALTH AND REHABILITATIVE SERVICES, DIVISION OF HEALTH.(FDOH)
- RULES OF THE DEPARTMENT OF ENVIRONMENTAL REGULATION (FDEP).
- RULES OF THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT (SWFWMD).
- STATE REQUIREMENTS FOR EDUCATIONAL FACILITIES (2014)

**JURISDICTION & PLANS REVIEW**
- THE AUTHORITY HAVING JURISDICTION (AHJ) FOR THE PROJECT IS THE FLORIDA POLYTECHNIC UNIVERSITY, FACILITIES & SAFETY SERVICES

**PROJECT OVERVIEW**
- THE PROJECT IS AN APPROXIMATE 40,000 GSF TWO STORY ENGINEERING BUILDING CONTAINING THE FOLLOWING PRIMARY PROGRAMS:
- RESEARCH LABORATORIES
- SUPPORT LABS
- OFFICES

**OCCUPANCY**
THE PROJECT WILL BUSINESS OCCUPANCY

**CONSTRUCTION TYPE**
CONSTRUCTION TYPE: IIB (NON COMBUSTIBLE, LIMITED AREA/STORIES)

**FIRE SUPRESSION & DETECTION SYSTEMS**
THE BUILDING WILL BE DESIGNED WITH A COMPLETE AUTOMATIC SPRINKLER SYSTEM, AUTOMATIC SMOKE DETECTION SYSTEM, AND FIRE ALARM WITH VOICE NOTIFICATION SYSTEM

**REQUIREMENTS BASED ON OCCUPANCY**
HAZARDOUS MATERIALS
STATE REQUIREMENTS FOR EDUCATIONAL FACILITIES
SCHOOLS, COLLEGES AND UNIVERSITIES

**SPECIAL DESIGN FEATURES**
VERTICAL OPENING

THE BUILDING DESIGN CONTAINS ONE VERTICAL OPENING AT MAIN LOBBY CONNECTING 2 FLOORS.
SMOKE CONTROL NOT REQUIRED PER FBC 404.5 EXCEPTION

# 02. ARCHITECTURAL PLANNING

## 02.6 OWNER'S STANDARDS, BY REFERENCE

### *02.6c CONFORMANCE WITH MASTER PLAN*

The Florida Polytechnic University Campus Master Plan 2021-2031, outlines the projected growth of the academic programs and land use needs of the institution. This plan provides documentation of the projected development of the facilities and the basis of organization that the overall plan envisions for the next 10 years.

This project sits within the 'A4' parcel on campus. The Basis of Design concept for the building provides a modern architectural design that is contextual to the IST building and Applied Research Center, and complimentary in the use of color, materials and form.

FLORIDA POLYTECHNIC UNIVERSITY

# SECTION 03 - NARRATIVES

## INTRODUCTION

The Engineering Shop building is located at the Florida Polytechnic University's Campus in Lakeland Florida, in warm-humid climate classified as climate zone 2A for Polk County. The building envelope will have to perform to handle climatic concerns dealing with Human comfort & thermal insulation, vapor moisture transmission, air & water infiltration and wind forces. The envelope system design is critical to maintain energy code compliance mandated by the Florida Building Code following ASHRAE 90.1-2016 performance evaluation. The building envelope system will also contribute to the projects sustainability goals of following a USGBC LEED Silver benchmark.
The building is anticipated to be categorized as RISK CATEGORY II for BUILDINGS AND OTHER STRUCTURES based on size and occupant load. All systems from these eight (8) categories below will have to conform to Florida Product Approval requirements for products being used in the state.

- Panel Walls
- Roofing
- Shutters
- Skylights
- Structural components
- Windows
- Exterior Doors
- Impact Protective Systems

## EXTERIOR ENVELOPE

EXTERIOR PANELIZED RAIN SCREEN ENVELOPE SYSTEM

This Engineering shop building will have a strong functional relationship to the Applied Research Center (ARC) and visually wants to match the cladding language and materiality. A rainscreen system is to be considered and panel joints must be baffled to the owner's satisfaction using rigid or flexible materials. The cladding system used for the ARC is an Ultra High-Performance Concrete (UHPC) system with a ventilated rain screen assembly approach as a strategy to control surface drainage and water flow. The manufacturer for the UHPC panels is TAKTL LLC. Alternative UHPC or Ultra-compact panel cladding system with baffled joints must be reviewed and approved by owner. The backup wall assembly and substrate for this panel wall system will be Exterior Sheathing on Cold Formed Metal Framing (CFMF) with batt insulation inside the wall cavity and external rigid insulation. Concrete or masonry backup walls are acceptable where interior durability is a concern. The final cladding system selection in design are intended to be High Preforming, durable and cost sensitive.  The language of the façade and materials should capture aesthetic components of the Florida Polytechnic University Campus Architecture.

EXTERIOR CURTAIN WALL GLAZING SYSTEM

The criteria for selection is that the curtain wall will be a unitized system to maintain quality control and improve installation efficiency, optimized to span the story heights without excessive intermediate cladding steel and be thermally broken. Teams are encouraged to consider the performance of a curtain wall with Structural Silicone Glazing (SSG) butt joints for a refined and minimal aesthetic demonstrated on the ARC building. The glazing for the curtain will be Insulated Glass Units (I.G.U) to achieve the appropriate Thermal Transmittance (U-Values) and Solar Heat Gain coefficient (SHGC) for energy Code compliance.

The story (floor to floor) height of this building is 16'-0" and will require what is considered a deep system for curtain walls. Exterior Curtain walls system can be categorized as Shallow, Medium or Deep systems based on mullion profile depths and are 5" systems, 7" systems and 10" nominal depth systems respectively. The 10" system will range from 10 ¼" -10 ½" and will span the floor height for this project most efficiently and reduce the quantity of intermediate cladding steel that would be required to adequately support smaller profile systems.

EXTERIOR SLOPED GLAZING

Specialized Sloped Glazing Systems are not anticipated for this project. However, if there are any glazed façades that will no longer be vertical through design development, it must be planned to not exceed a tilt angle that is more than 15 degrees from the vertical datum to not trigger sloped glazing requirements.

## EXTERIOR ENVELOPE

### EXTERIOR DOORS

All Exterior Doors shall be appropriate to handle wind pressures around the building and maintain a weather barrier. The exterior doors glazed into the curtain wall system will be Aluminum Full Glass (FG) storefront Entrance Doors Systems. All other exterior hinged doors will be solid core hollow Metal (HM) Doors and Frames. Polyurethane Insulated core should be considered basis of design for improved R-Values.  Note all door hardware and infrastructure must be coordinated in design to determine the appropriate levels, access control, door monitoring and exit devices.

### EXTERIOR OVERHEAD COILING DOORS

There will also be Overhead coiling doors for the large equipment movement and access into designated research spaces in the building. Careful detailing to achieve the best thermal barrier and a watertight sill is critical.  Insulated slats must be selected for the overhead coiling doors.

### LOUVERS

Louver assemblies specified on this project where Outdoor Air Intake is required for Air Handling Units (AHU) at a mechanical penthouse or room shall be jamb supported channel frames and be flangeless. Due to rainfall patterns in Florida the louvers will be drainable and wind-driven rain resistant. The louver must perform above a 45% Efficiency to achieve free area totals for AHU's. Construction Specialties (CS) or Greenheck are acceptable manufacturers.

### ROOF ACCESS HATCHES & DOORS

A means to access roof top and equipment shall be provided. Team must evaluate with owner if roof hatches are preferred and determine if a fixed ladders/ ships ladders through are needed.

## THERMAL AND MOISTURE PROTECTION

### LOW SLOPE ROOFING

The linear bar arrangement of the building blocks lends itself to a mono slope design with a fall of 1/4" rise over 12" run as the building code minimum for low slope roofs. The classification of the roof assembly can be class A or Class B and the constructed assembly will comprise of a single-ply membrane on a cover board and rigid insulation sitting on top of sloped structure and deck. The thickness of insulation will be determined based on the full roof assembly to achieve U-Values. The single-ply membrane shall have increased puncture resistance and be able to withstand the wind uplift forces for the project condition. Seaman's Corp FiberTite Roofing Membrane is a 50 MIL KEE product with Woven fiber and is to be considered for its enhanced puncture resistance and strength. The product color required will be the pure white version or color match to the adjacent ARC building.

### SHEET WATERPROOFING

The seasonal ground water table is approximately 6'-0" below grade on average based on geotechnical reports and waterproofing will be waterproofing required at the elevator pits which typically range to that depth. Sheet waterproofing maybe be applicable as the primary waterproofing with crystalline admixtures as a secondary line of defense for underground Cast-In-Place (CIP) Pit walls. All other areas not subject to hydrostatic pressure will use damp proofing methods and 15-mil under slab vapor barriers for slabs on grade.

### VAPOR RETARDERS & AIR BARRIERS

Continuous air barriers are required for code compliance and a self-adhering membrane will be incorporated in exterior enclosure wall assemblies that are not curtainwall glazing. The appropriate perm ratings and product options must be developed with a full specification. Fluid applied membranes and encouraged over concrete or masonry substrates.

## INTERIOR ENVIRONMENT

### INTERIOR DOORS

A mix of aluminum and glass doors, wood doors and HM doors & Frames will be specified with appropriate hardware based on function and will be further developed.

### INTERIOR PARTITION WALLS

Refer to floor plan layout for partition designation. Metal stud framing shall be 6" to achieve full floor spans at a more typical stud gauge. All finish of GWB interior Partitions shall be level 4 minimum. Building Mechanical and support spaces can have masonry wall where feasible when durability is a concern.

### OPERABLE PARTITIONS

Flexible and moveable partitions appropriate for the room spans and capable of providing the STC ratings required shall be selected for use on the project where ME Lab flexibility is required.

### INTERIOR GLAZED PARTITIONS

Unitized interior glazing system with aluminum frames will be used to admit maximum daylight into spaces and maintain a light open feel for interior spaces. The interior glazing may be Insulated units to achieve STC ratings and Laminated Monolithic glass units or tempered glass for safety glazing. Interior Glazed systems shall be able to span vertically up to 9'-0".

### CEILINGS

Accessible Acoustic Ceilings Systems shall be provided and coordinated with equipment access requirements. The ceilings will play a significant role in the acoustic treatment of the spaces and must be develop and specified.
Reference room data sheets for space requirements. Ceiling product as basis is a noncombustible ceiling panel product. Typical Ceiling heights 10'-0" above finish floor and in exposed deck area High-Hat workspace must be preserved with a 12'-0" clear head height.

## INTERIOR ENVIRONMENT

### FLOORS

Specialized flooring systems must be defined and designated in the documents but must address slip resistance, chemical resistance, static dissipation, and ease of cleaning depending on the type of space. Reference room data sheets for space requirements.

### CASEWORK

Majority of casework will be laboratory grade metal casework. There will be minimal standard fixed casework following a custom Grade AWI standard.  Refer to the Room Data Sheets and Division 12 specs and the ARC for details and quality standards.

### CONVEYING SYSTEMS

Machine Room-less Electric traction elevators are to be considered. Current service contracts on campus are Kone which should be factored as basis of design in the selection evaluation. Class 'A' Loading will be applicable for the elevators with a minimum 5000 lb capacity. Two elevators are anticipated for the Engineering building with 2 separate hoistways. The elevator associated with Back-of-house rooms shall have a 2-sided entry.  At least one Elevator must stop at the mechanical penthouse.

# 03. NARRATIVES

## 03.1 SITE DESIGN

### CAMPUS UTILITIES

Coordination of the existing campus Utility services and storm water management system is critical to support the development of the Engineering building.

A list of Services include:

- Campus Chilled Water Loop
- Campus Reuse/Reclaimed Water Loop
- Dedicated Irrigation Loop.
- Underground Potable Water
- Underground Storm Sewer System
- Underground Sanitary Sewer System
- Underground Gas lines
- Underground Communication Lines
- Underground Electric

### UTILITY RELOCATION

There are several infrastructure items on the site that may require relocation base on the engineering building footprint. “Remove, relocate and repair” scope must be factored.

- Storm Water Catch Basin/Inlet
- Fire Hydrant
- Campus Light Pole & Fixture

### ENVIRONMENTAL SITE ASSESSMENT

The adjacent sites on campus (IST & ARC etc.) found evidence of radon present.  The buildings on those parcels have incorporated passive radon mitigation system infrastructure.
Site assessment/evaluation may be required, and a full design factored based on findings.

### DRIVEWAYS & PATHWAYS

Enhanced Service drive details have been developed for transitions between concrete sidewalk and asphalt paved drives. coordinate with owner for current details.
When the service drive surface is disrupted due to construction/utility work, the repair must be coordinated to define the resurfacing extent, so the final surface appears as a single patch. (Multiple patches or lines of repair across the drive is not desired)

Concrete sidewalks and pathway are to have thickened edges and match adjacent work.
Crosswalks at Curb cuts must follow Florida polytechnics paver design campus Standards. Verify with owner.

## 03.3 STRUCTURAL

### 1. Project Description

The Florida Polytechnic University (FPU) Engineering Building will consist of a two-story structure with an enclosed penthouse designed to accommodate laboratories, offices, and shell space. Located directly adjacent to the recently completed Applied Research Center (ARC) Building, the Engineering Building is the next step in the Master Plan for the university.

### 2. Applicable Codesand Standards

The structural system for the building shall be designed in accordance with the following codes and standards:

a. Florida Building Code Seventh Edition (2020) with 2021 Supplement.

b. ASCE 7-16: Minimum Design Loads for Buildings and Other Structures.

c. ACI 318-14: Building Code Requirements for Structural Concrete.

d. AISC 360-16: Specification for Structural Steel Buildings.

### 3. Gravity Loads

The design dead loads shall be the actual weights of all structural building materials that are part of the structure and cladding. In addition, the following live loads and superimposed dead loads will be accommodated in the structural design:

a. Live Loads
- Typical Floors = 100 PSF (Reducible)
- Mechanical Rooms = 150 PSF (Nonreducible)
- Mechanical Penthouse = 150 PSF (Nonreducible)
- Stairs and Exit Ways = 100 PSF (Nonreducible)
- Roofs = 20 PSF (Reducible)

Live loads can be reduced in accordance with the Florida Building Code. The design roof loads Will accommodate a maximum ponded water depth of 4 inches.

b. Partition Loads

Since the typical floor live exceeds 80 PSF, an allowance for partition loads is not required.

c. Equipment Loads

Mechanical equipment for the building will be supported at the penthouse, which will be located over a portion of the second floor. The penthouse will be fully enclosed.

d. Superimposed Dead Loads
- Allowance for Ceiling/Mechanical/Electrical/Plumbing = 15 PSF
- Allowance for Roofing Material = 10 PSF

### 4. Wind Loads- ASCE7-16

The wind load criteria are as follows, based on the Florida Building Code and ASCE 7:

a. Ultimate Design Wind Speed ($V_{ULT}$) = 136 MPH

b. Nominal Design Wind Speed ($V_{ASD}$) = 113 MPH

c. Exposure Category = C

d. Building Risk Category = II

e. Wind Drift Limit = h/400 at a 25-year mean recurrence interval

f. The structure is not located in a wind-borne debris region and will be designed as enclosed. Impact-resistant exterior glazing or impact-resistant covering over exterior glazing is not required.

### 5. FloorVibration Criteria

Floor vibrations will be assessed in accordance with AISC Design Guide 11 2nd Edition, "Floor Vibrations due to Human Activity."

### 6. Foundation System

To our knowledge, a site-specific geotechnical investigation has not yet been performed; however, it is reasonable to assume that the foundation system will be similar to the recently completed ARC Building located directly to the north. The ARC Building foundation system consists of shallow foundations (spread footings) with ground improvement (vibro-replacement), which allowed for a net allowable bearing pressure of 6,000 PSF. Using a lower net allowable bearing pressure of 4,000 PSF without vibro-replacement may be appropriate for this project; however, this should be discussed with the geotechnical engineer. The final selected system shall be confirmed by the geotechnical engineer.

### 7. Ground Floor Construction

The slab-on-grade will be a 5" thick slab with turndowns at the perimeter. Local areas of thickened slab for heavy mechanical may be required. Control joints will be required and should be coordinated with the architect.

### 8. Structural FramingSystem

Typical bay size for the project will be 31'-6" by 31'-6" with some areas requiring a 42'-0" span in one direction. The structural framing system will be one of the following systems:

a. Option 1 - Composite Steel Deck on Steel Framing (Recommended): This option consists of 3 1/2" sand lightweight concrete on 3" deep 20 gage galvanized (G90) steel composite deck (6 1/2" total slab thickness) with W16 beams and W24 girders supported by steel columns. The total depth of structure will be approximately 31 inches, not including spray applied fireproofing. Where the span increases to 42'-0", the beams and girders will be W21 and W27, respectively. The roof structure will be 3" deep 20 gage galvanized (G90) steel roof deck supported by W16 steel beams and W21 girders.

b. Option 2: Concrete Beam and Slab Framing (Alternate): This option consists of a 6" thick mildly reinforced cast-in-place concrete slab with 18" wide by 24" deep concrete beams spaced at 15'-0" (at mid-span between columns) and 30" wide by 24" deep concrete girders supported by concrete columns.Where the span increases to 42'-0", the beams and girders would deepen to 30". This framing system would apply at the floor and roof. Spray applied fireproofing is not required for this framing option.

## 03.3 STRUCTURAL

Additional concrete systems including a pan-formed beam and slab system and a flat slab with drop panel system were considered; however, these systems are likely not as economical as the options listed above for a building of this size and shape.

**9. Lateral Force Resisting System**

For Option 1 above, the lateral load resistance for the building will be achieved by using steel braced frames.If Option 2 is selected, lateral load resistance for the building will be achieved using concrete moment frames.

**10. Miscellaneous Steel Framing**

Miscellaneous structural steel framing is anticipated to be required for support of the architectural façade, elevator divider beams, elevator hoist beams, hanging MEP equipment, and canopies. Steel framing will also be required at louver, door, curtain wall, and punched window attachments per Florida Product Approval requirements.

**11. Fireproofing of the Structure**

For steel construction, sprayed-on cementitious fireproofing will be required for the primary columns, beams, and braced frames. The underside of composite metal deck will not require fireproofing. Additional fireproofing is not required for the concrete framing option. Adequate concrete cover and element thicknesses will be provided to meet the fire ratings.

**12. Reinforced Concrete**

a. Minimum Concrete Compressive Strength (f'c)

- Shallow foundations 4,000 PSI at 28 days
- Steel deck slabs 4,000 PSI at 28 days
- Slabs-on-grade 4,000 PSI at 28 days
- Concrete beams and slabs 5,000 PSI at 28 days
- Concrete columns 5,000 PSI at 28 days

b. Reinforcing Steel

- All reinforcing steel shall be ASTM A 615 Grade 60.
- Smooth welded wire reinforcement shall be ASTM A 185, yield strength 65,000 PSI.

**13. Structural Steel**

a. All hot rolled steel plates, shapes, and bars shall be new steel conforming to ASTM Specification A6.

b. ASTM Specification and Grade:

- W- and WT-shapes: ASTM A992
- M- and S- shapes: ASTM A36
- C-shapes: ASTM A36
- L-shapes: ASTM A36
- Round HSS: ASTM A500, Gr B (Fy=42 KSI)
- Rectangular HSS: ASTM A500, Gr B (Fy=46 KSI)
- Base plates: ASTM A572 Gr 50
- Edge angles, bent plates, angle hangers, and angle kickers: ASTM A36.
- Connection material: ASTM A572 Gr 50

c. All bolts in structural connections shall conform to ASTM A 325 Type 1.

d. Electrodes for welding shall conform to E70XX (SMAW), F7XX (SAW), ER70S-X (GMAW), or E7XT-X (FCAW).

e. Typical anchor rods shall conform to ASTM F 1554 Grade 55 (with Supplementary requirement S1) and the size shall be 3/4" diameter and shall embed into the concrete foundation a distance of 1'-0" with a heavy head nut at the embedded end. Larger diameter anchor rods with deeper embedment should be expected at braced frame locations.

f. Grout below structural steel base plates shall be non-metallic non-shrink grout with a minimum strength of 8,000 PSI.

**14. Steel Composite Deck**

a. Composite deck shall be 40 KSI unless noted otherwise.

b. Headed stud anchors used as shear connectors for composite beams shall be AWS D1.1 Type B (Table 7.1) studs manufactured in conformance with specifications ASTM A 108 with a minimum tensile strength of 65,000 PSI.

**15. Steel Roof Deck**

a. Roof deck shall be 33 KSI unless noted otherwise.

b. Steel deck units shall be connected to all roof members with power-actuated fasteners, screws, or puddle welds.

**16. Future Expansion**

This building will not be designed for any future vertical expansion.

**17. Special Inspection**

This project is not classified as being a "Threshold Building." Special Inspection of the construction of "Threshold Buildings" is not required by the State of Florida in accordance with Chapters 471 and 553 of the Florida statutes; however, the owner may elect to include some or all the items that are typically covered under the Threshold Inspection Plan.The design team and contractor should coordinate the desired level of inspection with the owner.

**End of Structural Narrative**

## 03.4 MECHANICAL

### III. MECHANICAL SYSTEMS

#### EXECUTIVE SUMMARY

The new 40,000 sq. ft Engineering Building is to be designed with similar types and quality of systems as in the Applied Research Center. Primary function of this new building is for engineering labs, teaching labs, and offices.

New mechanical systems will be served from campus chilled water on the east side of the building and mechanical equipment located in the penthouse. Majority of level 2 will be shell space with the intent to be future lab spaces.

#### CODE REQUIREMENTS AND SITE-SPECIFIC CONDITIONS

The following applicable Codes, Standards and Guidelines are intended to be used to determine acceptable design criteria, standard of performance, workmanship, etc.

##### Applicable Codes

- 2020 Florida Building Code, Building, 7th Edition
- 2020 Florida Building Code, Mechanical, 7th Edition

##### Applicable Standards and guidelines

- ANSI/ASHRAE Standard 62.1-2016 Ventilation for Acceptable Indoor Quality
- NFPA 90A-2015 Standard for Installation of Air-Conditioning and Ventilating Systems
- NFPA 101-2016 Life Safety Code

#### BASE DESIGN CRITERIA

##### Outdoor Design Conditions

| | | Dry Bulb Temperature (°F) | Wet Bulb Temperature (°F) | Coincident Enthalpy (btu/lb) |
|---|---|---|---|---|
| Summer | Cooling Design[1] | 97.0 | 82.5 | 46.2 |
| | Cooling Coil/Dehumidification Design[2] | 82.0 | 82.0 | 45.8 |
| Winter | Heating Design[3] | 25.0 | - | - |
| | Humidification Design[4] | - | 21.0 | - |

(1) Based on the maximum Dry Bulb temperature as published in Typical Meteorological Year (TMY) data sets by the National Renewable Energy Laboratory (NREL) for Lakeland Linder Regional Airport, WMO #722119.

(2) Based on the maximum Dewpoint Temperature and corresponding Humidity Ratio as published in Typical Meteorological Year (TMY) data sets by the National Renewable Energy Laboratory (NREL) for Lakeland Linder Regional Airport, WMO #722119. Dewpoint is converted to Wet Bulb and Dry Bulb is based on 100% RH.

(3) Based on the minimum Dry Bulb temperature as published in Typical Meteorological Year (TMY) data sets by the National Renewable Energy Laboratory (NREL) for Lakeland Linder Regional Airport, WMO #722119.

(4) Based on the minimum Dewpoint Temperature and corresponding Humidity Ratio as published in Typical Meteorological Year (TMY) data sets by the National Renewable Energy Laboratory (NREL) for Lakeland Linder Regional Airport, WMO #722119. Dewpoint is converted to Wet Bulb.

##### System Design Conditions

| System | Design Temperature [1] (°F) | Differential Temperature [1] (°F) |
|---|---|---|
| Chilled Water | 46 | 16 |
| Chilled Beam Water | 58 | 6 |
| Heating Hot Water | 120 | 20 |

(1) Refers to circulated fluid temperature unless otherwise indicated.

##### Terminal Device Design Conditions

| System | Design Temperature [1] (°F) | Differential Temperature [1] (°F) |
|---|---|---|
| Cooling Coils | 44 | 16 |
| Chilled Beams | 58 | 6 |
| Heating Coils | 120 | 20 |
| General Air Handling Unit Supply Air | 49 | N/A |
| | | |

(1) Refers to circulated fluid temperature unless otherwise indicated.

##### Indoor Design Conditions, Ventilation Rates and Pressure Relationships

| Space Criteria[1] | | | | | | | |
|---|---|---|---|---|---|---|---|
| Room | Temperature (°F) [2] | | Humidity (%RH) [3] | | Minimum Ventilation (ACH) [4] | | Pressure Relationship |
| | Min. | Max. | Min. | Max. | Occ. | Unoc. | |
| Office, Conference and Administrative Support Areas | 72 | 75 | (6) | 50 | (5) | | Neutral or Positive |
| Breakroom | 72 | 75 | (6) | 50 | (5) | | Negative |
| Laboratory/Support Space | 72 | 75 | (6) | 50 | 6 | 4 | Negative |

## 03.4 MECHANICAL

| Space Criteria[1] | | | | | | | |
|---|---|---|---|---|---|---|---|
| Room | Temperature (°F) [2] | | Humidity (%RH) [3] | | Minimum Ventilation (ACH) [4] | | Pressure Relationship |
| | Min. | Max. | Min. | Max. | Occ. | Unoc. | |
| Toilet rooms/Janitor Closets | 72 | 75 | (6) | 50 | (5) | | Negative |
| Corridors | 72 | 75 | (6) | 50 | (5) | | Neutral or Positive |
| Telecommunication Rooms | 72 (year round) | | (6) | 50 | NR | | Neutral |
| Mechanical and Electrical Rooms | 60-85°F Maximum | | (6) | NR | NR | | Neutral |
| Elevator Machine Room | 75 (year round) | | (6) | NR | NR | | Neutral |
| Unoccupied Spaces | 65 | 85 | (6) | NR | NR | | Neutral or Positive |

(1) Minimum – Winter Heating
Maximum – Summer Cooling.
Occ. – Occupied Air Change Rate
Unoc. – Unoccupied Air Change Rate
NR – No requirement
N/A – Not applicable.

(2) Systems will be designed to meet the indicated temperature with a ± 2°F accuracy unless otherwise noted.

(3) Systems will be designed to meet the indicated relative humidity with a ± 5% accuracy unless otherwise noted.

(4) Total air changes per hour for supply air in positive pressure or neutral rooms, or return/exhaust air in negative pressure rooms.

(5) Based on Table 6-1 of ASHRAE 62.1 Standard 2013.

(6) Mechanical humidification not planned.

### Assumed Heating and Cooling Loads

| Internal Load Density | | | | | |
|---|---|---|---|---|---|
| Space | Lighting Density (W/sf) [1] | Equipment Density (W/sf) [1] | Occupant | | |
| | | | Occupants per 1000sf [2] | Sensible BTUH [3] | Latent BTUH [3] |
| Offices, Conference, and Administrative Support Areas | 1.1 | 1.5 | (2) | 250 | 200 |

| Internal Load Density | | | | | |
|---|---|---|---|---|---|
| Space | Lighting Density (W/sf) [1] | Equipment Density (W/sf) [1] | Occupant | | |
| | | | Occupants per 1000sf [2] | Sensible BTUH [3] | Latent BTUH [3] |
| Teaching and Engineering Laboratories | 1.4 | 6.0 | (2) | 250 | 200 |
| Laboratory Support Spaces (shared Equipment Spaces) | 1.4 | 15 | (2) | 250 | 200 |
| Computer Rooms/MDF/IDF Rooms | 1.7 | To be determined by actual equipment, based on an allowance of 5,000 btu/hr per rack | - | - | - |
| Corridor | 0.7 | 0 | | | |
| Storage Rooms | 0.7 | 0 | | | |

(1) Actual load will be used where higher than the listed value.

(2) Occupant density in each space will be based on code adopted ASHRAE Standard 62.1-2010 or the actual occupant density listed in the facility program.

(3) The occupancy heat rejection will be based on ASHRAE Handbook of Fundamentals 2013.

### Infiltration

The building pressurization calculations will include an infiltration load for spaces with exterior doors.

| Type | Airflow |
|---|---|
| Main Exterior Doors | 100 cfm per 3’0” x 7’0” door |
| Loading Dock Doors | 5 cfm per square foot of door opening area |

### Building Envelope

Performance criteria for building envelope construction materials will be in accordance with the data provided by Architect.

### Acoustic Criteria

Sound attenuation equipment will be provided based on standard design practice. Results are not guaranteed due to many items not under control of the design team and actual building usage.

## 03.4 MECHANICAL

| Space Type | Initial Goals for NC Levels (1) |
|---|---|
| Laboratory with one fume hood | NC 50 |
| Laboratory without fume hood | NC 45 |
| Support Spaces | NC 40 |
| Lecture Hall | NC 30 |
| Open Office | NC 40 |
| Private Office | NC 30 |
| Conference Rooms | NC 30 |

(1) Based on 2015 ASHRAE Handbook – HVAC Applications.

(2) Measured dBA values will be approximately 5 points higher than average NC levels. A space with NC-40 will have an average sound level of 45 dBA.

(3) Sound attenuation equipment will be provided based on standard design practice and recommendations from acoustical consultant. Based on past experience, sound attenuation devices may be required for main air handling units, exhaust fans, and downstream of supply air terminals for occupied spaces and upstream of exhaust air terminals for occupied spaces.

(4) Requirements and criteria will be further evaluated as design progresses

### Lab Equipment Exhaust

The exhaust air requirements for fume hoods will be based on maintaining a face velocity of 80 fpm through the open sash with the sash positioned at 18" above work surface.

Acid, combustible, or flammable storage cabinets are not vented unless otherwise noted.

| Hood Description/Exhaust Requirement: |
|---|
| 6'-0" high performance vertical sash benchtop hood: 700 cfm |
| 4" point (snorkel) exhaust: 80 ~ 100 cfm |

### HVAC AND PROCESS PIPING SYSTEMS DESCRIPTIONS

This section includes general descriptions for HVAC systems. Refer to Pipe Distribution Criteria for more detail.

### Chilled Water System

*System Description*

Chilled water system will consist of water chillers, primary pumps, secondary pumps, distribution piping, cooling coils in air handling units, fan coil units, and chilled beams.

Chilled water will be supplied to the building by the secondary pumps in the Central Utility Plant (CUP). Tertiary building pumps will be provided to circulate chilled water throughout this facility.

An automatic by-pass valve will be provided to by-pass the tertiary building pumps whenever there is sufficient pressure from the secondary pumps to serve the building.

Chilled water system will be variable volume system utilizing a modulating 2-way control valve at cooling coils of each cooling coil. Each tertiary distribution pump will be provided with variable frequency drive (VFD).

A differential pressure transmitter between the chilled water supply and return mains will be utilized to vary the speed of the pumps, via VFDs, to maintain a constant differential pressure between the piping mains.

An automatic bypass valve in the building be provided to maintain minimum differential pressure between supply and return pipes when one pump is operating at minimum speed.

Chilled water usage will be metered via automated BTU meter with flow rate, supply temperature and return temperature input. Data will be input to Building Automation System (BAS).

*Equipment and Components*

Chilled water tertiary pumps will be end suction type with a variable frequency drive.

The chilled water system will also include the following components:

- Cooling coils
- Appropriate valving and piping specialties

Subcircuits will be selected for linear control characteristics of the terminal device and control valve combination.

All major control valves will be sized by engineering calculations for linear control.

### Chilled Beam Cooling System

*System Description*

Chilled beam cooling will be piped to terminal coils in chilled beams throughout the facility.

Chilled beam cooling water will be generated by utilizing chilled water supplied from the Central Utility Plant (CUP) through blending loop.

Chilled beam cooling water system will consist of distribution pumps and piping and will be used to meet sensible cooling requirements for spaces.

*Equipment and Components*

Distribution pumps will be end suction type.

Subcircuits will be selected for linear control characteristics of the terminal device and control valve combination.

### Heating Hot Water System

*System Description*

Heating hot water system will serve AHU heating coils and reheat coils.

Heating hot water system will be variable volume system utilizing a modulating 2-way control valve at each terminal heating device. Distribution pumps will each be provided with VFD.

speed of the pumps, via variable frequency drives, to maintain a constant pressure differential between the piping mains.

An automatic bypass valve in the building be provided to maintain minimum differential pressure between supply and return pipes when one pump is operating at minimum speed.

*Equipment and Components*

Hot water boiler will be water tube type with sealed combustion with natural gas burner.

Distribution pumps will be base mounted end suction centrifugal type with VFDs.

The heating and reheat water system will also include the following components:

- Chemical pot feeder
- Air separator
- Bladder type expansion tank
- Make-up water assembly
- Heating coils
- Appropriate valving and piping specialties

### Pipe Distribution Criteria

| Piping Distribution Criteria | | | |
|---|---|---|---|
| **System** | **Material** | **Size Criteria** | **Pipe and Fitting Insulation** |
| Chilled Water | Type L copper piping with soldered fittings for pipes 2" and smaller and ST carbon steel piping with welded fittings for pipes 2-1/2" and larger.<br>Grooved end steel piping and fittings are optional only in mechanical rooms in lieu of welded fittings.<br>Unions will not be provided at terminal heating devices in copper piping. | Maximum pressure drop of 4 ft of water/100 ft of pipe for piping 6" or smaller.<br>10 fps maximum velocity for piping 8" and larger. | Closed cell type insulation with appropriate insulation jacket. |
| Chilled Water (Below Ground) | Piping will be pre-manufactured insulate piping (standard weight carbon steel carrier pipe, 2” polyurethane insulation and 200 mil HDPE outer jacket) or field fabricated pipes. | Maximum pressure drop of 4 ft of water/100 ft of pipe for piping 6” or smaller.<br>10 fps maximum velocity for piping 8" and larger. | 2” polyurethane insulation with appropriate insulation jacket |
| Heating Hot Water | Type L copper piping with soldered fittings for pipes 2" and smaller and ST carbon steel piping with welded fittings for pipes 2-1/2" and larger.<br>Grooved end steel piping and fittings are optional only in mechanical rooms in lieu of welded fittings.<br>Unions will not be provided at terminal heating devices in copper piping. | Maximum pressure drop of 4 ft of water/100 ft of pipe for piping 6” or smaller.<br>10 fps maximum velocity for piping 8" and larger. | Rigid glass fiber insulation with appropriate insulation jacket |
| Process Cooling | Type L copper piping with soldered fittings for pipes 2" and smaller and ST carbon steel piping with welded fittings for pipes 2-1/2" and larger.<br>Grooved end steel piping and fittings are optional only in mechanical rooms and in lieu of welded fittings.<br>Unions will not be provided at terminal heating devices in copper piping. | Maximum pressure drop of 4 ft of water/100 ft of pipe for piping 6” or smaller.<br>10 fps maximum velocity for piping 8" and larger. | Closed cell foam insulation with appropriate insulation jacket |

### HVAC AIR SYSTEMS DESCRIPTIONS

This section includes general descriptions for HVAC air systems. Refer to Duct Distribution Criteria for more detail.

### Air Handling Systems

*System Description*

<u>General Areas</u>

Factory fabricated semi-custom air handling units serve the building.

Systems will be single duct variable air volume reheat systems, providing heating and cooling to the spaces.

Air will be supplied to all appropriate spaces and a portion of this air will be removed to outside by the laboratory exhaust system. The balance of air supplied to spaces will be returned to the air handling units or relieved to outside. The remaining portion of air not returned to the air handling unit will be utilized as make-up air for the exhaust systems and building pressurization. No air from any of the laboratory or support spaces will be returned to any air handling units.

## 03.4 MECHANICAL

Ducted return air system will be used instead of return air ceiling plenum to return air from the spaces back to the AHUs.

In general, air handling systems will operate 10 hours per day, 5 days per week. Air handling system will provided with zone-level override controls to allow for occupancy outside of normal schedules. Air handling systems associated with laboratory spaces will operate 24 hours per day, 365 days per year.

Mechanical Room Air Handling Systems

A minimum of one air handling unit will provide cooling air for each mechanical, electrical, and telecommunications room. Systems will be single duct, constant air volume with return air.

Systems will consist of packaged fan coil units.

Systems will cycle with load.

*Equipment and Components*

| Components(1) | AHU Systems | | | |
|---|---|---|---|---|
| | Lobby, Atrium & Common Areas | North Wing | South Wing | Mechanical Room |
| Outside Air Intake Damper | X | X | X | None |
| Hot Water Preheating Coil | | X | X | None |
| Chilled Water Cooling Coils | X | X | X | X |
| Supply Fan Arrangement | Multi-fan array(2) | Multi-fan array(2) | Multi-fan array(2) | One DWDI Centrifugal |
| Supply Fan to VFD ratio | Multiple | Multiple | Multiple | No VFD |
| Sound Attenuator | Integral To Unit Supply and Inlet Sections | Duct Mounted Supply and Return Air | Duct Mounted Supply and Return Air | None |
| MERV 7, 2" Prefilters | X | X | X | X |
| MERV 13 Cartridge Final Filters | X | X | X | None |
| UV Radiation Lights downstream of cooling coil | X | X | X | None |
| Isolation/Smoke Dampers | X | X | X | None |
| Electronic Airflow Measuring Stations | X | X | X | None |
| Return Fan Arrangement | Ducted Inline or Floor Mounted Centrifugal | Ducted Inline or Floor Mounted Centrifugal | Ducted Inline or Floor Mounted Centrifugal | None |
| Return Fan to VFD ratio | 1:1 | 1:1 | 1:1 | None |
| Return Air Damper | X | X | X | None |
| Relief Air Damper | X | None | None | None |

(1) Components are not listed in airflow tunnel order.

(2) Quantity of fans dependent on size of unit. Utilize economies of scale to select the appropriate number of fans for each individual unit.

Supply fans will be plenum type with airfoil blades. Fan speed and air volume will be modulated through variable frequency drives (VFDs) controlled by supply duct static pressure controller.

Return fans will be single width single inlet centrifugal or mixed flow type with air foil blades. Fan speed and air volume will be modulated through VFDs controlled by return fan discharge static pressure controller.

*Design Criteria*

| Air Handling Unit Maximum allowable nominal face velocities at Maximum airflow | |
|---|---|
| Air Intake Louvers | 400 fpm through free area of louver |
| Intake Hoods | 400 fpm through free area of louver |
| Relief Hoods | 800 fpm through free area of louver |
| Hot Water Heating Coils | 650 fpm |
| Chilled Water Cooling Coils | 450 fpm |
| Pre-filters | 500 fpm |
| Final-filters | 500 fpm |
| Sound Attenuating Devices | Located in AHU: 500 fpm<br>Located in ductwork: Maximum 1,200 fpm or maximum 0.25" w.g. |

## 03.4 MECHANICAL

### Laboratory Exhaust Systems

*System Description*

Combined Laboratory Exhaust System

Laboratories will be served by an individual central exhaust air system. The systems will combine laboratory fume hood and snorkels with general exhaust. The system will be sized to accommodate future fume hood growth established in the Systems Diversity section.

Systems will consist of exhaust fans connected to common exhaust fan inlet plenums and will be located on the roof. Multiple fans within each system are intended to operate in parallel and will each be sized for a fraction of the design load.

Laboratory exhaust system will be variable air volume. While the system is variable air volume, the exhaust fans operate at constant volume to maintain a constant stack discharge velocity. A static pressure sensor in the exhaust fan inlet plenum modulates an outside air bypass damper, introducing the required outside air into the plenum to maintain a constant flow rate through the fans.

Each system will operate 24 hours per day, 365 days per year.

*Equipment and Components*

| Components | Lab Exhaust Systems | |
|---|---|---|
| | | South Wing System |
| Common exhaust fan intake plenum | | X |
| Sound attenuating device. | | X |
| Isolation damper at each fan inlet. | | X |
| Exhaust fans | | SWDI Centrifugal fan |
| Exhaust stack for each fan discharge. | | X |
| Outside air bypass with sound attenuating rain hood and control damper. | | X |

Exhaust fans will be of AMCA Class "C" spark-proof construction with bearings and motors out of the air stream. Motors will be provided with VFDs that have electric brakes to prevent counter rotation during start up.

Fans will have corrosion resistant coating on surfaces in contact with air stream

Induced flow exhaust fans will be used to dilute contaminated air at the stack outlet and increase outlet air volume.

Fans will have packless type sound attenuating devices on the exhaust main.

### Air Terminal Devices

Individual spaces up to two spaces having a common exterior exposure or a common interior space, and common occupancy, will be served by one supply air terminal (AT) device.

One air terminal device will be provided where individual space temperature control is required.

Air terminal devices will be utilized for fume hoods, snorkel exhausts, and general exhaust.

| Air Terminal Devices | | | |
|---|---|---|---|
| Spaces and System | Service | Type | Sound Attenuation |
| General | Supply | Galvanized steel single blade damper ATs will have internal liner with airflow measuring ring. (1) | (2), (3) |
| | Return/Exhaust | Galvanized Steel single blade damper ATs will have internal liner with airflow measuring ring. (1) | (2), (3) |
| General Lab | Supply and Exhaust | Pressure independent ATs will have characterized plunger and fast acting 24V actuator. Supply air terminal devices will have 2-pipe chilled beams where sensible cooling would otherwise drive airflow requirements. | (3) |
| Specialty Lab Exhaust | Fume Hood Exhaust | 316 stainless steel, variable volume] pressure independent ATs will have characterized plunger and fast acting 24V actuator. | (3) |

(1) ATs will be provided with system pressure independent DDC controllers with 24 V electric actuators.

(2) Ductwork will not be lined. Sound attenuating flexible duct up to 6 ft in total length, will be provided at the diffusers and grilles to control noise. Sound attenuators at the discharge of supply and inlet of exhaust/return air terminal devices will be provided to meet noise criteria.

## 03.4 MECHANICAL

(3) Sound attenuating flexible duct up to 6 ft in total length, will be provided at diffusers and grilles to control noise. Sound attenuators at the discharge of supply and inlet of exhaust/return air terminal devices will be provided to meet noise criteria.

### General Exhaust Systems

*System Description*

General Exhaust System

The system will service toilet rooms, janitor's closets, etc.

System will consist of multiple exhaust fans that will be controlled via occupied/unoccupied control.

System will consist of exhaust fans located on the roof.

The exhaust system will be variable volume to control building pressurization in response to variable outside air flow.

*Equipment and Components*

| Exhaust Components | General Exhaust Systems |
|---|---|
| Roof mounted downblast centrifugal fan | X |
| Inline exhaust fans | X |
| Fan Inlet Side Sound Attenuator | X |
| Automatic damper | X |

### Ductwork Systems

Ductwork will be constructed in accordance with SMACNA Standards for appropriate pressure class. Ductwork will be sealed to meet SMACNA Seal Class A as a minimum and to limit ductwork leakage not exceeding 1% of the design flow rate for high pressure ductwork and 2% for low pressure ductwork.

*Supply and Return/Exhaust System with Air Terminals*

| Description | Construction | Design Criteria | Insulation |
|---|---|---|---|
| Air Handling Unit to Air terminal (AT) Device | Galvanized Steel +6" Pressure Class | (1) | Fiberglass insulation |
| AT Device to Supply Diffuser | Galvanized Steel +2" Pressure class<br>Ductwork will be lined for 5 ft | (2) | Fiberglass insulation |
| | downstream of air terminal devices | | |
| Return/Exhaust Fan to AT Device | Galvanized Steel (-4)" Pressure class | (1) | None |
| AT Device to Return/Exhaust Grille | Galvanized Steel (-2)" Pressure class | (2) | None |

(1) Maximum pressure drop of 0.15"/100 ft when ≤ 10,000 cfm
Maximum velocity of 2,000 fpm when > 10,000 cfm
Maximum velocity of 2,500 fpm when > 10,000 cfm in mechanical room, risers in shafts, and where space constraints dictate quantity of fans dependent on size of unit. Utilize economies of scale to select the appropriate number of fans for each individual unit.

(2) Maximum pressure drop of 0.1"/100 ft when ≤ 8,000 cfm
Maximum velocity of 1,600 fpm when > 8,000 cfm

*Lab Exhaust*

| System | Construction | Design Criteria | Insulation |
|---|---|---|---|
| From Equipment, Grille, etc. to Air Terminal Device | (-2)" Pressure class 316 stainless steel, all welded construction | (1) | None |
| Exhaust Fan Stack Discharge Velocity | +10" Pressure class 316 stainless steel, all welded construction | (3) | None |

(1) Maximum pressure drop of 0.1"/100 ft when ≤ 8,000 cfm

(2) Maximum pressure drop of 0.15"/100 ft when ≤ 10,000 cfm
Maximum velocity of 2,000 fpm when > 10,000 cfm

(3) Nozzle velocity 3000 - 3500 fpm

### Miscellaneous Systems

Technology Space Cooling

Intermediate Distribution Framework (IDF) Rooms that require cooling will be provided with self-contained fan-coil units to maintain required space temperature.

Unit to include supply fan driven, filters, and DX cooling coil.

### Energy Conservation Measures

Energy Life Cycle Cost Analysis

## 03.4 MECHANICAL

Energy conservation measures will be evaluated using a life cycle cost analysis based on a whole-building energy simulation tool in accordance with Appendix G of ASHRAE 90.1-2010. The following energy conservation schemes will be included in the design based on the results of this analysis:

Demand-Controlled Ventilation

Active Chilled Beams

Outside Air Preconditioning with Energy Recovery

Office Areas

1). Chilled beams will be utilized in suitable offices.
2). Variable air volume control will be implemented.

Engineering and Teaching Laboratories

1). Chilled beams will be provided to accommodate sensible loads in the laboratory spaces without rollup doors.
2). Variable air volume control will be implemented.

Lobby, Atrium & Common Areas

1). Fixed plate energy recovery will be provided to precondition outside air with restroom and general exhaust air.
2). Demand control ventilation and variable air volume control will be implemented.

## 03.5 CONTROLS

### IV. BUILDING AUTOMATION SYSTEM

*System Description*

Mechanical systems will be controlled and monitored through a DDC based Building Automation System (BAS) with distributed processing at the local level. The overall building controls will be Johnson Controls, Inc., Siemens Building Technologies, Honeywell, Inc., Automated Logic Corporation, Schneider Electric, Alerton Technology, or Trane company. High Voltage Electric actuation will be utilized for all larger control valves and dampers while Low Voltage Electric actuation will be utilized for terminal unit control.

The control system will interface with BACnet/IP open protocol to the existing campus system. The control system will seamlessly integrate with existing site web server operator interface. Equipment and meters within the building will interface with BACnet/MSTP open protocol to the building level controller.

The control system will be standalone for monitoring and alarming at a central campus monitoring station.

The BAS will reside on the campus Enterprise network. The BAS will interface with a centralized virtual server that will provide storage capacity for recording and trending for: (1) every digital point each time the point changes state and (2) analog points on fifteen (15) minute intervals. The virtual server will provide storage capacity to trend and archive five (5) years' of data.

BAS will integrate with the following control systems/ equipment via communication based interface or dedicated contacts and will provide graphical user interfaces via BAS Web server as necessary.

| Table M29 – BAS Systems | |
|---|---|
| **System** | **Description** |
| Boilers | BAS will provide graphical interface including equipment flow diagram showing all sensing and control devices associated with the system and provide ability to monitor, schedule and override applicable controls. |
| Chilled Water | BAS will provide graphical interface including equipment flow diagram showing all sensing and control devices associated with the system and provide ability to monitor, schedule and override applicable controls. |
| | |
| Variable Frequency Drives | BAS will provide additional monitoring and remote notification for alarming. |
| HVAC equipment | Equipment will include but not be limited to air handling units, fan coil units, fume hoods, and numerous other pieces of equipment. |
| Generator System | BAS will provide additional monitoring and remote notification for alarming. |

| Table M29 – BAS Systems | |
|---|---|
| **System** | **Description** |
| Power Monitoring | BAS will provide additional monitoring for power consumption (LEED) and remote notification for alarming. |
| Lighting Control | BAS will integrate with the lighting control system for remote monitoring and scheduling. |
| Domestic Equipment: Sumps, ejectors, hot water equipment, pure water equipment, pressure boosters, etc. | BAS will provide additional monitoring as needed and remote notification for alarming of all systems. |
| CO2 Sensors | CO2 sensors will be utilized in all densely occupied spaces (conference rooms, Lecture Hall, etc.) and will be used for local demand-controlled ventilation. |
| Fume Hood and Laboratory Air Flow Control System | BAS will provide additional monitoring and remote notification for alarming. |

*Design Criteria*

DDC controllers will utilize distributed architecture and will not rely on "front-end" or higher level controller to perform required control sequence.

Systems with redundant mechanical equipment will have redundant controls installed to prevent a single controller failure from causing a total system failure.

DDC controllers serving major equipment will have a minimum of 10% spare points of each type (DI, DO, AI and AO) at each panel. For universal points, the spares will be divided evenly between the analog and digital types of points.

Control panels and DDC controllers serving equipment fed by emergency/stand-by power shall also be served by emergency/standby power. All BAS and DDC system primary controllers, PC's and communications equipment that monitors life safety and critical points (fire alarm, elevator emergency, etc.) will be supported by emergency generators. Control panels and DDC controllers fed by emergency/standby power will be served by building UPS with minimum of 5 minutes backup time.

Airflow tracking control using DDC will be utilized instead of space pressure control, to maintain the space pressure (positive, neutral or negative) as required by the programming.

Existing graphic workstations will be updated with new systems. Graphics will be designed to match any existing graphic displays on the existing system when integrate with existing systems. Transition from existing graphics to new graphics shall be seamless transition for operator in look, functionality, and operation.

Advanced alarm management strategies will prioritize alarms and suppress cascading alarms to reduce nuisance alarms.

Key performance indicators will allow the operators to understand how the building is performing, including:

1. Space temperature
2. Energy Use Intensity, EUI
3. Number of alarms or work orders

## 03.6 ELECTRICAL

### V. ELECTRICAL SYSTEMS

### EXECUTIVE SUMMARY

Utility power will be provided by a 480V, 1200A service from TECO. Backup power will be provided by a 480V, 250KW generator. Continuous power will be provided via point of use UPS units provided by FPU. Artificial lighting will be provided via energy efficient LED fixtures. Manual lighting controls will utilize wall switch and dimming. Automatic lighting controls will include occupancy and ambient light sensing technologies. Surge and lightning protection will be for the building and incoming utilities. Grounding system will be robust to ensure safety and functionality. A fire alarm system will provide monitoring and occupant notification.

### BASE DESIGN CRITERIA

#### Design Voltages

| Type | Voltage |
|---|---|
| Building Service | 480Y/277V , 3 phase, 4 wire + ground |
| Motors; ½ HP and larger | 480V, 3 phase, 3 wire |
| Motors; less than ½ HP | 120 or 208 Volts, 1 phase, 2 wire + ground |
| Lighting | 277 Volts, 1 phase, 2 wire + ground |
| Specific Equipment | 480 Volts, 3 phase, 3 wire + ground |
| Lab Support and Specialty Equipment | 208Y/120V, 3 phase, 4 wire |
| Receptacles | 120V, 1 phase, 2 wire + ground |

#### Equipment Sizing Criteria

*Branch Circuit Sizing Criteria*

| Type | Load |
|---|---|
| Lighting | Actual Installed VA |
| Receptacles | 180 VA per outlet (duplex or single) |
| Multiple Outlet Assemblies | 180 VA per 2' |
| Special Outlets | Actual Installed VA of Equipment Served |
| Motors | 125% of Motor VA |
| Special Equipment | Actual Installed VA |
| Special Care Area Receptacles | 300 VA per critical duplex |
| | 600 VA per normal duplex |
| | 1920 VA per dedicated receptacle at headwall |

*Diversity Factor*

Diversity factors will be used in establishing power service, feeder and equipment capacities. The diversity factor represents the ratio of the sum of the individual non-coincident maximum demands of various subdivisions of the system to the maximum demand of the complete system and will be established using historical data from similar buildings in conjunction with industry standards.

*Long Continuous Load/Demand Factors Criteria*

| Type | LCL Factor |
|---|---|
| Lighting (Continuous Loads) | 125% of installed VA |
| General Receptacles | 100% of first 10 kVA installed plus 50% of remainder |
| Motors | 125% of VA of largest motor plus 100% of VA of all other motors |
| Fixed Equipment | 100% of total installed VA |

#### Load Calculation Criteria

*Functional Area Load Density Criteria – Peak Connected*

| Functional Area | Service Load Density (VA/sq ft) | EM-SB Load Density (VA/sq ft) |
|---|---|---|
| Office Receptacle | 4.0 | 0 |
| Lighting | 1.0 | 0.2 |
| Lab | 12.0 | 2.0 |
| Lab Support | 30.0 | 10.0 |
| General Receptacle | 2.0 | 0 |
| Conference Rooms | 2.0 | 0.25 |
| Corridor | 1.0 | 0.25 |
| Public Space | 4.0 | 0.25 |
| Building Support | 2.0 | 0 |

Notes:
1. VA/sf values is based on historical data from projects with similar program elements.
2. EM-SB = Emergency -Standby

*Mechanical Equipment Load Density Criteria - Peak Connected*

| Mechanical System | Service Load Density (VA/sq ft) | EM-SB Load Density (VA/sq ft) |
|---|---|---|
| Ventilation (V) | 2.6 | 1.5 |
| Refrigeration Systems (Process and Comfort) (R) | 0.7 | 0.1 |
| Heating Systems (H) | 0.3 | 0 |

## 03.6 ELECTRICAL

| Mechanical System | Service Load Density (VA/sq ft) | EM-SB Load Density (VA/sq ft) |
|---|---|---|
| Piping Systems (P) | 1.2 | 0 |
| Miscellaneous Equipment (M) | 1.5 | 0.7 |
| Elevators (EL) | 0.9 | 0 |

Notes:
1. VA/sf values is based on historical data from projects with similar program elements.
2. EM-SB = Emergency - Standby

### Load Tables

*System Capacity and Calculated Demand Load*

| Building Load Summary | | |
|---|---|---|
| | Normal Power | Emergency / Standby Power |
| kVA | 804 | 202 |
| VA/SF | 18.7 | 4.7 |
| W/SF | 16.8 | 4.2 |

Notes:
1. Power factor is anticipated to be 90% and is derived from historical data on recent projects with similar program elements.

### SYSTEMS DESCRIPTIONS

### Electrical Service

*System Description*

The facility will be fed from single service distribution panel or switchboard. The service will be fed from a new 480V TECO transformer located adjacent to the building. The transformer will be fed from an existing TECO primary loop along Polytechnic Circle.

*Design Criteria*

The primary system service capacity will be designed to serve the calculated connected load of the facility plus an additional 20% for anticipated future loads.

Surge protection shall be provided at the main switchboard.

Switchboard distribution circuit breakers shall be fixed molded case breakers

### Emergency/Standby Power System

*System Description*

Emergency power source for the facility will consist of an Emergency Power Supply (EPS) coupled to an emergency Power Supply System (EPSS). The EPS will include single diesel operated engine generator set.

The emergency power system will be a Level 1 system per NFPA 110.

The 250KW / 312.5KVA, 480Y/277V, Emergency/Standby generator will be diesel engine driven. The sub-base fuel tank will have adequate capacity to operate the generator at full load for at least 72 hours.

The emergency/standby power generator will be located adjacent to the building. The generator set will be mounted on a concrete pad in a custom sound attenuated enclosure with turn-down intake and turn-up exhaust.

The emergency/standby power will be distributed to multiple automatic transfer switches segregated by system. Segregated systems are as described below:

| System | Associated Loads |
|---|---|
| Emergency Systems NEC Article 700 | Egress Lighting |
| | Exit Signs |
| | Fire Alarm Detection and Annunciation Systems |
| | Elevator Cab Lighting |
| Optional Standby Systems NEC Article 702 | Access Control System |
| | Telecommunication System |
| | Building Automation System (BAS) and Accessories |
| | Telecomm Rm HVAC |
| | Generator Set Accessories (lighting, receptacle, heaters, chargers) |
| | Lab refrigerators & freezers |
| | Lab servers |
| | Ventilation systems for labs with fume hoods (AHUs, EFs) |

*Design Criteria*

The capacity of the generator will be sufficient to serve the facility, with approximately 20% future capacity.

### Electrical Distribution

*System Description*

Normal Power Distribution

The normal distribution system shall include all electrical distribution equipment from the utility transformer to the branch distribution outlet device, not including those systems and devices as described in the following subsections.

Utility transformer secondary / service entrance will be distributed via 1200A rated aluminum cable and PVC conduit duct bank. The raceway will originate at the utility transformer and route into the main electrical room, where it will feed directly into the bottom of the main circuit breaker section.

## 03.6 ELECTRICAL

Distribution to the distribution panelboards will consist of EMT conduit and aluminum cable for 100 amps and larger and copper cable for less than 100 amps. Feed-through distribution will not be used to allow minimal electrical interruption during servicing.

480Y/277V distribution will be accomplished in the main electrical room utilizing distribution panelboards and lighting/appliance panelboards. Panelboards may also be located in an electrical room on the east side of the building to handle the high concentration of mechanical equipment.

208Y/120V distribution will be accomplished with a main electrical room and distribution rooms as indicated on the drawings. The electrical rooms on the second floor will align vertically / stacked with first floor. The first level rooms will house the 480:208Y/120V distribution transformer and distribution panelboard. The distribution panelboard will feed the electrical panels located within the electrical room and located at the laboratory entries.

Emergency/Standby Power Distribution

As required by Code, the feeders and branch circuit wiring to emergency loads (lighting, fire alarm, telecommunications, etc.) will be in dedicated raceway.

The emergency and standby power feeds will originate at the generator output breakers and feed enclosed main disconnects. The emergency and standby power disconnects will feed the emergency and standby power automatic transfer switches.

The emergency automatic transfer switch will feed branch fused panelboard to achieve full selective coordination. The branch fused panelboard will serve the emergency lighting.

The standby automatic transfer switch will feed a standby distribution panel. The distribution panel will feed 480V equipment and 480:208Y/120V transformers and distribution panels in the main and branch electrical rooms on the first floor. The distribution panels will feed 208Y/120V branch circuit panelboards located at the lab entries.

*Design Criteria*

Building service and distribution equipment sizes will be based on estimated demand plus known or anticipated future loads.

Power distribution equipment will be sized to support 25% spare capacity (amperes) to accommodate functional changes over the life of the building.

Power distribution equipment will be sized to include 25% spare circuit breakers plus spaces for 25% future circuit breakers

Power factor correction will be considered in the design of the power distribution system to bring the calculated power factor to 90% or better.

*Equipment and Components*

| Equipment | Description of Components |
|---|---|
| Switchboards | UL 891 construction<br>Front access NEMA 1 enclosure<br>Copper Bus<br>Main Circuit Breaker<br>Group mounted bolt-on feeder circuit breakers |
| Switchboards & Distribution Panelboards | Electronic trip circuit breakers with field-adjustable and field-changeable trip units will be used for all circuit breakers 225 amps and greater and for smaller sizes if special circumstances exist.<br>Circuit breakers 800 amps and greater will be UL listed for applications at 100% of their continuous ampere rating in their intended enclosure |
| | UL 891 listed, Front access NEMA 1 enclosure switchboards<br>UL 489 listed, NEMA 1 distribution panelboards<br>Copper Bus<br>Main Lug, Main Circuit Breaker after transformer<br>Fixed Group-mounted circuit breakers<br>Electronic trip circuit breakers with field-adjustable and field-changeable trip units will be used for all circuit breakers 225 amps and greater and for smaller sizes if special circumstances exist. |
| Branch Panelboards | UL 67 listed<br>54 Pole maximum, NEMA 1 enclosure, recessed and/or surface mounted<br>Copper Bus<br>Main Lug<br>Molded case with non-adjustable trip units to be used for all circuit breakers 225 amps and smaller<br>All circuit breakers will be bolt-on style<br>Panelboard covers will be hinged trim with door-in-door construction. |
| Distribution Transformers | 480 Delta to 208Y/120 VAC, Wye, three-phase, four-wire; 3-coil, 2-winding type; 150°C rise above 40°C ambient<br>Copper Winding<br>Transformers will incorporate vibration isolation pads in their construction located between the core/coil assembly and the transformer case. |
| Automatic Transfer Switches | Three pole<br>Copper Bus<br>WCR as indicated on riser<br>Solid Neutral<br>Open Transition Transfer Controls: Solid State microprocessor<br>Isolation Bypass: None<br>3 cycle for use with molded case breakers short circuit rating |

## 03.6 ELECTRICAL

### Grounding System

*System Description*

A complete low-impedance grounding electrode system will be provided for this facility. The grounding electrode system will include the main water service line, structural steel, Ufer ground, and ground ring around the perimeter of the building. The equipment grounding system will extend from the building service entrance equipment to the branch circuit. All grounding system connections will be made using irreversible compression connections.

Bonding jumpers will be provided as required across pipe connections to water meters, dielectric couplings in a metallic cold water system, and across expansion/deflection couplings in conduit and piping systems.

All feeders and branch circuits will be provided with an equipment ground conductor. Under no circumstances will the raceway system be used as an equipment grounding conductor.

*Design Criteria*

The grounding electrode system will be designed in accordance with NEC article 250.

System resistance to ground will be 5.0 ohms or less.

All conductors above grade will be installed in steel conduit. All conductors below grade will be installed in PVC conduit with stub-up elbows.

*Equipment and Components*

The reference ground for the equipment grounding system will be established from a structural ground grid as follows:

A No. 4/0 AWG bare copper ground wire will be installed at 30" below grade around the entire perimeter of the building. 3/4" x 10 ft driven copper ground rods (test wells) will be installed and connected to this ground loop at not-greater-than 200' intervals with a No. 4/0 AWG bare copper conductor. Steel columns in exterior walls will also be connected to this ground loop with 3/0 AWG bare copper at intervals not to exceed 60'. Interior steel columns will be connected to the exterior ground loop on each side of the building at intervals not to exceed 200' with a No. 3/0 AWG bare copper conductor.

A "Ufer" ground will be provided in the footing of the building consisting of 20' of #4 wire located 3" from the bottom of the footing.

Wall-mounted copper ground bus will be located in the main electrical room, floor electrical rooms, and voice/data rooms.

*Distribution*

A separate, insulated 3/0 AWG ground wire will be provided from the main electrical room ground bus to each floor's electrical room ground buses, underground incoming water service line ahead of meter, and underground gas line at the building entrance.

The main service entrance neutral will be bonded to the system ground bar within the switchboard by a removable bus bar link.

A code-sized, unbroken bond leader will be connecting the electrical room ground bar to the XO terminal of the local transformers.

A No. 3/0 AWG, bare copper, grounding electrode conductor will be extended to all voice/data rooms, so that those systems can be properly bonded.

A separate ground wire will be provided for all circuits.

### Lightning Protection System

*System Description*

A lightning protection system will be provided to protect structure and associated appurtenances.

*Design Criteria*

System will comply with NFPA 780 - Standard for the Installation of Lightning Protection Systems. The installer will be certified with the Lightning Protection Institute and the installing Contractor will provide a UL Master Label for the completed system.

*Equipment and Components*

Materials will be rated Class I for structure heights of 75' or less.

Air terminals will be solid copper with a tapered point, 10" minimum height, and have a mounting base suitable for the location.

Conductors will be bare-stranded aluminum, except copper will be used where installation is in contact with earth or copper surfaces.

Ground rods will be copper-clad steel, 3/4" diameter by 10' long, with a bronze mechanical-type conductor clamp.

*Distribution*

The system layout and design will encompass all exterior surfaces of the facilities under a complete zone of protection as defined by NFPA 780. Air terminal spacing will not exceed 20 ft, except spacing up to 50' is allowed for non-perimeter areas of flat roofs. Locations will comply with NFPA 780 and will generally follow the building roof ridges and/or perimeters.

One (1) down conductor will be provided for every 250 ft of building perimeter, with a minimum of two (2) conductors. Conductors will be configured to provide a two-way path to earth. Metal bodies will be bonded to the conductor system in accordance with NFPA 780.

A ground ring will be installed around the entire perimeter of the building connecting all down conductors together. Ground rods will be connected to the ground ring. The electric power service grounding system will be bonded to the Lightning Protection System.

### Lighting Systems

*System Description*

A complete lighting system for all indoor and outdoor illumination will be provided. The indoor lighting system will consist primarily of energy-efficient LED lighting fixtures. The outdoor lighting system will consist of LED fixtures.

## 03.6 ELECTRICAL

The indoor lighting control system will be digital room controller type. The control wiring between control devices will be CAT 5 cabling. The individual rooms will not tie into a central system, but they will have to option to upgrade to a central system in the future

The outdoor lighting controls will utilize photocells and BAS controlled relay with line voltage manual override switches.

Emergency/night lighting will be provided by unswitched branch circuits. These unswitched branch circuits will be fed from an emergency lighting panel. Exit signs and emergency egress lighting will be provided throughout the facility to illuminate egress corridors, stairwells, lobbies, etc. Exit and egress lighting circuits will originate from emergency system branch panels. Base design intent is that egress lighting circuits will be constant "on" with no toggle switch control.

Emergency lighting in conference rooms and classrooms will be switched / dimmed with normal lighting. Emergency lighting will be automatically adjusted to full output on loss of normal power or activation of the fire alarm system.

*Illuminance Levels Design Criteria*

| Space | Average Maintained Footcandles |
|---|---|
| Office | 30-40 |
| Laboratory, Support, Technical Area | 40-50 |
| Wet Laboratory Bench and Table Top (Bio & Life, Chemistry, Teaching) | 60-80 |
| Dry Laboratory Bench and Table Top (Optics, Elec, Mech, Comp, Data Ana) | 50-60 |
| Student Project Labs Bench and Table Top | 50-60 |
| Lounge | 20-30 |
| Machine / Automotive | 45-55 |
| Classroom | 45-55 |
| Conference / Study | 25-35 |
| Corridor | 10-20 |
| Lobby | 20-30 |
| Mech / Elec / IT | 25-35 |
| Restrooms | 10-20 |
| Storage / Janitor | 10-20 |
| Task | 40 |

*Equipment and Components*

| Space | Fixture Type |
|---|---|
| Laboratory and Laboratory Support | Direct/indirect suspended pendants |
| Office | Recessed 2' x 2' troffers |
| Common Area | Recessed downlights |
| Circulation | Recessed downlights and 2' x 2' troffers |
| Building Support | 4' chain hung lensed industrial strip |

EXIT signs will be State Fire Marshal approved LED type, located in all paths of egress.

*Lamps*

In general, LED lamps will have 3500K color temperature. Back of house and exterior LED lamps will be 4000K color temperature.

LED lamps to be LM-79 and LM-80 tested and have a minimum CRI of 80 to be supplied with applicable drivers or power supplies.

*Lighting Control*

Ambient light sensors and occupancy sensors will be utilized in select spaces to minimize energy consumption. Occupancy sensors will be combination infrared/ultrasonic type.

Dimmers will be provided in laboratories, lab support, shops, classrooms, conference rooms, a portion of the atrium, and private offices. All corridor lighting, except life-safety branch lighting, will be controlled by occupancy sensors.

*Distribution*

In general, lighting will be 277V.

All lighting circuit wiring will be in conduit and routed concealed within walls, partitions, or ceiling spaces. Surface-mounted conduit will be minimized and used only in non-finished spaces.

The ampacity of lighting circuits will be sized for 25% future growth plus 125% continuous loading factor per the National Electric Code.

### Fire Alarm System

*System Description*

The fire alarm system will be a stand-alone, fully addressable system comprised of smoke detectors, heat detectors, duct detectors, one manual pull station, and audio/visual signaling devices.

*Design Criteria*

The fire alarm system will comply with requirements of NFPA 72 for a protected premises signaling system except as modified and supplemented by this document.

A main fire alarm control panel will be located in the first floor data closet.

A fire alarm annunciator panel will be mounted at the main building entrance.

Audio/visual devices will be installed in all areas of the building in accordance with the NFPA 72 and the ADA Guidelines.

## 03.6 ELECTRICAL

Smoke detectors shall be installed as required by the Florida Building Code, Florida Fire Prevention Code and National Fire Alarm and Signaling Code.

Heat detectors will be installed in areas that are not feasible for smoke detectors and where required by code.

A manual pull station will be installed adjacent to the fire alarm control panel.

The fire alarm system will be connected to a remote monitoring station via wireless radio alarm communicator.

*Equipment and Material*

The fire alarm system will be an electronically multiplexed voice communication system.

Remote transponder panels will be used to provide supervised amplifiers and signal circuits for audio/visual devices and magnetic door holders.

The system will utilize individual, addressable photoelectric smoke detectors; addressable heat detectors; addressable manual pull station; and addressable monitor and control modules. The system will monitor all sprinkler supervisory and water flow switches and will interface with elevators, HVAC smoke control, and smoke fire dampers.

*Distribution*

All initiating and signaling devices will operate at 24VDC and will be installed in accordance with manufacturer's specifications.

All wiring will be installed in conduit. Minimum conduit size will be 3/4".

### ELECTRICAL SYSTEM STANDARDS

*Feeder and Branch Circuits*

Secondary distribution and branch circuit system design will be based on a maximum of 5 % voltage drop from the transformer to the utilization equipment

Neutral conductors derived from harmonic mitigating transformers will be capable of carrying 100% of normal phase current from transformer to first distribution panelboard. Neutral conductors from distribution panelboard to downstream panelboard or device will not be increased in size

Feeder and branch circuit sizes will be based on the load supplied and adjusted for voltage drop.

Feeder and branch circuit ampacity will not be smaller than the upstream overcurrent device or downstream equipment bus.

| Circuit Voltage Length | Wire Size |
|---|---|
| 480Y/277 volt circuits over 150' in length | Increase wire size one size for each 150' of length |
| 208Y/120 volt circuits over 100' in length | Increase wire size one size for each 100' of length |

*Receptacles*

Refer to the Laboratory Functional and Technical Criteria, in other sections of this narrative for requirements in these programmed spaces.

Laboratories, lab support, classrooms, open offices, conference rooms, atriums, lobbies, lounge, catering, storage, and support rooms, will be provided with a receptacles as required.

Enclosed offices will be provided with a double duplex receptacle at desk location.

Restrooms will be provided with one receptacle.

Corridors will provide receptacles 50' on center.

Electrical rooms will be provided with one receptacle.

IT rooms will be provide with receptacles for wall equipment and mounted to racks.

Mechanical equipment will be provided with a receptacle within 25'.

Duplex receptacles in office areas, lounges, lobbies, etc., shall be circuited with an average of (6) duplex receptacle's per 20A, single pole circuit.

Each workstation to receive minimum of (2) duplex receptacles that will be circuited with maximum of (3) workstations per 20A, single pole circuit.

Receptacles along laboratory benches shall be circuited with an average of (4) duplex receptacle's per 20A, single pole circuit.

Equipment such as refrigerators or freezers shall be connected to dedicated circuits.

Each fume hood to be provided with a minimum of (1) 20A single pole circuits.

Ground fault protection will be provided for outlets within 6' of a sink edge and other wet locations. Electrical outlets will be individually ground fault interrupted (GFCI) protected (not at the circuit breaker or first outlet on the circuit).

Dual channel surface mounted raceway will be provide in laboratories on walls and on Unistrut suspended below ceiling, as required.

Ceiling service panels will be installed in the some laboratories, be inset into ceiling grid and will have twist-lock outlets for 120V and 208V service as required to support the laboratory. Each circuit will have a dedicated neutral. Shared neutrals will not be allowed. 208V outlets will not be used to provided two 120V circuits to the lab bench.

Benchtop-mounted work surface receptacle modules will be installed some laboratories. Circuits shall be routed through umbilical to casework.

Ceiling mounted cord reel receptacles shall be provided and shops and labs, as required.

*Overcurrent Protective Device Coordination*

Overcurrent protective devices supporting emergency / NEC Article 700 power systems will be selectively coordinated from source of emergency supply through final device. Selectivity on emergency branch shall be provided through the entire instantaneous region.

Overcurrent protective devices supporting normal and optional standby power systems / NEC 702 will be selectively coordinated with supply side overcurrent protection to the greatest extent possible given the material capabilities of breaker types selected with the exception of the instantaneous region devices in keeping with industry practice.

Overcurrent protective device will be selectively coordinated with supply side overcurrent protective devices as follows:

| System | Seconds |
|---|---|
| Emergency System (NEC 700) | 0.01 |

## 03.6 ELECTRICAL

| System | Seconds |
|---|---|
| Optional Standby System (NEC 702) | 0.10 |
| Elevator Disconnecting Means | 0.01 |
| Normal Power System | 0.10 |

*Fault Current Ratings*

Short circuit withstand and interrupting ratings will be provided for electrical distribution equipment, feeder conductors, etc. based upon the actual available fault current and system motor contribution.

Equipment will have ratings not less than the calculated symmetrical short circuit value at each point in the distribution system.

Equipment will be fully rated for the calculated available short circuit. Series ratings will not be allowed.

*Conduit and Raceway*

| Conduit Types and Application | |
|---|---|
| **Conduit Type** | **Application** |
| Electrical Metallic Tubing (EMT) | Feeders and branch circuit wiring: building interior concealed, mechanical equipment rooms >6'AFF; Size 2" maximum |
| Rigid Metal Conduit (RMC) | Feeders and branch circuit wiring: areas subject to physical abuse, exterior above grade, building interior locations where EMT is not allowed. |
| Rigid Non-metallic Conduit (RNC) / PVC | Feeders and branch circuit wiring: Below grade (elbows to be RMC) |

Conduit will be run concealed, unless installed in mechanical, electrical, telecom, interstitial areas and other similar unfinished spaces.

Minimum conduit size for power circuit will be 3/4" for homeruns and 1/2" for all other.

Conduits will be independently supported.

All conduit stub-ups from below floor or in floor (where specifically allowed) will be galvanized rigid steel.

EMT fittings will be set screw type with steel body.

Conduits may be installed below floor slabs on grade.

Light fixtures, smoke detectors, junction and pull boxes and other equipment that is installed on or directly above the ceiling will be serviced and maintained without damage to ceiling tiles and other building elements.

Raceways for 2-hour rated systems shall be installed in either: UL listed assemblies for 2 hour fire rated applications or in 2-hour rated enclosures.

For lighting conduit homeruns, a j-box will be located above light fixture in an accessible location to allow for future expansion.

No home run will terminate in a wall mounted device box. A separate J-box will be provided above device box above ceiling in an accessible location.

*Wire and Cable*

| Cable Types | | |
|---|---|---|
| **Voltage Class** | **Insulation** | **Notes** |
| 600 V | THHN &THWN-2 | Conductors #10 and smaller will be solid or stranded copper. Conductors larger than #10 will be stranded copper |

All feeder conductors to be 98% conductivity copper or 65% conductivity aluminum as indicated in feeder schedules on drawing.

All branch wiring conductors will be 98% conductivity copper.

Minimum branch circuit wire size #12 AWG, for all areas.

Multi-wire branch circuits will be provided with dedicated neutral conductors for each phase, common neutral circuits will not be permitted.

Feeder conductors will be terminated using compression lugs. Mechanical lugs will not be used for feeders. Branch circuit conductors will typically be terminated using mechanical lugs.

MC cable will be allowed in offices walls only.

Conductor insulation color code will be as follows:

| Conductor Color Code | |
|---|---|
| **208Y/120V** | **480Y/277V** |
| Phase A – Black | Phase A – Brown |
| Phase B – Red | Phase B – Orange |
| Phase C – Blue | Phase C – Yellow |
| Neutral – White | Neutral – Gray |
| Ground – Green | Ground – Green |

*Wiring Devices*

Wiring devices will be specification grade, complete with all accessories

| Receptacle and Switch Color Code | |
|---|---|
| Normal Power | White |
| Emergency Power | Red |

Receptacles, switches, etc., will have faceplates with labeling indicating system panel and circuit identification.

## 03.6 ELECTRICAL

Stand-alone motor disconnects (separate from starter or VFD) will be fused and will be installed at each motor.

Motors smaller than 60 HP that are not provided with a variable frequency drive (VFD) will be provided with an across the line combination magnetic motor starter. Motors 60 HP and larger that are not provided with a variable frequency drive (VFD) will be provided with reduced voltage motor starter. Refer to other sections of the narrative for VFD requirements.

Combination motor starters will use circuit breakers or motor circuit protectors in lieu of fuses to reduce the possibility of single phasing. For mechanical and HVAC equipment that are not provided with a VFD, individual combination motor starters will be located within sight of the motor.

Selected motors will have variable frequency drives (VFDs) as described in other sections of this narrative.

VFD drive specifications will require that the VFDs for the project be provided such that the Special Category harmonic limits recommended in IEEE 519-1992 be maintained. The engineer will perform harmonic analysis as defined in IEEE 519-1992 and employ as a minimum 6 pulse VFD with equivalent 5% impedance by employing a combination of line reactors and/or DC bus choke to achieve the equivalent impedance. VFD filters and active front end VFDs may be utilized as needed.

*Grounding and Bonding*

A separate, insulated equipment grounding conductor, sized per the National Electrical Code, will be provided within each raceway and cable tray, with each end terminated on a suitable lug, bus, enclosure, or bushing.

A grounding riser with ground box will be located in the vicinity of each electrical room.

*Surge Protection*

Surge Protective Devices (SPD) will be used as design dictates. A single SPD device will be installed on the load side of each main service disconnects, the generator feeder disconnects, first panel on the load side of a distribution transformer, and any panels serving circuits that leave the building envelope.

*EMF and Harmonics*

Electrical vaults and major electrical equipment rooms containing transformers larger than 300 kVA to not be located adjacent to occupied workstations.

The power service will be required to meet the requirements IEEE Standard 519 to insure proper service. Harmonic distortion will be limited to 5 % maximum at the utility transformer secondary lugs.

*Electrical Rooms*

Electrical equipment rooms will be positioned to facilitate unobstructed initial installation of large equipment, and unobstructed removal and replacement of defective equipment.

Adequate space will be provided for maintenance of electrical equipment and equipment removal.

Pipes and other equipment foreign to the electrical equipment will not be located in, enter, or pass through such spaces or rooms.

for optimization of space.

Panelboards serving lighting and appliance circuits will be located on the same level as the circuits they serve and will be served from source of supply with a dedicated feeder. Emergency panels will be located in first floor the emergency main electrical room and will serve the entire building.

Feed through, subfed and double section panelboards will not be used unless required to comply with selective coordination requirements

*Prohibited Materials and Construction Practices*

The entire Emergency/Standby power distribution system will consist of conduit and wire. Busway will not be used in any portion of this system

Use of wood strips and wood screws to support lighting fixtures.

Extra-flexible non-labeled conduit

Conduit installation in concrete slabs

Use of wire ties to support conduit

Suspension systems for conduits, fixtures, etc. connected to other utility equipment is prohibited. Any suspension system with multiple levels must be hung from trapeze suspension systems

Use of Incompatible Materials: Aluminum fittings and boxes will not be used with steel conduit. All materials in a raceway system will be compatible

Direct burial electrical cable

*Acceptance Testing*

| Acceptance Tests | |
|---|---|
| Engine Generator | Automatic Transfer Switches |

*Accepted Manufacturers*

| Acceptable Manufacturers | |
|---|---|
| Low Voltage Distribution Equipment | Cutler Hammer, Square D, ABB-GE, Siemens |
| Generators | CAT, Cummins, MTU, Kohler |
| Automatic Transfer Switches | Russelectric, ASCO, Cummins, Zenith |
| Meters | Square D, Siemens, Cutler-Hammer |
| Lighting Controls | DLM/Watt Stopper, nLight/Acuity, Greengate/Eaton |
| Fire Alarm System | Gamewell, Notifier, Simplex |
| Wiring Devices | Cooper, Hubbell, Leviton, Pass & Seymour/Legrand |
| Surface Raceway | Wiremold/Legrand, Mono-Systems, Post Glover, Square D |
| Lighting Agencies | Envision, Tampa Bay, Sesco, Western Florida |

## 03.7 TECHNOLOGY

### VI. TECHNOLOGY SYSTEMS

### INTRODUCTION

#### Purpose

This Basis of Design (BOD) describes the magnitude, functions and requirements of the low voltage Technology systems in Florida Polytechnic University Engineering Building. It presents a description of the individual systems' proposed design and function.

#### Approach

Identify the Technology systems included in the project.

Coordinate the intrabuilding cabling plan and Technology support spaces with Florida Polytechnic University and HOK.

Coordinate the interbuilding cabling plan with Florida Polytechnic University

Coordinate Technology Systems' Mechanical, Electrical, Structural and Architectural needs with AEI and HOK.

Assist Florida Polytechnic University with selection of equipment for information technology and electronic security systems.

Coordinate development of Technology Design Documents with entire Project team.

#### Scope of Work

The Technology systems in this Project will include design and implementation information for the building structured cabling system. This system will support voice and data applications using equipment supplied by the Owner.

The building structured cabling system will also be used to support other applications including building automation and controls, access control and video.

The Technology System design will include provisions for using the building and campus data network for head-end networked communication for systems including building automation and controls, access control, video and fire alarm.

The Electronic Security System design will include IP video surveillance system and an electronic access control system for the building. The security system will tie into the existing campus video surveillance and access control systems.

#### Responsibilities

| System Name | Designed By | Installed By |
|---|---|---|
| Horizontal Structured Cabling System | AEI | Contractor |
| Backbone Structured Cabling | AEI | Contractor |
| Video Surveillance System | AEI | Contractor |
| Electronic Access Control System | AEI | Contractor |
| Audio/Visual Systems | Waveguide | Contractor |
| Wireless Local Area Network | FPU | Contractor |

**Table 1 - System responsibilities**

#### Definitions

| Definitions | |
|---|---|
| Backbone Cabling | Cables connecting BEF to MDF and MDF to IDFs |
| BEF | Building Entrance Facility - Located on first floor of the ARC building. Voice, data and video services are brought into the building in this room. |
| | |
| Cable | Assembly of one or more conductors or optical fibers within enveloping sheath, constructed to permit the use of conductors singly or in groups. |
| Cable Link | Includes SIO, station cable and termination hardware in consolidation points and MDF or IDF. |
| Cable Channel | Same as Cable Link, plus patch cords at SIO and in MDF or IDF. |
| Consolidation Point | Interconnection point within the horizontal cabling using TIA-568-C compliant connecting hardware rated for at least 200 cycles of reconnection. |
| Cross-Connect | Group of connection points, wall or rack mounted, used to mechanically terminate and administer building wiring. |
| Faceplate | Component at SIO that holds the jacks. |
| Horizontal Cabling | Cables connecting SIOs to MDF, IDFs and consolidation points. |
| IDF | Intermediate Distribution Frame - Used to distribute station cabling to workstation outlets and to house communications equipment. |
| Intrabuilding | Within a single building. |
| Interbuilding | Between two or more buildings. |
| IT | Information Technology |
| Jack | Modular connector located in SIO. |

## 03.7 TECHNOLOGY

| Definitions | |
|---|---|
| LAN | Local Area Network - Network or networks typically covering a small geographic area. Typically includes only Client-owned cabling and equipment. |
| MDF | Main Distribution Frame - Located on the first floor of the ARC building. Building voice, data and video services are distributed to IDFs on all levels from this room. |
| | |
| Outlet | See SIO |
| STP | Shielded Twisted Pair - Balanced, 4-pair cable used for copper station cabling. Each pair is wrapped with a shielding material and the overall cable is also wrapped with a shielding material. |
| | |
| SIO | Standard Information Outlet - A device assembly located in work area on which station cabling terminates and which can receive modular connectors. |
| Station Cabling | See Horizontal Cabling. |
| Telecommunications | Any transmission, emission, or reception of signs, signals, writings, images, sounds, or information of any nature by wire, radio, visual, optical, or other electromagnetic systems. |
| UTP | Unshielded Twisted Pair - Balanced, 4-pair cable used for copper station cabling and multi-pair copper backbone cables. |
| WAN | Wide Area Network - Network or networks typically covering a large geographic area. Typically includes Client-owned and service provider-owned cabling and equipment. |
| WAP | Wireless Access Point - Device that allows wireless devices to connect to a wire network. |

**Table 2 - Definitions**

### STRUCTURED CABLING

#### Load Calculation Criteria

The following outlet quantities indicate the general outlet densities expected for the project. Specific requirements to satisfy user needs will be implemented as space programming is completed.

The values in this table show the number of faceplates in each room and the number of jacks at each faceplate. For example, a conference room would have a total of 4 faceplates containing a total of 7 voice and 9 data jacks:

| Room or Space Function | No. of Faceplates | Voice Jacks per Faceplate | Data Jacks per Faceplate | Fiber Jacks per Faceplate |
|---|---|---|---|---|
| Typical Office | 2 | 0 | 2 | 0 |
| Conference Room | 1 | 0 | 2 | 0 |
| | 1 | 0 | 4 | 0 |
| Modular Furniture | 1 | 0 | 2 | 0 |
| Lab Support Rooms | As needed | 0 | 1 | 0 |
| Research Labs – Room | 1 | 0 | 2 | 0 |
| Research Labs – Bench top (per 8 lf of bench) | 1 | 0 | 1 | 0 |

**Table 3 - Outlet Quantities**

#### Equipment Sizing Criteria

*Pathways*

Cable pathways will be sized for a growth factor of three, or spare pathways will be provided to allow for growth. Typical pathway sizing is as follows:

- Station - 1" minimum conduit size.
- Reduce minimum conduit size to 3/4" when appropriate.
- Pathways will be installed to connect BEF, MDF and IDFs in an efficient manner.

*Termination and Mounting Space*

Equipment racks and wall fields will be sized with a minimum of 30% spare capacity.

*Copper Voice Backbones*

Interbuilding copper voice backbones will be sized at 50-pairs.

Intrabuilding copper voice backbones will be 25-pair per IDF.

*Network Electronics*

Network electronics will be sized, furnished and installed by the Owner.

#### System Descriptions

The structured cabling system will be provided as a certified cabling system. The manufacturer or manufacturers of the cable and termination components will qualify and warranty the performance of the entire system.

*Support Rooms*

All Technology support rooms have several common requirements. Each room will be provided with card access security control, emergency and/or UPS power and continuous HVAC cooling.

## 03.7 TECHNOLOGY

The support rooms should be located central to the areas that they serve and have clear access to cable pathways coming in and out of the rooms. Pedestrian and equipment access should be through a door located off a building corridor and should not require access through any other locked room. Door width will be at least three feet.

Suspended ceilings should not typically be provided; however, some means of maintaining the environmental parameters of the rooms must be implemented. If a suspended ceiling is required to maintain environmental integrity, the ceiling should be installed high enough to allow all pathways and room services to come into the rooms below the ceiling.

Floors, walls and ceilings in the support rooms will be treated to minimize dust and the potential for static electricity. At least two walls will be covered with fire treated plywood (3/4-inch-thick, 8 feet high, A-C grade).

*Building Entrance Facility (BEF)*

Interbuilding services will be brought into the facility at the BEF and the building demarcation will be located in this room. External service providers will bring services into this room for connection to the building's cabling system.

The BEF will be collocated in the Main Distribution Frame (see below).

*Main Distribution Frame (MDF)*

The building MDF provides a protected environment for terminating all backbone cables and is located on the first floor of the ARC building. This room is where the building Technology systems connect to the campus Technology systems and distribute to the rest of the ARC.

The MDF requires a minimum of 120 total square feet of space. The room will house voice PBX, voice cable terminations, data network equipment and data cable terminations.

*Intermediate Distribution Frames (IDF)*

Each floor will have two (2) IDFs, and each IDF will connect to the building MDF with intrabuilding backbone cabling. The IDFs provide a protected environment for terminating backbone cabling and station cabling on each floor and Technology services to the floor will be provided from the IDFs. Network electronics will also be housed in the IDFs.

Each IDF requires a minimum of 120 square feet (10 feet by 12 feet) of space.

### Backbone Cabling

*Backbone cable summary table*

| Backbone Cable Application | Cable Type | Cable Quantity |
|---|---|---|
| Interbuilding Data (i.e. computer networking) | SM Fiber Optic | 48 Strands Each |
| Interbuilding Voice | Copper UTP | 50 Pairs |
| Security (i.e. CCTV) Cameras | SM Fiber Optic | 12 Strands |

**Table 4 - Backbone Cabling**

The existing campus duct bank and manhole system will extend to the ARC to provide connection to the Campus Technology infrastructure. All Technology services for the ARC will enter through the duct bank and manhole system.

*Interbuilding Data Backbone Cabling and Connection Hardware*

The data system will use fiber optic cabling to bring data service into the building at the MDF from the existing campus fiber network. The data backbone will be sized at 48 single mode fiber optic strands.

All fiber strands will terminate on duplex LC connectors in rack mounted patch panels in the MDF.

*Intrabuilding Data Backbone Cabling and Connection Hardware*

The data system will use fiber optic cabling to distribute data service from the MDF to the IDFs. The data backbone from the MDF to each IDF will be sized at 24 total single mode strands.

All fiber strands will terminate on duplex LC connectors in rack mounted patch panels in the MDF and IDFs.

*Interbuilding Voice Backbone Cabling and Connection Hardware*

The voice system will use high pair-count copper cabling to bring voice service into the building at the MDF. The voice backbone will be sized at 50 pairs.

All cable pairs will terminate on wall-mounted protector panels and be cross-connected to wall-mounted system terminal blocks.

*Intrabuilding Voice Backbone Cabling and Connection Hardware*

The voice system will use high pair-count copper cabling to distribute voice service from the MDF to the IDFs. The voice backbone will typically be sized at 25 pairs per IDF.

All cable pairs will terminate on wall-mounted 110-blocks.

### Station Cabling

| Station Cable Application | Cable Type | Cable Quality |
|---|---|---|
| Data (i.e. computer networking) | Copper UTP | CAT6A |
| Wireless Data (i.e. WAP connections) | Copper UTP | CAT6A |
| Security (i.e. CCTV) Cameras | Copper UTP | CAT6A |

**Table 5 - Station Cabling Summary**

*Data Station Cabling and Connecting Hardware*

Each data jack will connect to the nearest IDF with a 4-pair UTP, Category 6A cable. All four pairs will terminate at the outlet and in the IDF.

Category 6A rated 8P8C type jacks will be used at the outlet locations and rack mounted patch panels will be used in the IDFs.

Cables from SIOs will run in conduit, J-hooks and cable trays to the IDFs.

## 03.7 TECHNOLOGY

### Support Equipment

*Innerduct*

All backbone fiber optic cabling will be installed in flexible, nonmetallic innerduct. This innerduct will protect the cables and segregate conduits and conduit sleeves.

*Equipment Racks*

All copper and fiber optic patch panels will be installed in 7-foot-high, standard TIA 19" equipment racks.

Horizontal and vertical cable management will be provided in all equipment racks.

*Cable Raceways*

The cable raceway system will consist of a combination of cable tray, J-hooks, conduit, surface raceway, cable runway and D-rings. The cable runway and D-rings will only be used in the support rooms.

Cable pathways from the SIOs to the IDFs will use conduit above inaccessible ceilings, cable tray above accessible ceilings and major cable runs and J-hooks for aggregating small quantities of cables in common areas.

*Grounding System*

The Technology grounding system will provide equipment protection in all support rooms. Ground bars and conductors will be provided to minimize the potential difference between the grounding system and the electrical sources powering the Technology equipment.

### MEP Requirements

No piping or ductwork will pass over or through any Technology support room, unless they are used to provide services to the support rooms. Piping and ductwork used to provide services to these rooms will be coordinated with the anticipated Technology equipment layout within the rooms.

*Electrical Requirements*

Technology support rooms will be connected to the building standby power source. Rack-mounted UPS equipment will be used to maintain system operation while the standby power source comes on-line.

| Electrical Circuit Type | Source | Circuit Quantity | Device Type |
|---|---|---|---|
| 120V, 20A | UPS | (1) per equipment rack | L5-20R |
| 120V, 30A | UPS | (1) Per equipment rack | L6-30R |

**Table 6 - MDF Electrical Service**

Electrical service for the MDF will be sized at 100 watts per square foot.

| Electrical Circuit Type | Source | Circuit Quantity | Device Type |
|---|---|---|---|
| 120V, 20A | UPS | (1) per equipment rack | L5-20R |
| 120V, 30A | UPS | (1) per equipment rack | L6-30R |

**Table 7 - IDF Electrical Service**

Electrical service for the IDFs will be sized at 100 watts per square foot.

Technology support rooms will be lit to a minimum of 50-foot candles horizontal illumination and 20-foot candles vertical illumination between the equipment rack rows (measured at three feet above the floor).

Access to Technology support rooms will be controlled by the building access control system to allow the Owner to track access to the rooms.

*Mechanical Requirements*

Technology support rooms will be maintained at between 68 and 72 degrees Fahrenheit with 30% to 50% relative humidity at all times. If the building HVAC system cannot provide continuous operation or adequate capacity to meet these criteria, supplemental cooling units will be installed.

Cooling requirements for the MDF will be sized at 75 watts per square foot.

Cooling requirements for the IDFs will be sized at 50 watts per square foot.

*Piping Requirements*

The MDF and IDFs will be sprinkled and include protective cages around the sprinkler heads.

### WIRELESS LOCAL AREA NETWORK

The Wireless LAN will be designed by FPU. AEI will provide structured and connectivity at each wireless access point (WAP) location identified by FPU. WAPs will be provided by FPU and installed by the contractor.

### AUDIO-VISUAL

The audio-visual system will be designed by Waveguide and installed by the contractor. AEI will coordinate with Waveguide to meet their data drop requirements for any A/V equipment.

### ACCESS CONTROL

The electronic access control system will be designed by AEI and installed by the contractor. The new system will match or interoperate with the existing campus access control system. The access control system is limited to electronic equipment including proximity readers, keypads, electric strikes, magnetic locks, door position switches and electronic requests-to-exit. All door hardware design and installation will be provided by the door hardware consultant/vendor. AEI will coordinate with FPU to determine which doors require controlled access.

### CCTV

AEI will coordinate with FPU to design a POE IP video surveillance system. The new video surveillance system will match or interoperate with the existing campus video surveillance system. All cameras, licenses, cabling and connectivity will be provided and installed by the contractor.

## 03.8 PIPING SYSTEMS

### SYSTEM DESCRIPTIONS

#### Storm and Clearwater Drainage

*System Description*

A storm drainage system will be provided to convey rainwater from flat roofs to site storm sewers

Secondary roof drainage will be accomplished by using a dedicated piped overflow drainage system separate from the primary storm drainage system which will discharge through the building wall onto grade.

Clearwater waste from air handling units, coolers, and other devices and equipment that discharge clearwater will be conveyed by gravity flow through a separate piping system and will connect to the building storm drain.

*Design Criteria*

The primary storm drainage system will be sized based on a maximum rainfall rate of 5 in/hr. The secondary storm drainage system will be sized based on the same design criteria as the primary system.

The sizing for all clearwater discharge from equipment system will be based on the maximum flow rate of the equipment.

*Equipment and Material*

Storm and clearwater drainage systems which cannot discharge to the storm sewer by gravity flow will be drained by gravity to a sump with pump(s) and will be pumped into the building storm drainage system.

Sump pumps will be connected to the emergency (standby) power system to permit operation during a loss of normal power.

*Distribution*

| Storm and Clearwater Waste Systems Materials | | |
|---|---|---|
| **System** | **Below Ground** | **Above Ground** |
| Storm and Clearwater Waste and Vent | Schedule 40 PVC with DWV pattern solvent cement socket fitting joints | Hubless cast-iron pipe with heavyweight no-hub couplings with stainless steel clamps |
| Pressurized Storm and Clearwater Waste and Vent | Schedule 40 PVC with solvent cement socket fitting joints | • Schedule 40 PVC with solvent cement socket fitting joints |

Roof and overflow drain bodies and above ground storm, secondary roof drainage and clearwater waste piping will be insulated.

#### Waste and Vent Systems

*System Description*

A sanitary waste and vent system will be provided for all plumbing fixtures and other devices that produce sanitary waste. Plumbing fixtures will be drained by gravity through conventional soil, waste and vent stacks, building drains and building sewers to the site sewer.

Plumbing fixtures in laboratories and laboratory support spaces will be provided with a drainage system separate from the sanitary drainage system. The laboratory waste system will drain by gravity flow to a sampling manhole located exterior to the building. The effluent from the sampling manhole will discharge to the sanitary sewer outside the building.

All fixtures will have traps and will be vented through the roof. Vent terminals will be located away from air intakes, exhausts, doors, openable windows and parapet walls at distances required by the plumbing code.

*Design Criteria*

The waste and vent piping will be sized in accordance with code requirements.

*Equipment and Material*

Waste receptors will be provided with electronic automatic trap primers when subject to loss of their trap seals due to evaporation caused by infrequent use.

*Distribution*

| Waste System Materials | | |
|---|---|---|
| **System** | **Below Ground** | **Above Ground** |
| Gravity Sanitary Waste and Vent | Schedule 40 PVC with DWV pattern solvent cement socket fitting joints | Hubless cast-iron pipe with heavyweight no-hub couplings with stainless steel clamps |
| Pressurized Sanitary Waste | Schedule 40 PVC with DWV pattern solvent cement socket fitting joints | Copper water tube, Type L, soldered joints and fittings |
| Laboratory Waste and Vent | CPVC, Sch 40, ASTM D1784 and ASTM F2618 with SWV pattern fittings, ASTM D3311. Solvent | CPVC, Sch 40, ASTM D1784 and ASTM F2618 with SWV pattern fittings, ASTM D3311. Solvent joints, |

## 03.8 PIPING SYSTEMS

| Waste System Materials | | |
|---|---|---|
| System | Below Ground | Above Ground |
| | joints, ASTTM F493. | ASTTM F493 |

Waste piping will be pitched according to code to maintain a minimum velocity of 2 fps when flowing half full.

Vents and the venting systems will be designed and installed so that the water seal of a trap will be subject to a maximum pneumatic pressure differential equal to 1" water column. This will be accomplished by sizing and locating the vents in accordance with the venting tables contained in the plumbing code.

### Elevator Sump Pumps

*System Description*

An elevator sump shall be required in the base of each elevator pit. Unless noted otherwise sump pit shall be formed into the elevator hoist-way base. Sump pump discharge will be with an air gap to a receptor and into the building sanitary drainage system.

*Design Criteria*

Sump pump will be sized in accordance with code requirements. Provide a pump sufficient to discharge 50 gpm per elevator hoist-way.

*Equipment and Material*

Sump pump shall be submersible type. Sump pumps will be connected to the emergency (standby) power system to permit operation during a loss of normal power.

*Distribution*

Piping shall be the same material and joint type as pressurized sanitary waste system.

### Domestic and Nonpotable Water

*System Description*

Domestic water will be provided to all toilet room fixtures, electric water coolers/drinking fountains, sinks, emergency shower/eyewash units, and any other devices that require a domestic water supply.

Water softeners will be provided for DHW systems.

Domestic hot water (DHW) will be delivered at 120°F to all fixtures and devices that require hot water. DHW serving lavatories in public toilets will be delivered at a temperature of <110°F per Florida Plumbing Code.

Emergency showers and eyewashes will be supplied with tepid water per the ANSI Z358.1 definition of tepid water.

All sinks and equipment located in laboratories and lab support spaces that require water will be supplied from the domestic water system. All lab sinks and equipment will be provided with vacuum breakers to provide isolation for the domestic system per the Lab Planners layout.

Non-potable water system will provide make-up water mechanical (HVAC) systems such as heating hot water, chilled water, and cooling towers. A reduced pressure backflow preventer will protect the domestic water supply.

*Design Criteria*

Each water heater will be sized for 50% of the design hot water load at an outlet temperature of 140°F.

Backflow preventers will be sized for 100% of the design flow.

*Equipment and Material*

The building's water system will be isolated from the municipal water system by a duplex reduced pressure backflow preventer located exterior of building.

Domestic hot water will be produced by a gas-fired, storage-type water heaters.

Legionella control in the domestic hot water system will be accomplished by heating and storing the water at 140F.

The hot water system temperature will be maintained by recirculating the hot water through a continuous loop(s) with an in-line circulating pump.

Water hammer arrestors will be provided at all quick closing solenoid valves and at other potential water hammer sources.

Tepid water to emergency fixtures will be provided by a local ASSE 1071 compliant mixing valve at each fixture.

Sub-metering of domestic water main supply into building, water supply to the Public Toilet cores and domestic hot water supply will be added for compliance with LEED water metering credits.

*Distribution*

| Water System Materials | | |
|---|---|---|
| Size | Below Ground | Above Ground |
| 2-1/2" and smaller:<br>Copper | Copper water tube, Type K, soldered joints and wrought copper fittings | Type L copper tube with soldered joints and wrought copper fittings |
| Underground (3" and larger):<br>Ductile Iron | Ductile iron, Class 52, AWWA C151, cement mortar lined with restrained mechanical joints and ductile iron fittings | Not applicable |
| Copper (3" and larger) | Not applicable | Type K copper tube with brazed joints and wrought copper fittings with rolled groove couplings |
| | | |

Piping 2-1/2" and larger and located in mechanical equipment rooms may be rolled groove mechanical joints.

## 03.8 PIPING SYSTEMS

The hot water system will be insulated in accordance with Code. The cold water system will be insulated to prevent condensation from forming. Isolation valves will be provided at all riser connections, branch piping run-outs to fixture groups, and at devices requiring maintenance.

The piping will be sized to limit the velocity in any section of the system to a maximum of 7 fps for cold water system and 4 fps for hot water and hot water circulating systems.

| Plumbing Fixtures | | | |
|---|---|---|---|
| **Fixture** | **Type** | **Operation** | **Flow Rate** |
| Water Closets | Wall hung, vitreous china, with elongated bowls, high efficiency. | Flush valves will be piston type, sensor operated, hard wired | 1.28 gallon flush |
| Urinals | Wall hung, vitreous china, high efficiency | Flush valves will be piston type, manual operated | 0.125 gallon flush |
| Lavatories Public | Depending upon requirements, Wall hung or Self-rimming, vitreous china. Refer to architectural floor plans for areas with wall hung units and counter mounted units. | Faucets will be hot and cold mixing type, sensor operated, hard wired | 0.5 gpm flow control |
| Lavatories | Wall hung or Self-rimming, vitreous china. Refer to architectural floor plans for areas with wall hung units and counter mounted units. | Faucets will be hot and cold mixing type, sensor operated, hard wired | 0.5 gpm flow control |
| Sinks | Countertop mounted stainless steel | Faucets will be hot and cold mixing type. Sinks in break rooms will be fitted with garbage disposals. | 1.5 gpm flow control |
| Laboratory Sinks | Integral with casework. Faucets will be furnished with the casework and installed by the Division 22 contractor | Faucets will be hot and cold mixing type, wrist blade handles | 1.5gpm flow control |
| Electric Water Coolers | Wall mounted, recessed self-contained, dual level | Manual push button operated, with stainless steel cabinets and disposable activated carbon water filters | 1.5 gpm flow control |
| Janitor Sinks | Flush mounted with vacuum breaker and loose key operator Floor mounted, precast terrazzo, with stainless steel splash wall panels | Manual Faucets will be hot and cold mixing type with hose connections and integral spout, vacuum breaker | - |
| Exterior Hose Bibbs | Recessed mounted freeze resistant with vacuum breaker and loose key operator | Manual | - |
| Mechanical Room Hose Bibbs | Surface mounted with in-line vacuum breakers | Manual | - |
| | | | |
| | | | |

### High Purity Water

*System Description*

**TO BE FINALIZED IN DESIGN**: A system will be provided to produce and distribute water meeting the quality requirements of ASTM Type II and Type C from the facilities laboratory water system.

| Water Quality | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Design Standard** | **Resistivity** | **Silica** | **Sodium** | **pH** | **Chlorides** | **TOC** | **Bacteria** | **Endotoxin** |
| | | | | | | | 1000 cfu/100 ml Limit | No Limit |
| ASTM Type II | ≥1 MΩ-cm @25°C | ≤3µg/L | ≤5µg/L | No Limit | ≤5µg/L | ≤50µg/L | | |

This system will not be validated.

Pure water will be continuously circulated in closed loops to users throughout the building laboratory.

## 03.8 PIPING SYSTEMS

Point of use polishing units will be provided for use points that require a higher level of quality water.

The system will be automatically monitored and controlled by a dedicated PLC based control system that will send a discrete alarm signal to the Building Automation System in the event of deviations.

*Design Criteria*

The system design will be based on performing sanitation using peracetic acid solutions.

The capacity of the production equipment and the storage tank will be based on the programmed use points and the following consumption estimates:

| Use Point Type | Peak Flow Rate | Daily Usage |
|---|---|---|
| Laboratory Sink | 1 gpm | 15 gallons |
| Water Polisher | 0.5 gpm | 10 gallons |
| Glasswasher | 2 gpm | 50 gallons |
| | | |

The production equipment shall be sized to produce the total estimated consumption in 16 hours of operation. The capacity of the production system is estimated at 40 gpm.

The storage tank will be sized to provide storage for 24 hours of estimated usage. The size of the storage tank is estimated to be 350 gallons.

The distribution system will be designed to maintain the temperature of the water under 80°F.

The distribution system will be designed to continuously circulate water at a minimum velocity of 3 feet per second. The maximum demand for the distribution system shall be based on the previous peak flow rates with 80% diversity factor.

*Equipment and Material*

The production equipment is anticipated to consist of a prefilter, multimedia filter, carbon filter, water softener, single pass RO unit, two-bed deionization exchange cylinders, mixed bed deionization exchange cylinders, a one micron post filter, a 185 nm ultraviolet light, and a 0.2 micron final filter.

.

Materials in contact with pure water will be:

- Equipment: 316L stainless steel polished to 25 Ra
- Storage tank: vinyl ester,
- Piping: low-extractable PVC
- Elastomers: Viton EPDM

*Distribution*

The distribution system will be comprised of one loop through which water will be continuously circulated. Each distribution loop will employ a series loop layout. The loops will drop to each use point location and a zero static tee diaphragm valve will be provided.

High purity water system distribution system shall be:

Low-extractable PVC or PP-R piping will be used for the distribution system. Joints will be made by solvent socket welding. Sanitary unions will be used where breakable connections are required. Piping will be continuously supported.

All tee connections shall be installed to minimize the dead leg. The distance from the sealing point on the branch to the inside of the main line wall shall be less than six (6) branch line diameters.

Piping will be installed so that it is completely free draining. A minimum slope of 1/8 inch per foot will be maintained.

Sink use points shall be a use point valve over the sink. Pipe loop drops within the room will be enclosed.

The quality of the water in the distribution system will be monitored by the PLC that will send a discrete alarm signal to the Building Management System in the event of deviations.

| Pure Water System Materials | | |
|---|---|---|
| **Size** | **Outside of Return Air plenum** | |
| 3" and smaller | Polypropylene (PP-R) SDR 11<br>ASTM F2389 with heat fused joints and PP-R fittings | |

### Special Gases - Laboratory System

*System Description*

**TO BE FINALIZED IN DESIGN:** Special gas cylinders, manifolds and distribution piping shall be provided to all points of use as required by the Owner. Special gases shall include but not be limited to: helium, argon, nitrogen, oxygen and carbon dioxide.

### Industrial Compressed Air

*System Description*

**TO BE FINALIZED IN DESIGN:** Instrument grade compressed air will be provided to designated laboratory areas at a pressure of 100 psig and a dewpoint of 40°F. Compressed air will be provided as required by the Owner.

*Design Criteria*

Compressed air piping system will be sized based on 1 scfm per outlet plus any flow required for individual pieces of equipment. Diversity factors will be applied to laboratory outlets as indicated below:

| Table 2<br>Compressed Air System Diversity Factors | | | |
|---|---|---|---|
| Number of Outlets | Diversity Factor | Minimum Flow (scfm) | Empirical Formula for Flowrate (scfm) |
| 1-5 | 1.00 | 0 | No. of Outlets*1 |
| 6-12 | 0.80 | 5 | 5+(No. of Outlets-5)*5/7 |

## 03.8 PIPING SYSTEMS

| Table 2 | | | |
|---|---|---|---|
| **Compressed Air System Diversity Factors** | | | |
| Number of Outlets | Diversity Factor | Minimum Flow (scfm) | Empirical Formula for Flowrate (scfm) |
| 13-33 | 0.60 | 10 | 10+(No. of Outlets-12)*10/21 |
| 34-80 | 0.50 | 20 | 20+(No. of Outlets-33)*20/47 |
| 81-150 | 0.40 | 40 | 40+(No. of Outlets-80)*20/70 |
| 151-315 | 0.35 | 60 | 60+(No. of Outlets-150)*50/165 |
| 316-565 | 0.30 | 110 | 110+(No. of Outlets-315)*60/250 |
| 566 and up | 0.25 | 170 | 170+(No. of Outlets-565)*80/435 |

The compressors will be controlled by pressure switches in receiver set to operate between 100 and 115 psig. Each compressor will be sized for 50% of the maximum total demand. The compressors will be controlled on lead/lag/alternate basis.

*Equipment and Material*

Instrument grade compressed air will be produced by oil-less scroll air compressors. Compressors will be base mounted. Air will be treated with particulate filters and dried with refrigerated air dryers.
Compressed air will be stored in an ASME rated vertical receiver with outlet pressure regulator.

*Distribution*

Compressed air piping system will be ASTM B-280 Type L, oxygen cleaned copper piping with brazed joints.

### LaboratoryVacuum

A centralized building Vacuum system is not needed. Localized Vacuum pump will be utilized per research needs.

### NaturalGas

*System Description*

Natural gas is anticipated to be piped to equipment (ex: boilers, water heaters) as required to meet building needs. Gas pressure will be determined based on equipment requirements. Natural gas is anticipated to be a centrally piped and distributed system to serve lab and fume hood gas outlets food service equipment. Natural gas will be extended to the building from the gas company's natural gas main in the street.  It is anticipated that the gas meter(s) will be located at grade at the service entrance to the building.

*Design* Criteria

All design and installation will be in accordance with the applicable codes.

Natural gas will be supplied at a pressure of 2 psig. Piping will be sized to limit the pressure drop across the system to 10% of the supply pressure.

Natural gas shutoff valves, where required, will be located in ceiling spaces. In classrooms a recessed wall valve box at 4'-6" above finished floor will provide access to a shutoff valve. .

Natural gas piping system *will be sized based on 5 cfh per outlet plus any flow required for individual pieces of equipment.  Diversity factors will be applied to laboratory outlets as indicated below:*

| Table 2 | | | |
|---|---|---|---|
| **Natural Gas System Diversity Factors** | | | |
| Number of Inlets | Diversity Factor | Minimum Flow (cfh) | Empirical Formula for Flowrate (cfh) |
| 1-5 | 1.00 | 0 | No. of Inlets*5 |
| 6-12 | 0.80 | 5 | (5+(No. of Inlets-5)*5/7)*5 |
| 13-33 | 0.60 | 50 | (10+(No. of Inlets-12)*10/21)*5 |
| 34-80 | 0.50 | 100 | (20+(No. of Inlets-33)*20/47)*5 |
| 81-150 | 0.40 | 200 | (40+(No. of Inlets-80)*20/70)*5 |
| 151-315 | 0.35 | 300 | (60+(No. of Inlets-150)*50/165)*5 |

*Equipment and Material*

Natural gas meter and building pressure regulating valves will be provided by and in accordance with gas utility company requirements.

Where shutoff valves are installed in valve boxes, the valve boxes will be steel frames with steel doors, piano hinges and level latches. All pipe penetrations through the box walls will be sealed.

Point of use pressure regulators will be self-operated spring-loaded constant pressure valves with internal relief capability.

*Distribution*

Natural gas piping will be Schedule 40 black steel pipe with malleable iron threaded fittings. .

Natural gas valves 2-1/2" and smaller will be two-piece ball valves with bronze bodies and stainless steel balls. Valves 3" and larger will be plug valves with cast iron bodies.

**END OF BOD**

## 03.9 FIRE PROTECTION

### VIII. FIRE PROTECTION SYSTEMS

### SYSTEM DESCRIPTIONS

#### Fire Service

*System Description*

An underground fire line will supply the sprinkler system in the Florida Polytechnic University Engineering Building.

*Design Criteria*

The design of the underground fire lines shall comply with NFPA 24.

Current water supply flow test data will be obtained from the City Water Department in order to determine the capacity of the water mains.

*Equipment and Material*

Piping for all underground lines will be cement lined ductile iron or, where approved by the Owner and local Authority Having Jurisdiction, Polyvinyl Chloride (PVC).

#### Wet Pipe Sprinkler System

*System Description*

The building will be protected throughout with hydraulically calculated sprinkler systems, which except for special protection needs, will be wet pipe systems. All areas of the building will be protected per NFPA 13, loading docks, stair towers, exterior canopies, and mechanical rooms.

*Design Criteria*

The sprinkler system for the building will be designed and installed in accordance with NFPA 13.

All systems will be hydraulically calculated with a computer calculation program using the Hazen-Williams method.

If there are no special Client standards or Client insurance carrier recommendations, the following sprinkler design densities shall apply:

| Sprinkler Design Densities | | | |
|---|---|---|---|
| **Hazard-Areas Designated as** | **Density-Minimum Sprinkler Flow** | **Remote Area** | **Hose Stream Allowance** |
| Light Hazard | 0.10 gpm per sq ft | 1500 sq ft | 100 gpm |
| Ordinary Hazard Group 1 | 0.15 gpm per sq ft | 1500 sq ft | 250 gpm |
| Ordinary Hazard Group 2, where stockpiles of combustibles do not exceed 12 ft. | 0.20 gpm per sq ft | 1500 sq ft | 250 gpm |

The pipe sizing for the systems will be as required to satisfy the hydraulic demand.

*Equipment and Material*

Piping 2" and smaller in size will be Schedule 40 black steel with threaded joints.

Piping larger than 2" will be Schedule 10 black steel with welded fittings or roll groove couplings or Schedule 40 black steel with welded fittings, threaded joints, or cut groove couplings.

All sprinklers in Light Hazard areas will be quick-response type.

The type of sprinkler installed in a particular area will be selected by the Engineer and the Project Architect. Generally, concealed sprinklers will be installed in areas of high visibility and quality of finishes. Recessed sprinklers will be installed in other areas having suspended ceilings. Pendent or upright sprinklers will be installed in areas without ceilings. Sidewall sprinklers will be provided only when other types cannot be utilized.

Areas subject to temperatures below 40°F will be protected by dry barrel sprinklers.

*Distribution*

The sprinkler system will be provided throughout the building in accordance with NFPA 13 and, when required by the Owner, with insurance carrier recommendations.

FLORIDA POLYTECHNIC UNIVERSITY

# SECTION 04 - APPENDIX

# 04. APPENDIX

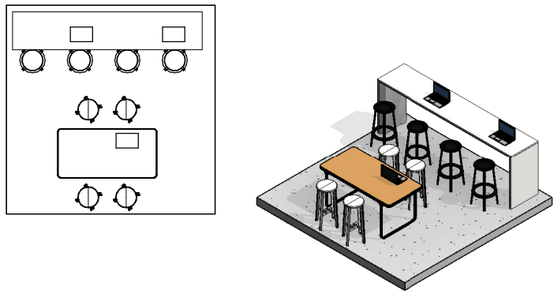
## 04.1 PROGRAM OF SPACE

| Program Level 1 | Program Level 2 | Name | Prog Quantity | Prog NSF | Comments | Sum of Prog Total NSF |
|---|---|---|---|---|---|---|
| Commmon | Admin Suite | Shared Conference Room - 12 Seat | 1 | 300 | | 300 |
| | | Work Room/Copy Room | 1 | 50 | | 50 |
| | | Department Chair Office | 2 | 150 | | 300 |
| | | Storage (Industry Partner) | 1 | 150 | | 150 |
| | Admin Suite Total | | | | | 800 |
| | Faculty / Staff Office | Faculty/Staff Office | 17 | 120 | | 2040 |
| | Faculty / Staff Office Total | | | | | 2040 |
| | Public Space | Lobby | 1 | 800 | | 800 |
| | | Quite Room/Mothers Room | 1 | 90 | | 90 |
| | | Vending | 1 | 50 | | 50 |
| | | Faculty Lounge - Break Room | 1 | 200 | | 200 |
| | | Faculty Informal Collaboration Space | 2 | 170 | | 340 |
| | Public Space Total | | | | | 1480 |
| | Shared Conference / Seminar Rooms | Shared Conference Room - 6 Seat | 2 | 150 | | 300 |
| | Shared Conference / Seminar Rooms Total | | | | | 300 |
| Commmon Total | | | | | | 4620 |
| Environmental and Civil Eng | Research Lab | Environmental Lab | 2 | 900 | | 1800 |
| | | Research Lab | 2 | 1500 | One requires access to a rollup door. | 3000 |
| | Research Lab Total | | | | | 4800 |
| | Research Lab Support | Environmental Lab Support | 1 | 500 | | 500 |
| | Research Lab Support Total | | | | | 500 |
| | Research Office | Research Office | 2 | 120 | | 240 |
| | | Research Office (Lab Tech) | | | | 120 |
| | Research Office Total | | | | | 360 |
| Environmental and Civil Eng Total | | | | | | 5660 |
| Research Environments | Research Lab | Experiential Lab (Vehicle Bay) | 1 | 1000 | | 1000 |
| | | Mechanical Engineering Lab | 2 | 1200 | | 2400 |
| | | Civil Engineering Lab | 1 | 1100 | | 1100 |
| | Research Lab Total | | | | | 4500 |
| | Student Commons / Study Space | Student Collaboration | 2 | 200 | | 400 |
| | Student Commons / Study Space Total | | | | | 400 |
| Research Environments Total | | | | | | 4900 |
| Support | Building Support Spaces | Recycling | 1 | 50 | Included in BOH Services | 50 |
| | | Attic Storage | 1 | 300 | Included in BOH Services | 300 |
| | | Custodial Storage | 1 | 50 | | 50 |
| | | Custodial Closet | 2 | 50 | | 100 |
| | | Hazardus Storage | 1 | 100 | One Room should be classified H and located at exterior wall | 100 |
| | | Chemcial Storage | 1 | 100 | | 100 |
| | Building Support Spaces Total | | | | | 700 |
| Support Total | | | | | | 700 |
| Grand Total | | | | | | 15880 NSF |
| | | | | | Efficiency Target | 55% |
| | | Total Gross Assignable Area | | | | 28873 GSF |
| | | | | | Grossing Factor | 1.82 |

# 04. APPENDIX

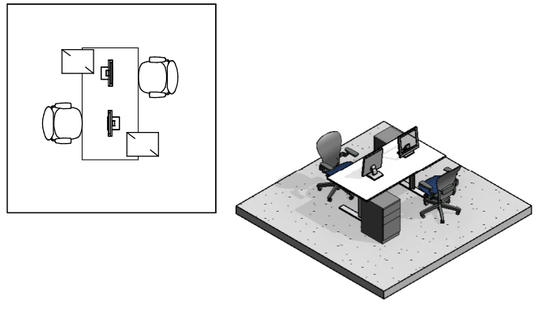
## 04.2 ROOM DATA SHEETS (RDS)

#1



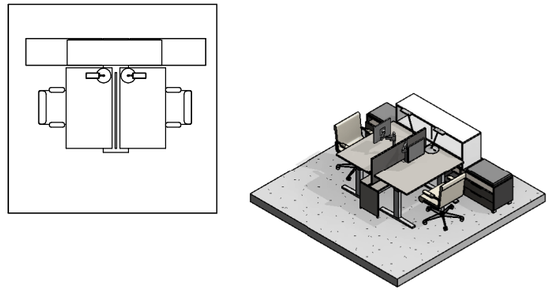
*STUDENT COLLABORATION*

#2

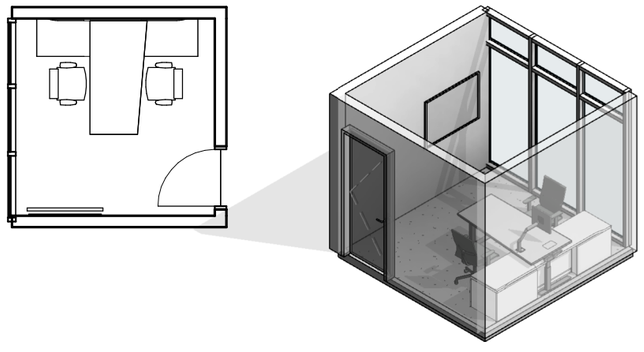


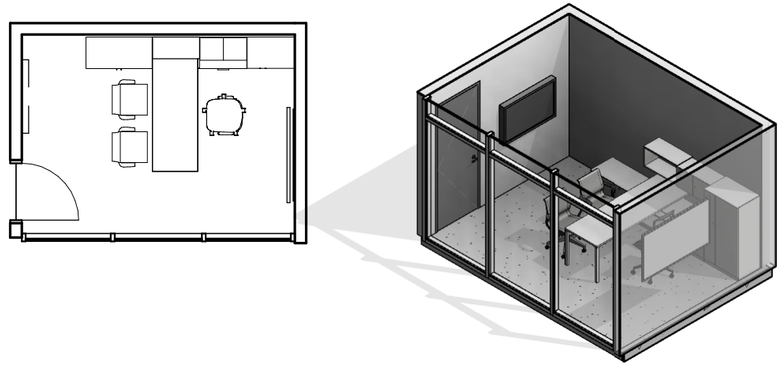
*RESEARCH OFFICE / FACULTY STAFF OFFICE*

#3



*DEPARTMENT CHAIR OFFICE*





# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

| | |
|---|---|
| **Name** | Office Template |
| **Last modified** | Byers, Virginia, 10/22/2022 11:30 AM |

| **Details** | | **Groups / Classifications / Status** |
|---|---|---|
| Programmed Area | 0.00 | |
| Description | Room Data Information for Department Chair Offices, Faculty Staff Offices, and Research Offices | |

See Room List for Programmed Area.

**USER DATA**

**ROOM DATA**

| | |
|---|---|
| Representative | |
| Functional Adjacencies | |
| Occupancy | 1 |
| Population | 0 |

**UTILIZATION**

| | |
|---|---|
| 8 hours/day | ☐ |
| 14 hours/day | ☑ |
| 24 hours/day | ☐ |
| Other: | ☐ |

**COMMENTS**

**ARCHITECTURAL**

**WALL FINISH**

| | |
|---|---|
| GWB, Paint | ☑ |
| GWB, Epoxy Paint | ☐ |
| FRP | ☐ |
| Pre-Fab Modular | ☐ |
| Other: | ☐ |

**WALL SUBSTRATE**

| | |
|---|---|
| GWB, Stud | ☑ |
| CMU | ☐ |
| CIP | ☐ |
| Demountable | ☐ |
| Other: | ☐ |

**WALL PROTECTION**

| | |
|---|---|
| Corner Guards | ☐ |
| Crash Rails | ☐ |
| Other: | ☐ |

**FLOOR BASE**

| | |
|---|---|
| Applied | ☐ |
| Integral | ☐ |
| Material: | |

**FLOORING**

| | |
|---|---|
| VCT | ☐ |
| Sheet Vinyl | ☐ |
| Electrostatic Dissipative | ☐ |
| Epoxy | ☐ |
| Carpet | ☑ |
| Sealed Concrete | ☐ |
| Commercial Rubber | ☐ |
| Other: | ☐ |

**DOOR 1**

| | |
|---|---|
| Size: | 3'-0" x 8'-0" |
| Type: | Full Vision Panel |
| Material: | Metal |

**DOOR 2**

| | |
|---|---|
| Size: | |
| Type: | |
| Material: | |

**DOOR 3**

| | |
|---|---|
| Size: | |
| Type: | |
| Material: | |

**CEILINGS**

| | |
|---|---|
| Open | ☐ |
| Acoustic Tile | ☑ |
| Gyp. Board | ☐ |
| Special Ceilings: | ☐ |
| Other: | ☐ |

**HAZARD / SHIELDING**

Type:

**COMMENTS**

Standards Typical to FPU Building ARC

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

### CASEWORK

**CASEWORK TYPE**

| | |
|---|---|
| Fixed Casework | ☑ |
| Movable Casework | ☐ |
| Wall Cabinets | ☐ |
| Wall Shelves | ☐ |
| Lockable Cabinets | ☐ |
| Other: | ☐ |

**CASEWORK MATERIAL**

| | |
|---|---|
| Metal | ☐ |
| Wood | ☑ |
| Stainless Steel | ☐ |
| Other: | ☐ |

**BENCHTOP MATERIAL**

| | |
|---|---|
| Epoxy | ☐ |
| Wood | ☑ |
| Stainless Steel | ☐ |
| Plastic Laminate | ☐ |
| Phenolic | ☐ |
| Other: | ☐ |

**SHELVING MATERIAL**

| | |
|---|---|
| Metal | ☐ |
| Wood | ☐ |
| Stainless Steel | ☐ |
| Glass | ☐ |
| Other: | ☐ |

**COMMENTS**

Casework to meet FPU ARC building standards. Active furnishings preferred.

### EXHAUST DEVICES

| | |
|---|---|
| Benchtop Fume Hoods: | ☐ |
| Walk-in Fume Hoods: | ☐ |
| Radioisotope Hoods: | ☐ |
| Perchloric Hoods: | ☐ |
| Bio Safety Cabs: | ☐ |
| Vert Lam Flow Hoods: | ☐ |
| Hori Lam Flow Hoods: | ☐ |
| Polypropylene Hoods: | ☐ |
| Canopy Hoods: | ☐ |
| ADA Hoods: | ☐ |
| Point Exhaust: | ☐ |
| Other: | ☐ |

**COMMENTS**

### HVAC

**ENVIRONMENT**

| | |
|---|---|
| Design Temp Cooling: | 72 F Range +/-: 2 |
| Relative Humidity Cooling: | 50 % Range +/-: 2 |
| Design Temp Heating: | 72 F Range +/-: 2 |
| Relative Humidity Heating: | 25 % Range +/-: 2 |
| Supply Air Filtration | |
| Min. Air Change Rate (ac/hr): | 2 |
| Indicator | |
| Pressure Monitor | ☐ |
| Laminar Flow Distribution | ☐ |
| Exhaust Air Filtration | |
| Exhaust Air: 100% Exhausted | ☐ |
| Exhaust Air: Recirculated Air | ☑ per ASHRAE 62.1 |
| Low Wall Exhaust | ☐ |
| Night Setback | ☐ |

**ACOUSTIC**

| | |
|---|---|
| Sound Transmision Class: | 35 or above. |
| Noise Criteria: | |

**SPECIAL REQUIREMENTS**

| | |
|---|---|
| Oxgen/gas Detection: | ☐ |
| Other: | ☐ |

**COMMENTS**

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

### PLUMBING

**ROOM SERVICES + LOCATION**

| | |
|---|---|
| Natural Gas (GAS): | ☐ |
| Vacuum (VAC): | ☐ |
| Carbon Diox. (CO2): | ☐ |
| Compressed Air (CA): | ☐ |
| Chilled Water (CW S/R): | ☐ |
| Nitrogen (N2): | ☐ |
| Helium (He): | ☐ |
| Argon (Ar): | ☐ |
| Oxygen (O2): | ☐ |
| Hydrogen (H): | ☐ |
| Liq Nitrogen (LN2): | ☐ |
| Special Gas 1 (SG1): | ☐ |
| Special Gas 2 (SG2): | ☐ |
| Other: | ☐ |

**SINKS**

| | |
|---|---|
| Standard | ☐ |
| ADA | ☐ |
| Scullery | ☐ |
| Epoxy | ☐ |
| Stainless Steel | ☐ |
| Marine Edge | ☐ |

**SERVICES AT SINKS**

| | |
|---|---|
| Hot Water (HW) | ☐ |
| Cold Water (CW) | ☐ |
| High Purity Water | ☐ |
| Eye Wash | ☐ |
| Drench Hose | ☐ |
| DI/RO Water (DI/RO): | ☐ |

**OTHER**

| | |
|---|---|
| Floor Drain (FD) | ☐ |
| Floor Sink (FS) | ☐ |
| Trench Drain (TD) | ☐ |
| Safety Shower (SS) | ☐ |
| Eye Wash (EW) | ☐ |
| Other: | ☐ |

**COMMENTS**

### ELECTRICAL / LIGHTING

**ELECTRICAL**

| | |
|---|---|
| Raceway | ☐ |
| 110V, 20A, 1 Phase: | ☑ |
| 208V, 30A, 1 Phase | ☐ |
| 208V, 30A, 3 Phase: | ☐ |
| Other V/Phase | ☐ |
| Standby Power | ☐ |
| UPS | ☐ |
| Power at Table | ☐ |
| Data | ☐ |
| Phone | ☑ |
| Other: | ☑ All Data Wifi |

**LIGHTING**

| | |
|---|---|
| 80-100 fc @ wrk srfc | ☑ |
| 30-60 fc @ wrk srfc | ☐ |
| Other fc @ wrk srfc: | ☐ |
| Task Lighting | ☑ |
| Surgical Light | ☐ |
| Dimmable Lighting | ☑ |
| Zoned Lighting | ☐ |
| Prefer Natural Light | ☐ |
| Other: | ☑ Natural Light Required |

**COMMENTS**

### SECURITY / AV

**SECURITY**

| | |
|---|---|
| Key Lock | ☑ |
| Card Access | ☐ |
| Video Surveillance | ☐ |
| Emergency Shutoff | ☐ |
| Equipment Theft Alarm | ☐ |
| Glass Break Sensor | ☐ |
| Alarmed Door | ☐ |
| Motion Detector | ☐ |
| Motion Sensors | ☐ |
| Close Circuit Telev. | ☐ |
| Other: | ☐ |

**COMMUNITCATIONS**

**AUDIO VISUAL**

| | |
|---|---|
| Projection | ☐ |
| Flat Panel Display | ☐ |
| Camera | ☐ |
| Microphone | ☐ |
| Distance Learning | ☐ |
| Other: | ☐ |

**COMMENTS**

### GENERAL ROOM REMARKS

GENERAL ROOM REMARKS

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

| | |
|---|---|
| **Name** | Student Workstations / Student Collaboration |
| **Last modified** | Byers, Virginia, 10/22/2022 11:29 AM |

| **Details** | | **Groups / Classifications / Status** |
|---|---|---|
| Programmed Area | 0.00 | |
| Description | Open workstation environment for graduate students and faculty touchdown. | |

See Room List for Programmed Area

**USER DATA**

**ROOM DATA**

| | |
|---|---|
| Representative | |
| Functional Adjacencies | |
| Occupancy | 0 |
| Population | 0 |

**UTILIZATION**

| | |
|---|---|
| 8 hours/day | ☑ |
| 14 hours/day | ☐ |
| 24 hours/day | ☐ |
| Other: | ☐ |

**COMMENTS**

**ARCHITECTURAL**

**WALL FINISH**

| | |
|---|---|
| GWB, Paint | ☑ |
| GWB, Epoxy Paint | ☐ |
| FRP | ☐ |
| Pre-Fab Modular | ☐ |
| Other: | ☐ |

**WALL SUBSTRATE**

| | |
|---|---|
| GWB, Stud | ☑ |
| CMU | ☐ |
| CIP | ☐ |
| Demountable | ☐ |
| Other: | ☐ |

**WALL PROTECTION**

| | |
|---|---|
| Corner Guards | ☐ |
| Crash Rails | ☐ |
| Other: | ☐ |

**FLOOR BASE**

| | |
|---|---|
| Applied | ☑ |
| Integral | ☐ |
| Material: | |

**FLOORING**

| | |
|---|---|
| VCT | ☐ |
| Sheet Vinyl | ☐ |
| Electrostatic Dissipative | ☐ |
| Epoxy | ☐ |
| Carpet | ☑ |
| Sealed Concrete | ☐ |
| Commercial Rubber | ☐ |
| Other: | ☐ |

**DOOR 1**

| | |
|---|---|
| Size: | 3'-6" x 8'-0" |
| Type: | Full Vision Panel |
| Material: | Metal |

**DOOR 2**

| | |
|---|---|
| Size: | |
| Type: | |
| Material: | |

**DOOR 3**

| | |
|---|---|
| Size: | |
| Type: | |
| Material: | |

**CEILINGS**

| | |
|---|---|
| Open | ☐ |
| Acoustic Tile | ☑ |
| Gyp. Board | ☐ |
| Special Ceilings: | ☐ |
| Other: | ☐ |

**HAZARD / SHIELDING**

Type:

**COMMENTS**

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

### CASEWORK

**CASEWORK TYPE**

| | |
|---|---|
| Fixed Casework | ☐ |
| Movable Casework | ☑ |
| Wall Cabinets | ☐ |
| Wall Shelves | ☐ |
| Lockable Cabinets | ☑ |
| Other: | ☐ |

**CASEWORK MATERIAL**

| | |
|---|---|
| Metal | ☐ |
| Wood | ☑ |
| Stainless Steel | ☐ |
| Other: | ☐ |

**BENCHTOP MATERIAL**

| | |
|---|---|
| Epoxy | ☐ |
| Wood | ☑ |
| Stainless Steel | ☐ |
| Plastic Laminate | ☐ |
| Phenolic | ☐ |
| Other: | ☐ |

**SHELVING MATERIAL**

| | |
|---|---|
| Metal | ☐ |
| Wood | ☐ |
| Stainless Steel | ☐ |
| Glass | ☐ |
| Other: | ☐ |

**COMMENTS**

Casework to match FPU ARC furniture standards. Active furnishings preferred.

### EXHAUST DEVICES

| | |
|---|---|
| Benchtop Fume Hoods: | ☐ |
| Walk-in Fume Hoods: | ☐ |
| Radioisotope Hoods: | ☐ |
| Perchloric Hoods: | ☐ |
| Bio Safety Cabs: | ☐ |
| Vert Lam Flow Hoods: | ☐ |
| Hori Lam Flow Hoods: | ☐ |
| Polypropylene Hoods: | ☐ |
| Canopy Hoods: | ☐ |
| ADA Hoods: | ☐ |
| Point Exhaust: | ☐ |
| Other: | ☐ |

**COMMENTS**

### HVAC

**ENVIRONMENT**

| | |
|---|---|
| Design Temp Cooling: | 72 F Range +/-: 2 |
| Relative Humidity Cooling: | 50 % Range +/-: 2 |
| Design Temp Heating: | 72 F Range +/-: 2 |
| Relative Humidity Heating: | 25 % Range +/-: 2 |
| Supply Air Filtration | |
| Min. Air Change Rate (ac/hr): | 2 |
| Indicator | |
| Pressure Monitor | ☐ |
| Laminar Flow Distribution | ☐ |
| Exhaust Air Filtration | |
| Exhaust Air: 100% Exhausted | ☐ |
| Exhaust Air: Recirculated Air | ☑ per ASHRAE 62.1 |
| Low Wall Exhaust | ☐ |
| Night Setback | ☐ |

**ACOUSTIC**

| | |
|---|---|
| Sound Transmision Class: | 35 or above |
| Noise Criteria: | |

**SPECIAL REQUIREMENTS**

| | |
|---|---|
| Oxgen/gas Detection: | ☐ |
| Other: | ☐ |

**COMMENTS**

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

### PLUMBING

**ROOM SERVICES + LOCATION**

| | |
|---|---|
| Natural Gas (GAS): | ☐ |
| Vacuum (VAC): | ☐ |
| Carbon Diox. (CO2): | ☐ |
| Compressed Air (CA): | ☐ |
| Chilled Water (CW S/R): | ☐ |
| Nitrogen (N2): | ☐ |
| Helium (He): | ☐ |
| Argon (Ar): | ☐ |
| Oxygen (O2): | ☐ |
| Hydrogen (H): | ☐ |
| Liq Nitrogen (LN2): | ☐ |
| Special Gas 1 (SG1): | ☐ |
| Special Gas 2 (SG2): | ☐ |
| Other: | ☐ |

**SINKS**

| | |
|---|---|
| Standard | ☐ |
| ADA | ☐ |
| Scullery | ☐ |
| Epoxy | ☐ |
| Stainless Steel | ☐ |
| Marine Edge | ☐ |

**SERVICES AT SINKS**

| | |
|---|---|
| Hot Water (HW) | ☐ |
| Cold Water (CW) | ☐ |
| High Purity Water | ☐ |
| Eye Wash | ☐ |
| Drench Hose | ☐ |
| DI/RO Water (DI/RO): | ☐ |

**OTHER**

| | |
|---|---|
| Floor Drain (FD) | ☐ |
| Floor Sink (FS) | ☐ |
| Trench Drain (TD) | ☐ |
| Safety Shower (SS) | ☐ |
| Eye Wash (EW) | ☐ |
| Other: | ☐ |

**COMMENTS**

### ELECTRICAL / LIGHTING

**ELECTRICAL**

| | |
|---|---|
| Raceway | ☐ |
| 110V, 20A, 1 Phase: | ☑ |
| 208V, 30A, 1 Phase | ☐ |
| 208V, 30A, 3 Phase: | ☐ |
| Other V/Phase | ☐ |
| Standby Power | ☐ |
| UPS | ☐ |
| Power at Table | ☐ |
| Data | ☐ |
| Phone | ☑ |
| Other: | ☑ Data wifi |

**LIGHTING**

| | |
|---|---|
| 80-100 fc @ wrk srfc | ☑ |
| 30-60 fc @ wrk srfc | ☐ |
| Other fc @ wrk srfc: | ☐ |
| Task Lighting | ☑ |
| Surgical Light | ☐ |
| Dimmable Lighting | ☐ |
| Zoned Lighting | ☐ |
| Prefer Natural Light | ☐ |
| Other: | ☐ |

**COMMENTS**

### SECURITY / AV

**SECURITY**

| | |
|---|---|
| Key Lock | ☑ |
| Card Access | ☑ |
| Video Surveillance | ☐ |
| Emergency Shutoff | ☐ |
| Equipment Theft Alarm | ☐ |
| Glass Break Sensor | ☐ |
| Alarmed Door | ☐ |
| Motion Detector | ☐ |
| Motion Sensors | ☐ |
| Close Circuit Telev. | ☐ |
| Other: | ☐ |

**COMMUNITCATIONS**

**AUDIO VISUAL**

| | |
|---|---|
| Projection | ☐ |
| Flat Panel Display | ☐ |
| Camera | ☐ |
| Microphone | ☐ |
| Distance Learning | ☐ |
| Other: | ☐ |

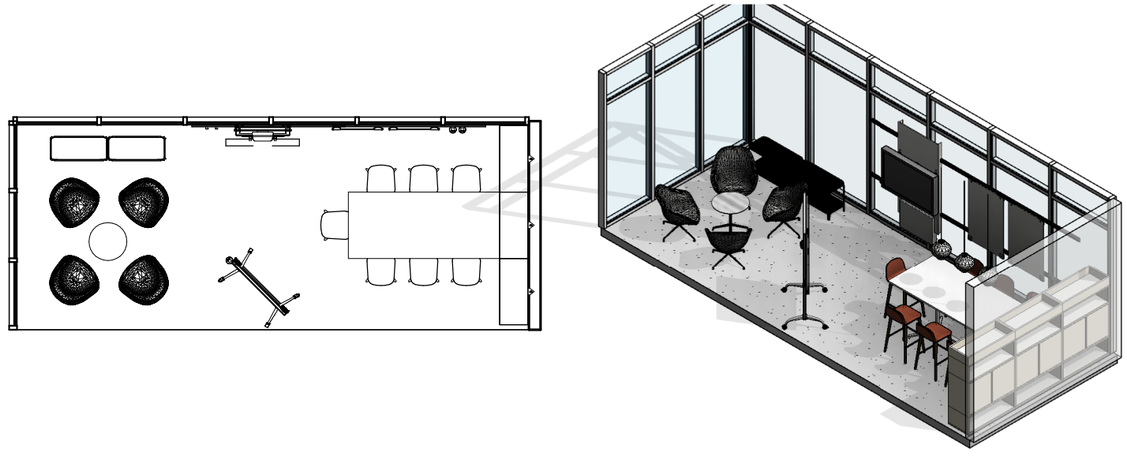
**COMMENTS**

### GENERAL ROOM REMARKS

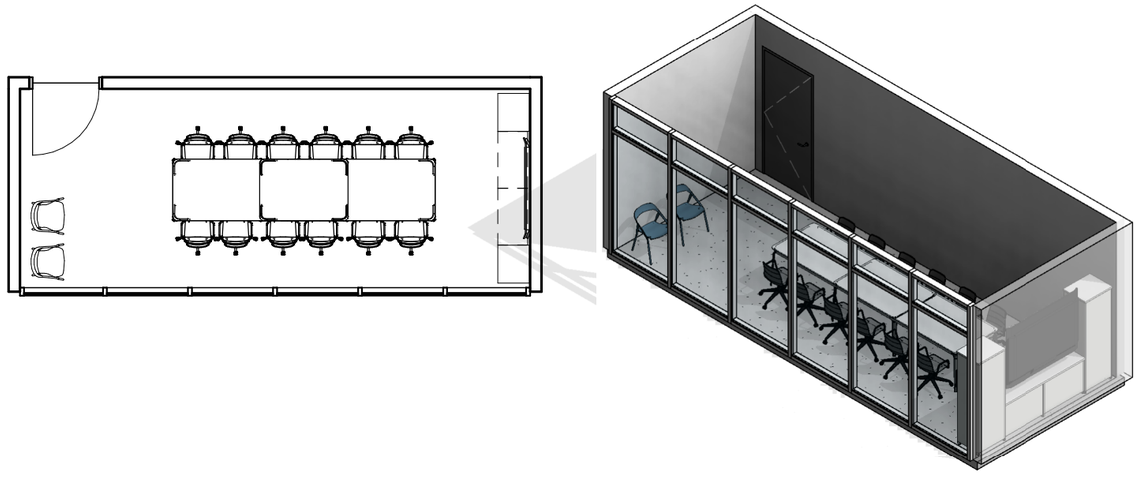
GENERAL ROOM REMARKS

# 04. APPENDIX

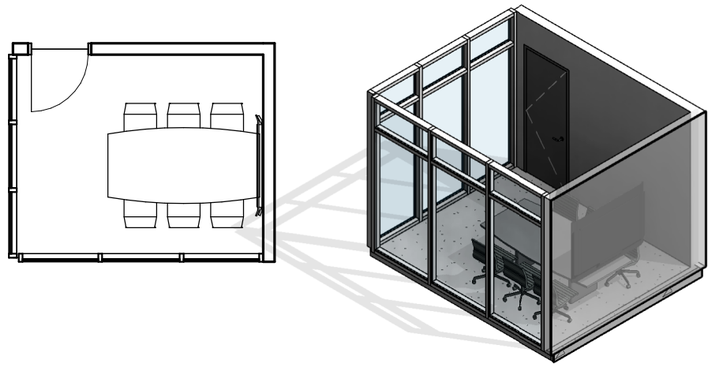
## 04.2 ROOM DATA SHEETS (RDS)



*FACULTY INFORMAL COLLABORATION*



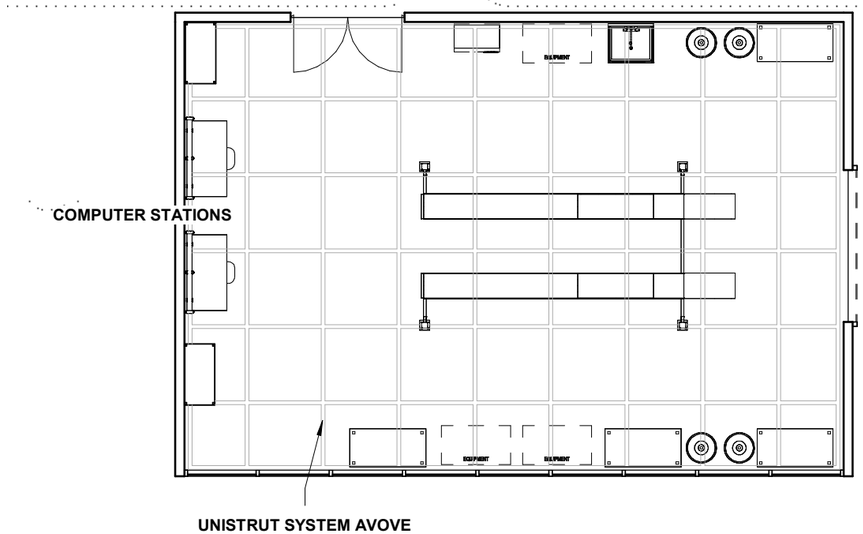
*SHARED CONFERENCE - 12 SEATS*

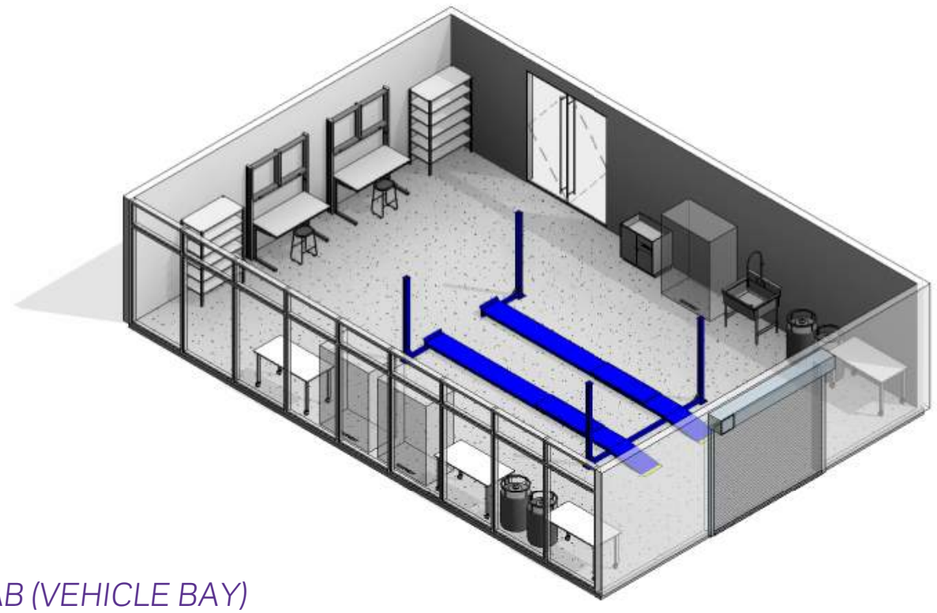


*SHARED CONFERENCE - 6 SEATS*

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)



*EXPERIENTIAL LAB (VEHICLE BAY)*

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

| | |
|---|---|
| **Name** | Experiential Lab (Vehicle Bay) |
| **Last modified** | Byers, Virginia, 10/27/2022 8:32 PM |

| **Details** | | **Groups / Classifications / Status** |
|---|---|---|
| Programmed Area | 1,000.00 | |
| Description | Electric Vehicle Laboratory | |

**USER DATA**

**ROOM DATA**

| | |
|---|---|
| Representative | |
| Functional Adjacencies | |
| Occupancy | 6 |
| Population | 0 |

**UTILIZATION**

| | |
|---|---|
| 8 hours/day | ☐ |
| 14 hours/day | ☑ |
| 24 hours/day | ☐ |
| Other: | ☐ |

**COMMENTS**

**ARCHITECTURAL**

**WALL FINISH**

| | |
|---|---|
| GWB, Paint | ☐ |
| GWB, Epoxy Paint | ☑ |
| FRP | ☐ |
| Pre-Fab Modular | ☐ |
| Other: | ☐ |

**WALL SUBSTRATE**

| | |
|---|---|
| GWB, Stud | ☐ |
| CMU | ☑ |
| CIP | ☐ |
| Demountable | ☐ |
| Other: | ☐ |

**WALL PROTECTION**

| | |
|---|---|
| Corner Guards | ☑ |
| Crash Rails | ☐ |
| Other: | ☐ |

**FLOOR BASE**

| | |
|---|---|
| Applied | ☐ |
| Integral | ☑ |
| Material: | |

**FLOORING**

| | |
|---|---|
| VCT | ☐ |
| Sheet Vinyl | ☐ |
| Electrostatic Dissipative | ☐ |
| Epoxy | ☑ |
| Carpet | ☐ |
| Sealed Concrete | ☐ |
| Commercial Rubber | ☐ |
| Other: | ☐ |

**DOOR 1**

| | |
|---|---|
| Size: | 4'-0" x 8'-0" |
| Type: | Full Vision Panel |
| Material: | Metal |

**DOOR 2**

| | |
|---|---|
| Size: | |
| Type: | Overhead |
| Material: | Metal |

**DOOR 3**

| | |
|---|---|
| Size: | |
| Type: | |
| Material: | |

**CEILINGS**

| | |
|---|---|
| Open | ☑ |
| Acoustic Tile | ☐ |
| Gyp. Board | ☐ |
| Special Ceilings: | ☐ |
| Other: | ☐ |

**HAZARD / SHIELDING**

Type:

**COMMENTS**

Overhead Rollup door: transparent made of tempered glass or polycarbonate.

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

### CASEWORK

**CASEWORK TYPE**

| | |
|---|---|
| Fixed Casework | ☑ |
| Movable Casework | ☑ |
| Wall Cabinets | ☐ |
| Wall Shelves | ☑ |
| Lockable Cabinets | ☑ |
| Other: | ☐ |

**BENCHTOP MATERIAL**

| | |
|---|---|
| Epoxy | ☐ |
| Wood | ☑ |
| Stainless Steel | ☐ |
| Plastic Laminate | ☐ |
| Phenolic | ☐ |
| Other: | ☐ |

**COMMENTS**

Countertops to be static dissipative material.
Lockable tall storage for monitored equipment, tools and supplies.
CPU on mobile benches

**CASEWORK MATERIAL**

| | |
|---|---|
| Metal | ☑ |
| Wood | ☐ |
| Stainless Steel | ☐ |
| Other: | ☐ |

**SHELVING MATERIAL**

| | |
|---|---|
| Metal | ☑ |
| Wood | ☐ |
| Stainless Steel | ☐ |
| Glass | ☐ |
| Other: | ☐ |

### EXHAUST DEVICES

| | |
|---|---|
| Benchtop Fume Hoods: | ☐ |
| Walk-in Fume Hoods: | ☐ |
| Radioisotope Hoods: | ☐ |
| Perchloric Hoods: | ☐ |
| Bio Safety Cabs: | ☐ |
| Vert Lam Flow Hoods: | ☐ |
| Hori Lam Flow Hoods: | ☐ |
| Polypropylene Hoods: | ☐ |
| Canopy Hoods: | ☐ |
| ADA Hoods: | ☐ |
| Point Exhaust: | ☑ ( Qty: 1 ) |
| Other: | ☐ |

**COMMENTS**

### HVAC

**ENVIRONMENT**

| | |
|---|---|
| Design Temp Cooling: | 72 F Range +/-: 2 |
| Relative Humidity Cooling: | 50 % Range +/-: 2 |
| Design Temp Heating: | 72 F Range +/-: 2 |
| Relative Humidity Heating: | 25 % Range +/-: 2 |
| Supply Air Filtration | |
| Min. Air Change Rate (ac/hr): | 6 |
| Indicator | |
| Pressure Monitor | ☐ |
| Laminar Flow Distribution | ☐ |
| Exhaust Air Filtration | |
| Exhaust Air: 100% Exhausted | ☑ |
| Exhaust Air: Recirculated Air | ☐ per ASHRAE 62.1 |
| Low Wall Exhaust | ☐ |
| Night Setback | ☐ |

**ACOUSTIC**

| | |
|---|---|
| Sound Transmision Class: | 45 or above |
| Noise Criteria: | |

**SPECIAL REQUIREMENTS**

| | |
|---|---|
| Oxgen/gas Detection: | ☑ |
| Other: | ☐ |

**COMMENTS**

Activities have potential to be heat producing. Additional cooling capacity needed.

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

### PLUMBING

**ROOM SERVICES + LOCATION**

| | | |
|---|---|---|
| Natural Gas (GAS): | ☐ | |
| Vacuum (VAC): | ☐ | |
| Carbon Diox. (CO2): | ☐ | |
| Compressed Air (CA): | ☑ | Ceiling |
| Chilled Water (CW S/R): | ☐ | |
| Nitrogen (N2): | ☐ | |
| Helium (He): | ☐ | |
| Argon (Ar): | ☐ | |
| Oxygen (O2): | ☐ | |
| Hydrogen (H): | ☐ | |
| Liq Nitrogen (LN2): | ☐ | |
| Special Gas 1 (SG1): | ☐ | |
| Special Gas 2 (SG2): | ☐ | |
| Other: | ☐ | |

**SINKS**

| | | |
|---|---|---|
| Standard | ☐ | |
| ADA | ☐ | |
| Scullery | ☑ | ( 1 ) |
| Epoxy | ☐ | |
| Stainless Steel | ☐ | |
| Marine Edge | ☐ | |

**SERVICES AT SINKS**

| | |
|---|---|
| Hot Water (HW) | ☑ |
| Cold Water (CW) | ☑ |
| High Purity Water | ☐ |
| Eye Wash | ☑ |
| Drench Hose | ☑ |
| DI/RO Water (DI/RO): | ☐ |

**OTHER**

| | |
|---|---|
| Floor Drain (FD) | ☑ |
| Floor Sink (FS) | ☐ |
| Trench Drain (TD) | ☐ |
| Safety Shower (SS) | ☑ |
| Eye Wash (EW) | ☑ |
| Other: | ☐ |

**COMMENTS**

Battery Storage in room demands access to safety shower and eyewash.

### ELECTRICAL / LIGHTING

**ELECTRICAL**

| | | |
|---|---|---|
| Raceway | ☑ | |
| 110V, 20A, 1 Phase: | ☑ | |
| 208V, 30A, 1 Phase | ☐ | |
| 208V, 30A, 3 Phase: | ☑ | |
| Other V/Phase | ☐ | |
| Standby Power | ☐ | |
| UPS | ☑ | |
| Power at Table | ☐ | |
| Data | ☐ | |
| Phone | ☑ | |
| Other: | ☑ | All Data is Wireless |

**LIGHTING**

| | |
|---|---|
| 80-100 fc @ wrk srfc | ☑ |
| 30-60 fc @ wrk srfc | ☐ |
| Other fc @ wrk srfc: | ☐ |
| Task Lighting | ☑ |
| Surgical Light | ☐ |
| Dimmable Lighting | ☐ |
| Zoned Lighting | ☐ |
| Prefer Natural Light | ☐ |
| Other: | ☐ |

**COMMENTS**

### SECURITY / AV

**SECURITY**

| | |
|---|---|
| Key Lock | ☑ |
| Card Access | ☑ |
| Video Surveillance | ☐ |
| Emergency Shutoff | ☑ |
| Equipment Theft Alarm | ☐ |
| Glass Break Sensor | ☐ |
| Alarmed Door | ☐ |
| Motion Detector | ☐ |
| Motion Sensors | ☐ |
| Close Circuit Telev. | ☐ |
| Other: | ☐ |

**COMMUNITCATIONS**

**AUDIO VISUAL**

| | |
|---|---|
| Projection | ☑ |
| Flat Panel Display | ☐ |
| Camera | ☐ |
| Microphone | ☐ |
| Distance Learning | ☐ |
| Other: | ☐ |

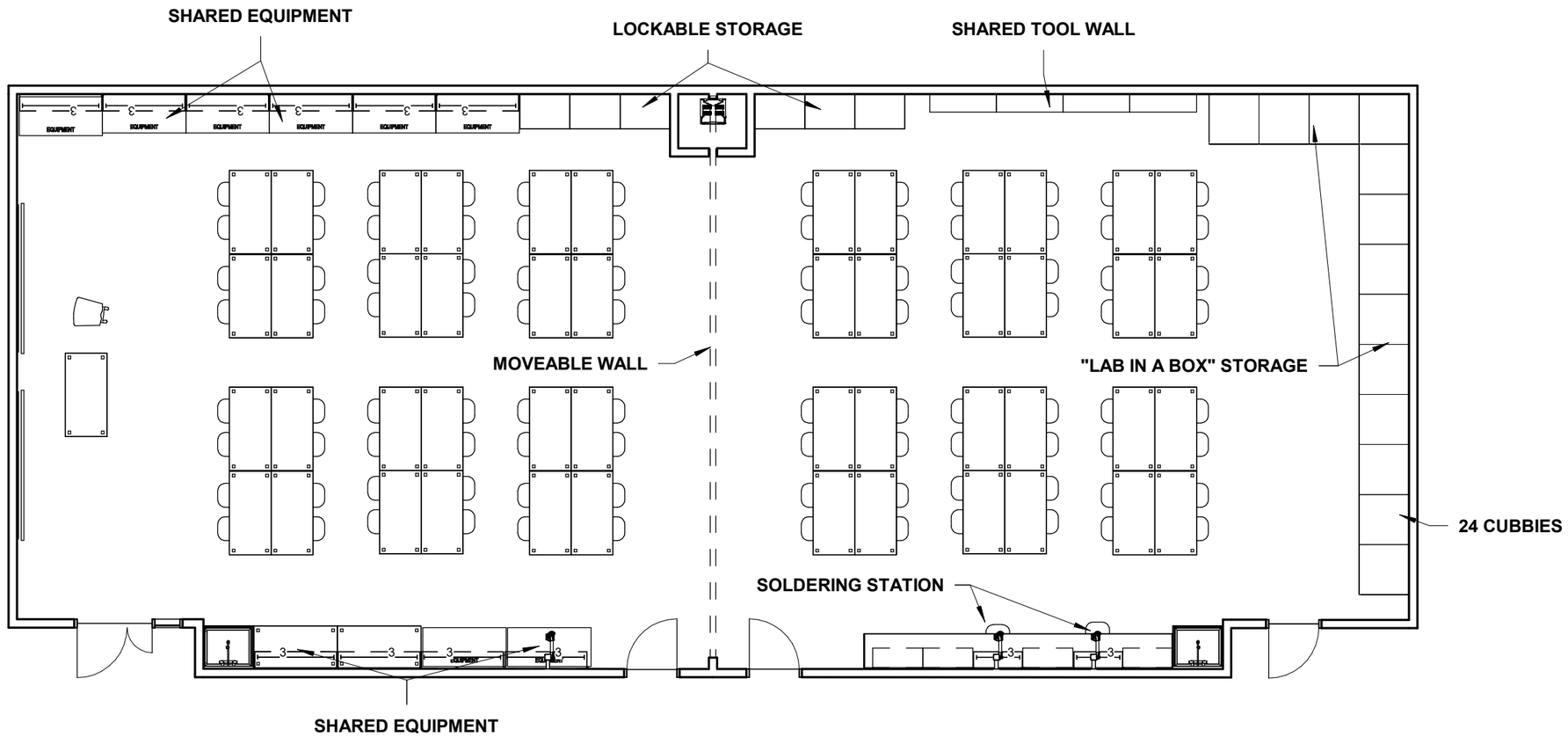
**COMMENTS**

### GENERAL ROOM REMARKS

GENERAL ROOM REMARKS

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)




*MECHANICAL ENGINEERING LAB PLAN*

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

| Details | | Groups / Classifications / Status |
|---|---|---|
| Programmed Area | 1,200.00 | |
| Description | Mechanical Engineering Lab | |

Two rooms with movable wall. Movable wall should be automated.

**USER DATA**

**ROOM DATA**

| | |
|---|---|
| Representative | |
| Functional Adjacencies | |
| Occupancy | 26 |
| Population | 0 |

**UTILIZATION**

| | |
|---|---|
| 8 hours/day | ☐ |
| 14 hours/day | ☑ |
| 24 hours/day | ☐ |
| Other: | ☐ |

**COMMENTS**

**ARCHITECTURAL**

**WALL FINISH**

| | |
|---|---|
| GWB, Paint | ☑ |
| GWB, Epoxy Paint | ☐ |
| FRP | ☐ |
| Pre-Fab Modular | ☐ |
| Other: | ☑ Glass clerestory window on one side. |

**WALL SUBSTRATE**

| | |
|---|---|
| GWB, Stud | ☑ |
| CMU | ☐ |
| CIP | ☐ |
| Demountable | ☐ |
| Other: | ☐ |

**WALL PROTECTION**

| | |
|---|---|
| Corner Guards | ☑ |
| Crash Rails | ☐ |
| Other: | ☐ |

**FLOOR BASE**

| | |
|---|---|
| Applied | ☐ |
| Integral | ☑ |
| Material: | |

**FLOORING**

| | |
|---|---|
| VCT | ☐ |
| Sheet Vinyl | ☐ |
| Electrostatic Dissipative | ☐ |
| Epoxy | ☐ |
| Carpet | ☐ |
| Sealed Concrete | ☐ |
| Commercial Rubber | ☑ |
| Other: | ☐ |

**DOOR 1**

| | |
|---|---|
| Size: | 3'-6" x 8'-0" |
| Type: | Full Vision Panel |
| Material: | Metal |

**DOOR 2**

| | |
|---|---|
| Size: | 1'-6" x 8'-0" |
| Type: | Full Vision Panel |
| Material: | Metal |

**DOOR 3**

| | |
|---|---|
| Size: | |
| Type: | |
| Material: | |

**CEILINGS**

| | |
|---|---|
| Open | ☑ |
| Acoustic Tile | ☐ |
| Gyp. Board | ☐ |
| Special Ceilings: | ☐ |
| Other: | ☐ |

**HAZARD / SHIELDING**

Type:

**COMMENTS**

Door and 1/2 style entrance doors.
Ceilings 10' Clear

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

### CASEWORK

**CASEWORK TYPE**

| | |
|---|---|
| Fixed Casework | ☑ |
| Movable Casework | ☑ |
| Wall Cabinets | ☐ |
| Wall Shelves | ☐ |
| Lockable Cabinets | ☑ |
| Other: | ☑ Tall Lockable Cabinets |

**CASEWORK MATERIAL**

| | |
|---|---|
| Metal | ☑ |
| Wood | ☐ |
| Stainless Steel | ☐ |
| Other: | ☐ |

**BENCHTOP MATERIAL**

| | |
|---|---|
| Epoxy | ☐ |
| Wood | ☑ |
| Stainless Steel | ☐ |
| Plastic Laminate | ☐ |
| Phenolic | ☐ |
| Other: | ☐ |

**SHELVING MATERIAL**

| | |
|---|---|
| Metal | ☑ |
| Wood | ☐ |
| Stainless Steel | ☐ |
| Glass | ☐ |
| Other: | ☐ |

**COMMENTS**

Open pegboard style tool storage wall.
CPU holder on all movable tables.

### EXHAUST DEVICES

| | |
|---|---|
| Benchtop Fume Hoods: | ☐ |
| Walk-in Fume Hoods: | ☐ |
| Radioisotope Hoods: | ☐ |
| Perchloric Hoods: | ☐ |
| Bio Safety Cabs: | ☐ |
| Vert Lam Flow Hoods: | ☐ |
| Hori Lam Flow Hoods: | ☐ |
| Polypropylene Hoods: | ☐ |
| Canopy Hoods: | ☐ |
| ADA Hoods: | ☐ |
| Point Exhaust: | ☑ ( Qty: 0 ) Type: Point exhaust for soldering station |
| Other: | ☐ |

**COMMENTS**

### HVAC

**ENVIRONMENT**

| | |
|---|---|
| Design Temp Cooling: | 72 F Range +/-: 2 |
| Relative Humidity Cooling: | 50 % Range +/-: 2 |
| Design Temp Heating: | 72 F Range +/-: 2 |
| Relative Humidity Heating: | 25 % Range +/-: 2 |
| Supply Air Filtration | |
| Min. Air Change Rate (ac/hr): | 4 |
| Indicator | |
| Pressure Monitor | ☐ |
| Laminar Flow Distribution | ☐ |
| Exhaust Air Filtration | |
| Exhaust Air: 100% Exhausted | ☐ |
| Exhaust Air: Recirculated Air | ☑ per ASHRAE 62.1 |
| Low Wall Exhaust | ☐ |
| Night Setback | ☐ |

**ACOUSTIC**

| | |
|---|---|
| Sound Transmision Class: | |
| Noise Criteria: | |

**SPECIAL REQUIREMENTS**

| | |
|---|---|
| Oxgen/gas Detection: | ☐ |
| Other: | ☐ |

**COMMENTS**

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

### PLUMBING

**ROOM SERVICES + LOCATION**

| | |
|---|---|
| Natural Gas (GAS): | ☐ |
| Vacuum (VAC): | ☐ |
| Carbon Diox. (CO2): | ☐ |
| Compressed Air (CA): | ☑ |
| Chilled Water (CW S/R): | ☐ |
| Nitrogen (N2): | ☐ |
| Helium (He): | ☐ |
| Argon (Ar): | ☐ |
| Oxygen (O2): | ☐ |
| Hydrogen (H): | ☐ |
| Liq Nitrogen (LN2): | ☐ |
| Special Gas 1 (SG1): | ☐ |
| Special Gas 2 (SG2): | ☐ |
| Other: | ☐ |

**SINKS**

| | |
|---|---|
| Standard | ☑ ( 0 ) |
| ADA | ☐ |
| Scullery | ☐ |
| Epoxy | ☐ |
| Stainless Steel | ☐ |
| Marine Edge | ☐ |

**SERVICES AT SINKS**

| | |
|---|---|
| Hot Water (HW) | ☑ |
| Cold Water (CW) | ☑ |
| High Purity Water | ☐ |
| Eye Wash | ☐ |
| Drench Hose | ☐ |
| DI/RO Water (DI/RO): | ☐ |

**OTHER**

| | |
|---|---|
| Floor Drain (FD) | ☐ |
| Floor Sink (FS) | ☐ |
| Trench Drain (TD) | ☐ |
| Safety Shower (SS) | ☐ |
| Eye Wash (EW) | ☑ |
| Other: | ☐ |

**COMMENTS**

### ELECTRICAL / LIGHTING

**ELECTRICAL**

| | |
|---|---|
| Raceway | ☑ |
| 110V, 20A, 1 Phase: | ☐ |
| 208V, 30A, 1 Phase | ☐ |
| 208V, 30A, 3 Phase: | ☑ |
| Other V/Phase | ☐ |
| Standby Power | ☐ |
| UPS | ☑ |
| Power at Table | ☑ |
| Data | ☐ |
| Phone | ☑ |
| Other: | ☑ Data wifi |

**LIGHTING**

| | |
|---|---|
| 80-100 fc @ wrk srfc | ☑ |
| 30-60 fc @ wrk srfc | ☐ |
| Other fc @ wrk srfc: | ☐ |
| Task Lighting | ☑ |
| Surgical Light | ☐ |
| Dimmable Lighting | ☑ |
| Zoned Lighting | ☑ |
| Prefer Natural Light | ☑ |
| Other: | ☐ |

**COMMENTS**

Power for computers in floor. Accessible trench for power.

### SECURITY / AV

**SECURITY**

| | |
|---|---|
| Key Lock | ☑ |
| Card Access | ☑ |
| Video Surveillance | ☐ |
| Emergency Shutoff | ☑ |
| Equipment Theft Alarm | ☐ |
| Glass Break Sensor | ☐ |
| Alarmed Door | ☐ |
| Motion Detector | ☐ |
| Motion Sensors | ☐ |
| Close Circuit Telev. | ☐ |
| Other: | ☐ |

**COMMUNITCATIONS**

**AUDIO VISUAL**

| | |
|---|---|
| Projection | ☑ |
| Flat Panel Display | ☑ |
| Camera | ☐ |
| Microphone | ☐ |
| Distance Learning | ☐ |
| Other: | ☐ |

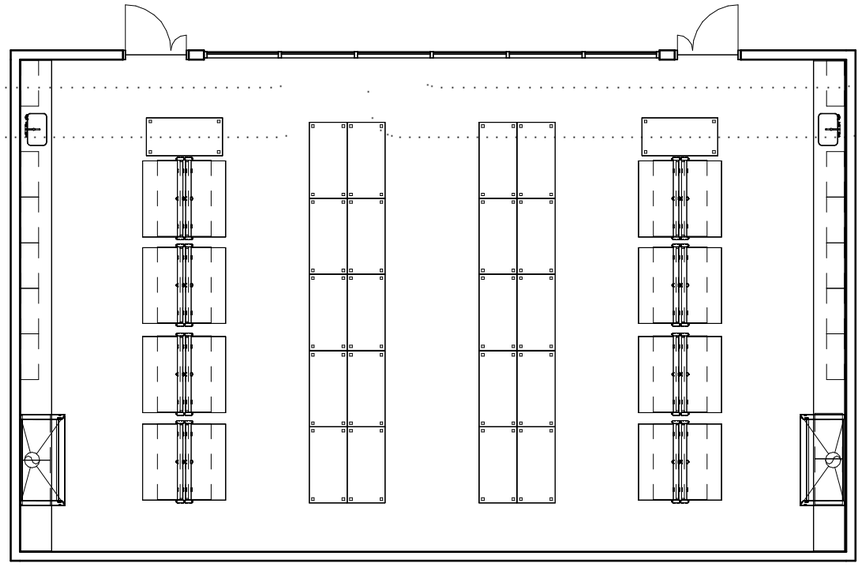
**COMMENTS**

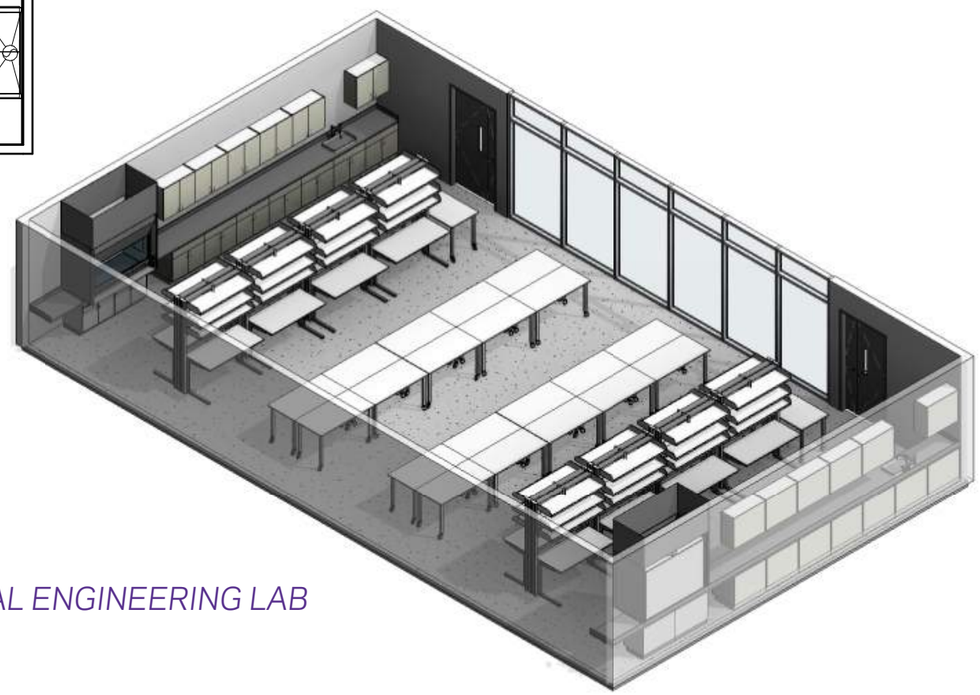
### GENERAL ROOM REMARKS

| | |
|---|---|
| GENERAL ROOM REMARKS | White boards and writeable surfaces. |

# 05. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)





*ENVIRONMENTAL ENGINEERING LAB*

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

| | |
|---|---|
| Description | Environmental Engineering Research Lab |

**USER DATA**

**ROOM DATA**

| | |
|---|---|
| Representative | |
| Functional Adjacencies | |
| Occupancy | 0 |
| Population | 0 |

**UTILIZATION**

| | |
|---|---|
| 8 hours/day | ☐ |
| 14 hours/day | ☑ |
| 24 hours/day | ☐ |
| Other: | ☐ |

**COMMENTS**

**ARCHITECTURAL**

**WALL FINISH**

| | |
|---|---|
| GWB, Paint | ☑ |
| GWB, Epoxy Paint | ☐ |
| FRP | ☐ |
| Pre-Fab Modular | ☐ |
| Other: | ☐ |

**WALL SUBSTRATE**

| | |
|---|---|
| GWB, Stud | ☑ |
| CMU | ☐ |
| CIP | ☐ |
| Demountable | ☐ |
| Other: | ☐ |

**WALL PROTECTION**

| | |
|---|---|
| Corner Guards | ☐ |
| Crash Rails | ☐ |
| Other: | ☐ |

**FLOOR BASE**

| | |
|---|---|
| Applied | ☑ |
| Integral | ☐ |
| Material: | |

**FLOORING**

| | |
|---|---|
| VCT | ☐ |
| Sheet Vinyl | ☐ |
| Electrostatic Dissipative | ☐ |
| Epoxy | ☐ |
| Carpet | ☐ |
| Sealed Concrete | ☐ |
| Commercial Rubber | ☑ |
| Other: | ☐ |

**DOOR 1**

| | |
|---|---|
| Size: | 3'-0" x 8'-0" |
| Type: | Full Vision Panel |
| Material: | Metal |

**DOOR 2**

| | |
|---|---|
| Size: | |
| Type: | |
| Material: | |

**DOOR 3**

| | |
|---|---|
| Size: | |
| Type: | |
| Material: | |

**CEILINGS**

| | |
|---|---|
| Open | ☐ |
| Acoustic Tile | ☑ |
| Gyp. Board | ☐ |
| Special Ceilings: | ☐ |
| Other: | ☐ |

**HAZARD / SHIELDING**

Type:

**COMMENTS**

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

### CASEWORK

| CASEWORK TYPE | | BENCHTOP MATERIAL | | COMMENTS |
|---|---|---|---|---|
| Fixed Casework | ☑ | Epoxy | ☑ | |
| Movable Casework | ☑ | Wood | ☐ | |
| Wall Cabinets | ☑ | Stainless Steel | ☐ | |
| Wall Shelves | ☑ | Plastic Laminate | ☐ | |
| Lockable Cabinets | ☐ | Phenolic | ☐ | |
| Other: | ☐ | Other: | ☐ | |

| CASEWORK MATERIAL | | SHELVING MATERIAL | |
|---|---|---|---|
| Metal | ☐ | Metal | ☐ |
| Wood | ☐ | Wood | ☐ |
| Stainless Steel | ☐ | Stainless Steel | ☐ |
| Other: | ☐ | Glass | ☐ |
| | | Other: | ☐ |

### EXHAUST DEVICES

| | | |
|---|---|---|
| Benchtop Fume Hoods: | ☑ | ( Qty: 1 ) Size: 6' |
| Walk-in Fume Hoods: | ☐ | |
| Radioisotope Hoods: | ☐ | |
| Perchloric Hoods: | ☐ | |
| Bio Safety Cabs: | ☐ | |
| Vert Lam Flow Hoods: | ☐ | |
| Hori Lam Flow Hoods: | ☐ | |
| Polypropylene Hoods: | ☐ | |
| Canopy Hoods: | ☐ | |
| ADA Hoods: | ☐ | |
| Point Exhaust: | ☐ | |
| Other: | ☐ | |

**COMMENTS**

### HVAC

**ENVIRONMENT**

| | | |
|---|---|---|
| Design Temp Cooling: | 72 F | Range +/-: 2 |
| Relative Humidity Cooling: | 50 % | Range +/-: 2 |
| Design Temp Heating: | 72 F | Range +/-: 2 |
| Relative Humidity Heating: | 25 % | Range +/-: 2 |
| Supply Air Filtration | | |
| Min. Air Change Rate (ac/hr): | 6 | |
| Indicator | | |
| Pressure Monitor | ☐ | |
| Laminar Flow Distribution | ☐ | |
| Exhaust Air Filtration | | |
| Exhaust Air: 100% Exhausted | ☑ | |
| Exhaust Air: Recirculated Air | ☐ | per ASHRAE 62.1 |
| Low Wall Exhaust | ☐ | |
| Night Setback | ☐ | |

**ACOUSTIC**

Sound Transmision Class:

Noise Criteria:

**SPECIAL REQUIREMENTS**

| | |
|---|---|
| Oxgen/gas Detection: | ☐ |
| Other: | ☐ |

**COMMENTS**

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

### PLUMBING

**ROOM SERVICES + LOCATION**

| | |
|---|---|
| Natural Gas (GAS): | ☐ |
| Vacuum (VAC): | ☑ Lab only. Building vacuum not required. |
| Carbon Diox. (CO2): | ☐ |
| Compressed Air (CA): | ☑ Desiccant Air Dryer system. Dry Air |
| Chilled Water (CW S/R): | ☐ |
| Nitrogen (N2): | ☐ |
| Helium (He): | ☐ |
| Argon (Ar): | ☐ |
| Oxygen (O2): | ☐ |
| Hydrogen (H): | ☐ |
| Liq Nitrogen (LN2): | ☐ |
| Special Gas 1 (SG1): | ☑ |
| Special Gas 2 (SG2): | ☐ |
| Other: | ☐ |

**SINKS**

| | |
|---|---|
| Standard | ☑ ( 0 ) |
| ADA | ☐ |
| Scullery | ☐ |
| Epoxy | ☑ ( 0 ) |
| Stainless Steel | ☐ |
| Marine Edge | ☐ |

**SERVICES AT SINKS**

| | |
|---|---|
| Hot Water (HW) | ☑ |
| Cold Water (CW) | ☑ |
| High Purity Water | ☑ |
| Eye Wash | ☐ |
| Drench Hose | ☐ |
| DI/RO Water (DI/RO): | ☐ |

**OTHER**

| | |
|---|---|
| Floor Drain (FD) | ☐ |
| Floor Sink (FS) | ☐ |
| Trench Drain (TD) | ☐ |
| Safety Shower (SS) | ☑ |
| Eye Wash (EW) | ☑ |
| Other: | ☐ |

**COMMENTS**

Point of use polisher for high purity water. Polisher CFCI.

### ELECTRICAL / LIGHTING

**ELECTRICAL**

| | |
|---|---|
| Raceway | ☑ |
| 110V, 20A, 1 Phase: | ☑ |
| 208V, 30A, 1 Phase | ☐ |
| 208V, 30A, 3 Phase: | ☐ |
| Other V/Phase | ☐ |
| Standby Power | ☐ |
| UPS | ☐ |
| Power at Table | ☐ |
| Data | ☑ |
| Phone | ☑ |
| Other: | ☑ Data Wifi |

**LIGHTING**

| | |
|---|---|
| 80-100 fc @ wrk srfc | ☑ |
| 30-60 fc @ wrk srfc | ☐ |
| Other fc @ wrk srfc: | ☐ |
| Task Lighting | ☑ |
| Surgical Light | ☐ |
| Dimmable Lighting | ☑ |
| Zoned Lighting | ☑ |
| Prefer Natural Light | ☑ |
| Other: | ☐ |

**COMMENTS**

### SECURITY / AV

**SECURITY**

| | |
|---|---|
| Key Lock | ☑ |
| Card Access | ☑ |
| Video Surveillance | ☐ |
| Emergency Shutoff | ☐ |
| Equipment Theft Alarm | ☐ |
| Glass Break Sensor | ☐ |
| Alarmed Door | ☐ |
| Motion Detector | ☐ |
| Motion Sensors | ☐ |
| Close Circuit Telev. | ☐ |
| Other: | ☐ |

**COMMUNITCATIONS**

**AUDIO VISUAL**

| | |
|---|---|
| Projection | ☐ |
| Flat Panel Display | ☐ |
| Camera | ☐ |
| Microphone | ☐ |
| Distance Learning | ☐ |
| Other: | ☐ |

**COMMENTS**

### GENERAL ROOM REMARKS

| | |
|---|---|
| GENERAL ROOM REMARKS | Whiteboard or writable surface |

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

| | |
|---|---|
| **Name** | Environmental Engineering Support Lab |
| **Last modified** | Byers, Virginia, 10/22/2022 11:14 AM |

| **Details** | | **Groups / Classifications / Status** |
|---|---|---|
| Programmed Area | 500.00 | |
| Description | Shared Support Lab | |

**USER DATA**

**ROOM DATA**

| | |
|---|---|
| Representative | |
| Functional Adjacencies | |
| Occupancy | 0 |
| Population | 0 |

**COMMENTS**

**UTILIZATION**

| | |
|---|---|
| 8 hours/day | ☐ |
| 14 hours/day | ☑ |
| 24 hours/day | ☐ |
| Other: | ☐ |

**ARCHITECTURAL**

**WALL FINISH**

| | |
|---|---|
| GWB, Paint | ☑ |
| GWB, Epoxy Paint | ☐ |
| FRP | ☐ |
| Pre-Fab Modular | ☐ |
| Other: | ☐ |

**WALL SUBSTRATE**

| | |
|---|---|
| GWB, Stud | ☑ |
| CMU | ☐ |
| CIP | ☐ |
| Demountable | ☐ |
| Other: | ☐ |

**WALL PROTECTION**

| | |
|---|---|
| Corner Guards | ☐ |
| Crash Rails | ☐ |
| Other: | ☐ |

**FLOOR BASE**

| | |
|---|---|
| Applied | ☑ |
| Integral | ☐ |
| Material: | |

**FLOORING**

| | |
|---|---|
| VCT | ☐ |
| Sheet Vinyl | ☐ |
| Electrostatic Dissipative | ☐ |
| Epoxy | ☐ |
| Carpet | ☐ |
| Sealed Concrete | ☐ |
| Commercial Rubber | ☑ |
| Other: | ☐ |

**DOOR 1**

| | |
|---|---|
| Size: | 3'-0" x 8'-0" |
| Type: | 1/2 Vision Panel |
| Material: | Metal |

**DOOR 2**

| | |
|---|---|
| Size: | |
| Type: | |
| Material: | |

**DOOR 3**

| | |
|---|---|
| Size: | |
| Type: | |
| Material: | |

**CEILINGS**

| | |
|---|---|
| Open | ☐ |
| Acoustic Tile | ☑ |
| Gyp. Board | ☐ |
| Special Ceilings: | ☐ |
| Other: | ☐ |

**HAZARD / SHIELDING**

Type:

**COMMENTS**

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

### CASEWORK

| CASEWORK TYPE | | BENCHTOP MATERIAL | |
|---|---|---|---|
| Fixed Casework | ☑ | Epoxy | ☑ |
| Movable Casework | ☑ | Wood | ☐ |
| Wall Cabinets | ☑ | Stainless Steel | ☐ |
| Wall Shelves | ☑ | Plastic Laminate | ☐ |
| Lockable Cabinets | ☐ | Phenolic | ☐ |
| Other: | ☐ | Other: | ☐ |

| CASEWORK MATERIAL | | SHELVING MATERIAL | |
|---|---|---|---|
| Metal | ☑ | Metal | ☐ |
| Wood | ☐ | Wood | ☐ |
| Stainless Steel | ☐ | Stainless Steel | ☐ |
| Other: | ☐ | Glass | ☐ |
| | | Other: | ☐ |

**COMMENTS**

### EXHAUST DEVICES

| | |
|---|---|
| Benchtop Fume Hoods: | ☐ |
| Walk-in Fume Hoods: | ☐ |
| Radioisotope Hoods: | ☐ |
| Perchloric Hoods: | ☐ |
| Bio Safety Cabs: | ☐ |
| Vert Lam Flow Hoods: | ☐ |
| Hori Lam Flow Hoods: | ☐ |
| Polypropylene Hoods: | ☐ |
| Canopy Hoods: | ☐ |
| ADA Hoods: | ☐ |
| Point Exhaust: | ☐ |
| Other: | ☐ |

**COMMENTS**

### HVAC

**ENVIRONMENT**

| | |
|---|---|
| Design Temp Cooling: | 72 F Range +/-: 2 |
| Relative Humidity Cooling: | 50 % Range +/-: 2 |
| Design Temp Heating: | 72 F Range +/-: 2 |
| Relative Humidity Heating: | 25 % Range +/-: 2 |
| Supply Air Filtration | |
| Min. Air Change Rate (ac/hr): | 6 |
| Indicator | |
| Pressure Monitor | ☐ |
| Laminar Flow Distribution | ☐ |
| Exhaust Air Filtration | |
| Exhaust Air: 100% Exhausted | ☑ |
| Exhaust Air: Recirculated Air | ☐ per ASHRAE 62.1 |
| Low Wall Exhaust | ☐ |
| Night Setback | ☐ |

**ACOUSTIC**

| | |
|---|---|
| Sound Transmision Class: | |
| Noise Criteria: | |

**SPECIAL REQUIREMENTS**

| | |
|---|---|
| Oxgen/gas Detection: | ☐ |
| Other: | ☐ |

**COMMENTS**

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

### PLUMBING

**ROOM SERVICES + LOCATION**

| | |
|---|---|
| Natural Gas (GAS): | ☐ |
| Vacuum (VAC): | ☑ |
| Carbon Diox. (CO2): | ☐ |
| Compressed Air (CA): | ☑ |
| Chilled Water (CW S/R): | ☐ |
| Nitrogen (N2): | ☐ |
| Helium (He): | ☐ |
| Argon (Ar): | ☐ |
| Oxygen (O2): | ☐ |
| Hydrogen (H): | ☐ |
| Liq Nitrogen (LN2): | ☐ |
| Special Gas 1 (SG1): | ☑ |
| Special Gas 2 (SG2): | ☐ |
| Other: | ☐ |

**SINKS**

| | |
|---|---|
| Standard | ☑ ( 0 ) |
| ADA | ☐ |
| Scullery | ☐ |
| Epoxy | ☑ ( 0 ) |
| Stainless Steel | ☐ |
| Marine Edge | ☐ |

**SERVICES AT SINKS**

| | |
|---|---|
| Hot Water (HW) | ☑ |
| Cold Water (CW) | ☑ |
| High Purity Water | ☐ |
| Eye Wash | ☐ |
| Drench Hose | ☐ |
| DI/RO Water (DI/RO): | ☐ |

**OTHER**

| | |
|---|---|
| Floor Drain (FD) | ☐ |
| Floor Sink (FS) | ☐ |
| Trench Drain (TD) | ☐ |
| Safety Shower (SS) | ☑ |
| Eye Wash (EW) | ☑ |
| Other: | ☐ |

**COMMENTS**

### ELECTRICAL / LIGHTING

**ELECTRICAL**

| | |
|---|---|
| Raceway | ☑ |
| 110V, 20A, 1 Phase: | ☑ |
| 208V, 30A, 1 Phase | ☐ |
| 208V, 30A, 3 Phase: | ☐ |
| Other V/Phase | ☐ |
| Standby Power | ☐ |
| UPS | ☐ |
| Power at Table | ☐ |
| Data | ☑ |
| Phone | ☑ |
| Other: | ☑ Data Wifi |

**LIGHTING**

| | |
|---|---|
| 80-100 fc @ wrk srfc | ☑ |
| 30-60 fc @ wrk srfc | ☐ |
| Other fc @ wrk srfc: | ☐ |
| Task Lighting | ☑ |
| Surgical Light | ☐ |
| Dimmable Lighting | ☑ |
| Zoned Lighting | ☑ |
| Prefer Natural Light | ☑ |
| Other: | ☐ |

**COMMENTS**

### SECURITY / AV

**SECURITY**

| | |
|---|---|
| Key Lock | ☐ |
| Card Access | ☐ |
| Video Surveillance | ☐ |
| Emergency Shutoff | ☐ |
| Equipment Theft Alarm | ☐ |
| Glass Break Sensor | ☐ |
| Alarmed Door | ☐ |
| Motion Detector | ☐ |
| Motion Sensors | ☐ |
| Close Circuit Telev. | ☐ |
| Other: | ☑ Access controlled into main lab. |

**COMMUNITCATIONS**

**AUDIO VISUAL**

| | |
|---|---|
| Projection | ☐ |
| Flat Panel Display | ☐ |
| Camera | ☐ |
| Microphone | ☐ |
| Distance Learning | ☐ |
| Other: | ☐ |

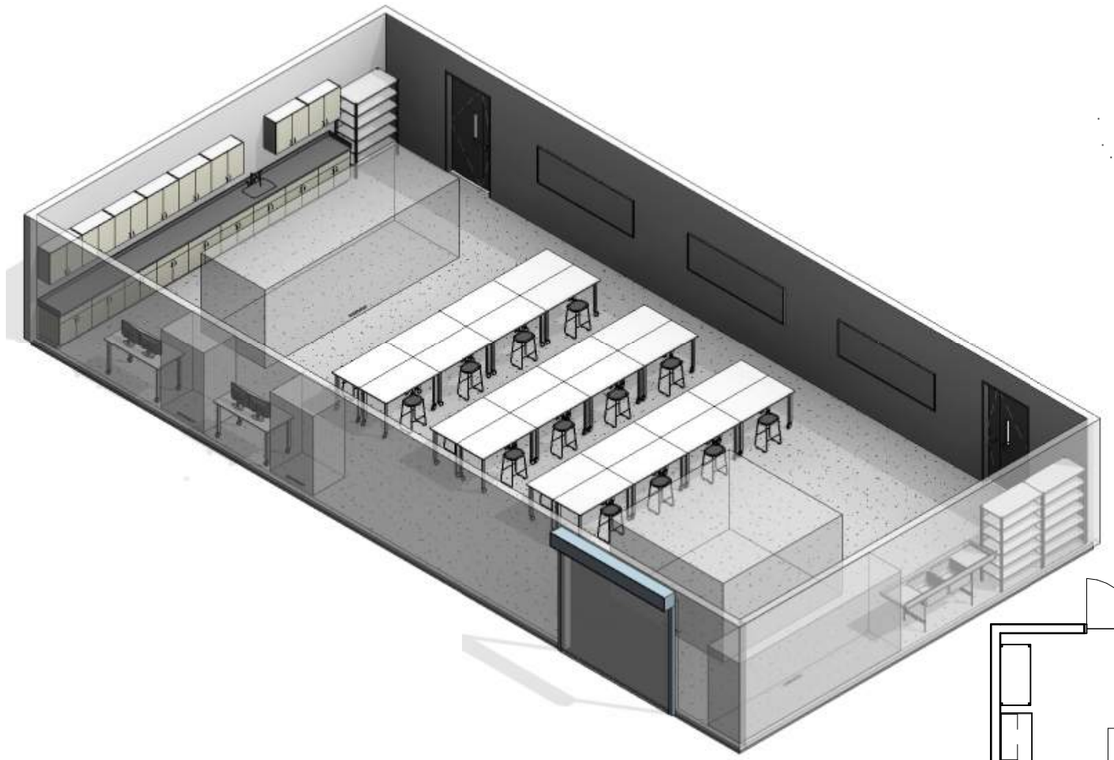
**COMMENTS**

### GENERAL ROOM REMARKS

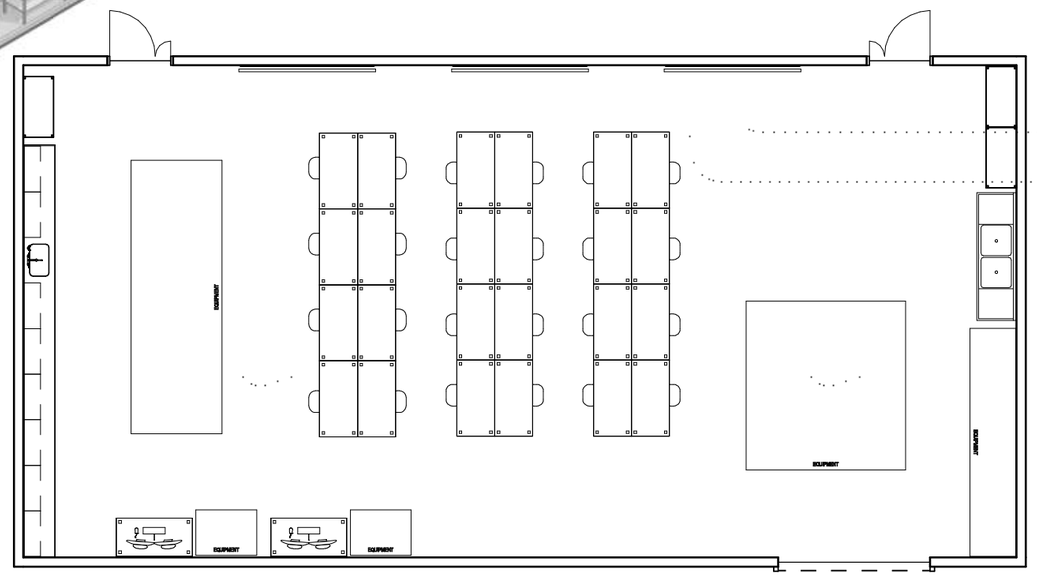
| | |
|---|---|
| GENERAL ROOM REMARKS | Whiteboard or writable surface. |

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)



*CIVIL ENGINEERING LAB*



# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

| | |
|---|---|
| **Name** | Civil Engineering Lab |
| **Last modified** | Byers, Virginia, 10/27/2022 9:29 PM |

| **Details** | | **Groups / Classifications / Status** |
|---|---|---|
| Programmed Area | 1,100.00 | |
| Description | Civil Engineering Lab | |

### USER DATA

**ROOM DATA**

| | |
|---|---|
| Representative | |
| Functional Adjacencies | |
| Occupancy | 0 |
| Population | 0 |

**UTILIZATION**

| | |
|---|---|
| 8 hours/day | ☐ |
| 14 hours/day | ☑ |
| 24 hours/day | ☐ |
| Other: | ☐ |

**COMMENTS**

### ARCHITECTURAL

**WALL FINISH**

| | |
|---|---|
| GWB, Paint | ☑ |
| GWB, Epoxy Paint | ☐ |
| FRP | ☐ |
| Pre-Fab Modular | ☐ |
| Other: | ☑ Glass Storefront on one side. View into Classroom |

**WALL SUBSTRATE**

| | |
|---|---|
| GWB, Stud | ☑ |
| CMU | ☐ |
| CIP | ☐ |
| Demountable | ☐ |
| Other: | ☐ |

**WALL PROTECTION**

| | |
|---|---|
| Corner Guards | ☐ |
| Crash Rails | ☐ |
| Other: | ☐ |

**FLOOR BASE**

| | |
|---|---|
| Applied | ☐ |
| Integral | ☐ |
| Material: | |

**FLOORING**

| | |
|---|---|
| VCT | ☐ |
| Sheet Vinyl | ☐ |
| Electrostatic Dissipative | ☐ |
| Epoxy | ☐ |
| Carpet | ☐ |
| Sealed Concrete | ☑ |
| Commercial Rubber | ☐ |
| Other: | ☑ Strongfloor, items should be able to secure to floor through eyebolt or similar |

**DOOR 1**

| | |
|---|---|
| Size: | 3'-6" x 8'-0" |
| Type: | Full Vision Panel |
| Material: | Metal |

**DOOR 2**

| | |
|---|---|
| Size: | 1'-6" x 8'-0" |
| Type: | Full Vision Panel |
| Material: | Metal |

**DOOR 3**

| | |
|---|---|
| Size: | |
| Type: | Overhead |
| Material: | |

**CEILINGS**

| | |
|---|---|
| Open | ☑ |
| Acoustic Tile | ☐ |
| Gyp. Board | ☐ |
| Special Ceilings: | ☐ |
| Other: | ☐ |

**HAZARD / SHIELDING**

Type:

**COMMENTS**

Door and 1/2 style entrance doors.
Overhead Rollup door: transparent made of tempered glass or polycarbonate.

10' Clear Floor to Ceiling

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

### CASEWORK

| CASEWORK TYPE | | BENCHTOP MATERIAL | |
|---|---|---|---|
| Fixed Casework | ☑ | Epoxy | ☐ |
| Movable Casework | ☑ | Wood | ☑ |
| Wall Cabinets | ☐ | Stainless Steel | ☐ |
| Wall Shelves | ☐ | Plastic Laminate | ☐ |
| Lockable Cabinets | ☑ | Phenolic | ☐ |
| Other: | ☑ Tall Lockable Cabinets | Other: | ☐ |

| CASEWORK MATERIAL | | SHELVING MATERIAL | |
|---|---|---|---|
| Metal | ☑ | Metal | ☑ |
| Wood | ☐ | Wood | ☐ |
| Stainless Steel | ☐ | Stainless Steel | ☐ |
| Other: | ☐ | Glass | ☐ |
| | | Other: | ☐ |

**COMMENTS**

### EXHAUST DEVICES

| | |
|---|---|
| Benchtop Fume Hoods: | ☐ |
| Walk-in Fume Hoods: | ☐ |
| Radioisotope Hoods: | ☐ |
| Perchloric Hoods: | ☐ |
| Bio Safety Cabs: | ☐ |
| Vert Lam Flow Hoods: | ☐ |
| Hori Lam Flow Hoods: | ☐ |
| Polypropylene Hoods: | ☐ |
| Canopy Hoods: | ☐ |
| ADA Hoods: | ☐ |
| Point Exhaust: | ☐ |
| Other: | ☐ |

**COMMENTS**

### HVAC

**ENVIRONMENT**

| | |
|---|---|
| Design Temp Cooling: | 72 F Range +/-: 2 |
| Relative Humidity Cooling: | 50 % Range +/-: 2 |
| Design Temp Heating: | 72 F Range +/-: 2 |
| Relative Humidity Heating: | 25 % Range +/-: 2 |
| Supply Air Filtration | |
| Min. Air Change Rate (ac/hr): | 4 |
| Indicator | |
| Pressure Monitor | ☐ |
| Laminar Flow Distribution | ☐ |
| Exhaust Air Filtration | |
| Exhaust Air: 100% Exhausted | ☐ |
| Exhaust Air: Recirculated Air | ☑ per ASHRAE 62.1 |
| Low Wall Exhaust | ☐ |
| Night Setback | ☐ |

**ACOUSTIC**

| | |
|---|---|
| Sound Transmision Class: | 45 or above |
| Noise Criteria: | |

**SPECIAL REQUIREMENTS**

| | |
|---|---|
| Oxgen/gas Detection: | ☐ |
| Other: | ☐ |

**COMMENTS**

Room is noise producing.

# 04. APPENDIX

## 04.2 ROOM DATA SHEETS (RDS)

### PLUMBING

**ROOM SERVICES + LOCATION**

| | |
|---|---|
| Natural Gas (GAS): | ☐ |
| Vacuum (VAC): | ☐ |
| Carbon Diox. (CO2): | ☐ |
| Compressed Air (CA): | ☑ |
| Chilled Water (CW S/R): | ☐ |
| Nitrogen (N2): | ☐ |
| Helium (He): | ☐ |
| Argon (Ar): | ☐ |
| Oxygen (O2): | ☐ |
| Hydrogen (H): | ☐ |
| Liq Nitrogen (LN2): | ☐ |
| Special Gas 1 (SG1): | ☐ |
| Special Gas 2 (SG2): | ☐ |
| Other: | ☐ |

**SINKS**

| | |
|---|---|
| Standard | ☐ |
| ADA | ☑ ( 0 ) |
| Scullery | ☑ ( 0 ) |
| Epoxy | ☐ |
| Stainless Steel | ☐ |
| Marine Edge | ☐ |

**SERVICES AT SINKS**

| | |
|---|---|
| Hot Water (HW) | ☑ |
| Cold Water (CW) | ☑ |
| High Purity Water | ☐ |
| Eye Wash | ☑ |
| Drench Hose | ☐ |
| DI/RO Water (DI/RO): | ☐ |

**OTHER**

| | |
|---|---|
| Floor Drain (FD) | ☑ |
| Floor Sink (FS) | ☐ |
| Trench Drain (TD) | ☐ |
| Safety Shower (SS) | ☑ |
| Eye Wash (EW) | ☑ |
| Other: | ☐ |

**COMMENTS**

P-Trap primer in floor drains.

### ELECTRICAL / LIGHTING

**ELECTRICAL**

| | |
|---|---|
| Raceway | ☑ |
| 110V, 20A, 1 Phase: | ☐ |
| 208V, 30A, 1 Phase | ☐ |
| 208V, 30A, 3 Phase: | ☑ |
| Other V/Phase | ☐ |
| Standby Power | ☐ |
| UPS | ☑ |
| Power at Table | ☑ |
| Data | ☐ |
| Phone | ☑ |
| Other: | ☑ Data wifi |

**LIGHTING**

| | |
|---|---|
| 80-100 fc @ wrk srfc | ☑ |
| 30-60 fc @ wrk srfc | ☐ |
| Other fc @ wrk srfc: | ☐ |
| Task Lighting | ☑ |
| Surgical Light | ☐ |
| Dimmable Lighting | ☐ |
| Zoned Lighting | ☑ |
| Prefer Natural Light | ☑ |
| Other: | ☐ |

**COMMENTS**

### SECURITY / AV

**SECURITY**

| | |
|---|---|
| Key Lock | ☑ |
| Card Access | ☑ |
| Video Surveillance | ☐ |
| Emergency Shutoff | ☐ |
| Equipment Theft Alarm | ☐ |
| Glass Break Sensor | ☐ |
| Alarmed Door | ☐ |
| Motion Detector | ☐ |
| Motion Sensors | ☐ |
| Close Circuit Telev. | ☐ |
| Other: | ☐ |

**COMMUNITCATIONS**

**AUDIO VISUAL**

| | |
|---|---|
| Projection | ☐ |
| Flat Panel Display | ☑ |
| Camera | ☐ |
| Microphone | ☐ |
| Distance Learning | ☐ |
| Other: | ☐ |

**COMMENTS**

### GENERAL ROOM REMARKS

GENERAL ROOM REMARKS

CTA: 42615 98097

## Product Information

Materials Testing Machines ProLine Z005 to Z100


ProLine Z050 TN with body-over-wedge grips, makroXtens P, and base option


ProLine Z010 TH with pneumatic grips

Our ProLine materials testing machines were primarily developed for the performance of standardized tests on materials and components. When combined with our intuitive testXpert III testing software, ProLine materials testing machines offer fast, easy operation.

### Advantages and features

**Integrated safety in accordance with the EC Machinery Directive**

Maximum level of safety for user and testing system is guaranteed. All EC Machinery Directive safety requirements are guaranteed. Compliance is documented with an EC Declaration of Conformity. State-of-the-art safety technology and proven industrial components that comply with the highest level of safety and industrial standards (IEC 60947) are used.

**Powerful drives**

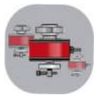
- Extremely low minimum speeds can be set with simultaneous high speed-stability. In addition, the drive delivers high crosshead travel resolution. This is important, for example in the case of component testing with high demands on travel precision and tests on specimens with high stiffness and short test travel.
- The high test-speed range can be used without restriction. In addition, test loads up to 110 % of machine nominal load are permissible to compensate for heavy combinations of test fixtures, accessories etc.
- Faster return speeds mean reduced cycle times and increased test throughput. The motor employs zero-maintenance AC technology.

# Product Information

## Materials Testing Machines ProLine Z005 to Z100

**High stiffness and precise crosshead guidance**
Two steel columns provide highly accurate guidance for ProLine's moving crosshead. The stiff load-frame profile and generous connecting surfaces reduce the inclination angle of the crosshead under load, enabling very precise alignment and application of force to the specimen. This is advantageous for flexure tests, compression tests, precision tests on components etc.

**Safety for the entire testing system**
The highest level of safety is achieved with the two-channel safety circuit. It includes the crosshead limit switch, the drive-Off switch, motor break function and the operation mode switch. Relevant accessories are also integrated into the safety circuit. The CE-compliant safety device with electrical interlocking and mechanical guard locking prevents interference with the machine during the test.



**Exclusively at ZwickRoell: Xforce Load Cells**
Patented Xforce load cells are developed and manufactured by ZwickRoell, and offer outstanding accuracy and high resistance to parasitic influences. Parasitic influences such as temperature and transverse forces have significantly less impact on test results than other comparable sensors. Xforce load cells are also very robust and more resistant to factors such as transverse forces during compression and flexure tests.

**Mechanical Modularity**
Mechanical modularity enables the testing system to be expanded by the wide range of ZwickRoell test fixtures and specimen grips or with customized devices. This is where the highly adaptable, play-free plug and T-slot system comes into its own, backed by a wide variety of crosshead mount options. Specimen grips and test tools can be changed whenever required, enabling a wide range of tests to be performed with the same testing machine and allowing rapid, highly flexible adaptation to the current testing situation.

**Short delivery times**
With the ProLine materials testing machines' short delivery time of two weeks, test tasks can be taken on quickly, saving valuable time.


**ZwickRoell Engineering—Made in Germany**
The development and manufacture of materials testing machines, including all mechanical, electronic and software components, together with our comprehensive range of accessories, takes place at ZwickRoell's production facility in Germany, enabling us to create a product that is perfectly harmonized. Each materials testing machine is made of the highest quality standard enabling ZwickRoell to offer the best possible support.

**Overview of the key advantages of testControl II machine electronics**

**Innovative testControl II machine electronics**
All ZwickRoell materials testing machines are equipped with the powerful testControl II measurement and control electronics, offering the ideal basis for precise, reproducible test results.
The electronics are mounted vertically on the side of the load frame. This position protects the electronics from penetration of liquids and conductive particles.
The high-quality surfaces protect testControl II from external influences. In addition, the components used are highly durable.

**testControl II machine electronics and testXpert III testing software—a powerful combination**
testXpert III testing software and testControl II machine electronics are perfectly matched, ensuring safe and efficient operation of the testing system. testXpert III provides the optimal solution for any testing requirement.

# Product Information

## Materials Testing Machines ProLine Z005 to Z100

**Flexibility Through Modularity**
testControl II offers six flexible time-synchronized slots. These make it possible to use multiple sensors at the same time, and can be monitored and protected irrespective of use.

- For example, an extensometer and a transverse strain extensometer can be used in addition to the load cell.
- If the testing system is equipped with several load cells or additional sensors, these can all remain plugged in. All plugged-in sensors are automatically protected against overloads.

**Machine compliance correction**
Due to the high-quality drive technology and real-time correction of the machine compliance during the test, target positions are approached with accuracy and travel is precisely determined with the crosshead travel monitor. The testXpert III testing software automatically sets the optimal correction curve, guaranteeing the highest possible level of precision.

**High data transmission rate**
Each travel and force peak is acquired with high resolution and recorded synchronously at 500 Hz on all measuring channels. Optionally, the measured value acquisition rate can be expanded to 2,000 Hz. The high data transmission rate enables fast measurement with the highest degree of reproducibility. This is highly advantageous for quick tests, short, brittle fracture events and in tear-growth, adhesion and peel tests.

**System monitoring**
testControl II system monitoring provides the user/laboratory manager with detailed information on the current status and level of utilization of the testing equipment. This enables further increases in testing equipment availability and greatly simplifies maintenance planning and spares/replacement procurement.

**Fast, adaptive drive controller**
The high drive control frequency of 1,000 Hz delivers fast, precise force and strain control. Benefits include enabling components to be loaded very quickly and accurately with a predetermined force.


**Maximum accuracy**
The smallest force changes on the specimen are quickly and accurately recorded and displayed. The A/D converter guarantees high measured-value accuracy over a wide measurement range with sampling rates of 400 kHz and 24 bit resolution.


**Innovative Interfaces**
The innovative EtherCat® interface is incorporated as standard. The time-synchronized real-time Ethernet field bus system ensures future-proof integration of sensors and power units.

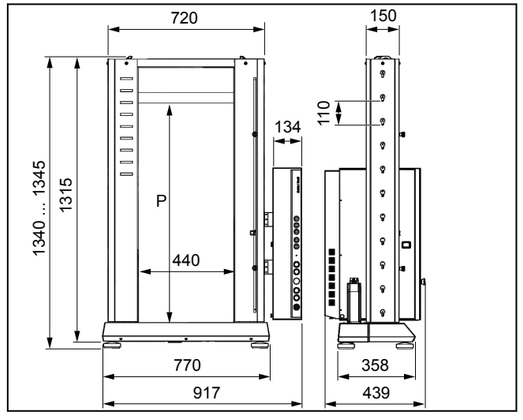

**Eco mode**
The testControl II machine electronics automatically switch to eco mode when not in use, saving energy.

**Ergonomic remote control with color display**
Tests can be performed entirely via the display-equipped remote control, independent of the PC. All important information is shown on the color display. Machine operation is therefore more ergonomic and effective. Maximum operator safety is guaranteed with the integrated Emergency stop. The rocker-switch with integrated dial makes positioning fast yet highly accurate.

## Product Information

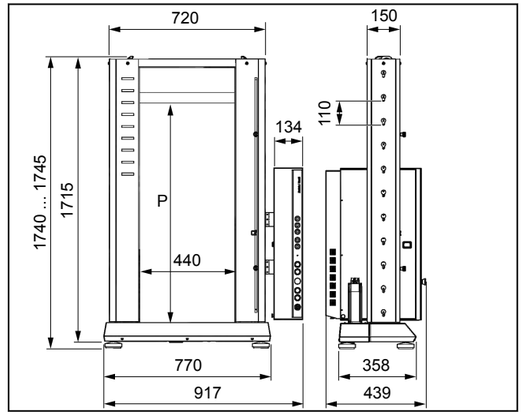
Materials Testing Machines ProLine Z005 to Z100

CTA: 36955 36955




ProLine Z005 TN, Z010 TN and Z020 TN, dimensions

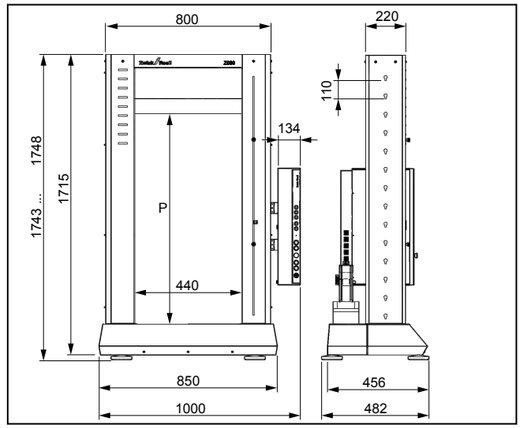
**P** Height of the test area without accessories




ProLine Z005 and Z010 TH, dimensions

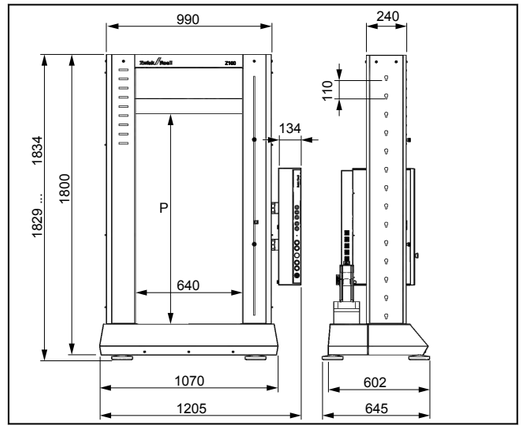
**P** Height of the test area without accessories

CTA: 54507 54507




ProLine Z030 and Z050 TN, dimensions

**P** Height of the test area without accessories




ProLine Z100 TN, dimensions

**P** Height of the test area without accessories

# Product Information

## Materials Testing Machines ProLine Z005 to Z100

### Technical data

### General technical data for ProLine

| | | |
|---|---|---|
| **Load frame** | | |
| Finish | RAL 7021 black gray/stainless steel metallic, RAL 3031 orient red | |
| Ambient temperature | +10 ... +35 | °C |
| Relative humidity (non-condensing) | 20 ... 90 | % |
| Conformity | ISO 9000 and CE | |
| **Drive system** | | |
| Motor | AC servo motor | |
| Motor holding brake | Yes | |
| Control, set value preselection | Digital (real-time Ethernet, EtherCAT®) | |
| Controller | Adaptive | |
| Cycle time | 1000 | Hz |
| Positioning repeatability (without reversal of direction) | ±2.0 | µm |
| **Power input specifications** | | |
| Power supply | 230 | V, 1Ph/N/PE |
| Permissible voltage fluctuation | ±10 | % |
| Power frequency | 50/60 | Hz |

| Description | Value | |
|---|---|---|
| **Machine electronics** | | |
| Number of available slots for measurement and control modules: | | |
| Synchronized module slots | 2 (expandable to 5)[1)] | |
| Synchronized PCIe slots | 1 | |
| Force measurement | Class 0.5/1, depending on load cell, compliant to DIN EN ISO 7500-1, ASTM E4 | |
| Measurement range | Up to 165% of Fmax | |
| Calculated resolution (e.g., load cell in tensile/compression direction) | 24 | bits |
| Effective resolution in tensile/compression direction: | | |
| DCSC module | 19 bits (corresponds to ±524,000 points) | |
| USC module | 20 bits (corresponds to ±1,000,000 points) | |
| Measured value recording rate | 400 | kHz |
| Measured-value transmission rate to PC | 500 (optional 2000) | Hz |
| Zero-point correction | Automatic, at start of measurement | |
| Measurement signal run-time correction | Yes | |
| Interface to PC | Ethernet | |
| Eco mode | Yes (time adjustable) | |
| CE conformity | Yes, according to Machinery Directive 2006/42/EC | |

# Product Information

## Materials Testing Machines ProLine Z005 to Z100

**Z005, Z010**

| **Type**<br>**Item No.** | **Z005 TN**<br>**059008** | **Z005 TH[1)]**<br>**1097346** | **Z010 TN**<br>**059010** | **Z010 TH[2)]**<br>**059011** | |
|---|---|---|---|---|---|
| Test load $F_{max}$ | 5 | 5 | 10 | 10 | kN |
| **Test area** | | | | | |
| Height, travel distance of the moving crosshead | 1000[3)] | 1400[3)] | 980[3)] | 1380[3)] | mm |
| Width | 440 | 440 | 440 | 440 | mm |
| **Load frame** | | | | | |
| Dimensions | | | | | |
| Height with leveling elements | 1340 ... 1345 | 1740 ... 1745 | 1340 ... 1345 | 1740 ... 1745 | mm |
| Width | 770 | 770 | 770 | 770 | mm |
| Width with machine electronics | 917 | 917 | 917 | 917 | mm |
| Depth with machine electronics | 439 | 439 | 439 | 439 | mm |
| Weight | | | | | |
| With machine electronics, approx. | 110 | 125 | 135 | 150 | kg |
| Connection, stud | Ø 20 | Ø 20 | Ø 20 | Ø 20 | mm |
| Average noise level at $v_{max}$ measured at 1 m distance from the front of the machine | 59 | 59 | 57 | 57 | dB(A) |
| **Drive system** | | | | | |
| Crosshead speed $v_{min}$ ... $v_{max}$ | 0.0005 ... 1500[4)] | 0.0005 ... 1500[4)] | 0.0005 ... 1000[4)] | 0.0005 ... 1000[4)] | mm/min |
| Crosshead return speed, max. | 2000[4)] | 2000[4)] | 1500[4)] | 1500[4)] | mm/min |
| Deviation from the set drive speed, max. | 0.05 | 0.05 | 0.05 | 0.05 | % of $v_{actual}$ |
| Drive travel resolution | 0.0348 | 0.0348 | 0.0232 | 0.0232 | µm |
| **Power input specifications** | | | | | |
| Power supply | 230 | 230 | 230 | 230 | V, 1Ph/N/PE |
| Power consumption (full load), approx. | 800 | 800 | 800 | 800 | VA |

1) For the ProLine Z005 TH testing machine, the maximum total weight of the specimen grips and tools mounted on the crosshead is limited to 20 kg.

2) For the ProLine Z010 TH testing machine, the maximum overall weight for specimen grips and tools mounted on the crosshead is 20 kg.

3) Height of the (lower) test area without accessories

4) Values apply to machines with the safety doors closed in automatic mode and to machines without safety devices. For machines with the safety door open, the speed is reduced to 600 mm/min.

**Z020; Z030; Z050; Z100**

| **Type**<br>**Item No.** | **Z020 TN**<br>**059012** | **Z030 TN**<br>**059013** | **Z050 TN**<br>**059021** | **Z100 TN**<br>**1025089** | |
|---|---|---|---|---|---|
| Test load $F_{max}$ | 20 | 30 | 50 | 100 | kN |

## Product Information

Materials Testing Machines ProLine Z005 to Z100

| Type<br>Item No. | Z020 TN<br>059012 | Z030 TN<br>059013 | Z050 TN<br>059021 | Z100 TN<br>1025089 | |
|---|---|---|---|---|---|
| **Load frame** | | | | | |
| Dimensions | | | | | |
| Height with leveling elements | 1340 ... 1345 | 1743 ... 1748 | 1743 ... 1748 | 1829 ... 1834 | mm |
| Width | 770 | 850 | 850 | 1070 | mm |
| Width with machine electronics | 917 | 1000 | 1000 | 1205 | mm |
| Depth with machine electronics | 439 | 462 | 462 | 645 | mm |
| Weight | | | | | |
| With machine electronics, approx. | 135 | 330 | 330 | 530 | kg |
| Connection, stud | Ø 36 | Ø 36 | Ø 36 | Ø 60 | mm |
| Average noise level at $v_{max}$ measured at 1 m distance from the front of the machine | 58 | 68 | 69 | 60 | dB(A) |
| **Drive system** | | | | | |
| Crosshead speed $v_{min}$ ... $v_{max}$ | 0.0005 ... 500 | 0.0005 ... 300 | 0.0005 ... 600 | 0.0005 ... 300 | mm/min |
| Crosshead return speed, max. | 750[2)] | 500 | 800[2)] | 400 | mm/min |
| Deviation from the set drive speed, max. | 0.05 | 0.05 | 0.05 | 0.05 | % of $v_{actual}$ |
| Drive travel resolution | 0.0115 | 0.0076 | 0.0122 | 0.0123 | µm |
| **Power input specifications** | | | | | |
| Power supply | 230 | 230 | 230 | 230 | V, 1Ph/N/PE |
| Power consumption (full load), approx. | 800 | 800 | 1600 | 1600 | VA |

1) Height of the (lower) test area without accessories

2) Values apply to machines with the safety doors closed in automatic mode and to machines without safety devices. For machines with the safety door open, the speed is reduced to 600 mm/min.

HIF

# DIGITAL HYDRAULIC BENCH

A mobile, self-contained bench with recirculating water supply. It provides water at different flow rates direct to experiments and includes digital flow display for hydraulic and fluid mechanics experiments.

FIVE YEAR QUALITY TECQUIPMENT SINCE 1958 WARRANTY



DIGITAL FLOW DISPLAY

## KEY FEATURES

- Electronic flowmeter and digital display for accurate measurements and quicker experiments
- Made of lightweight fibreglass for strength, easier transport and long life
- Lockable wheels for mobility with stability
- Flat top to hold experiment modules from TecQuipment's Fluid Mechanics range
- Self-contained with recirculating water circuit – needs no external water supply and saves mains water
- Pump includes thermal overload protection

## KEY SPECIFICATIONS

- Digital flow display
- 0.001 $L.s^{-1}$ and 0.1 $L.min^{-1}$ resolution
- Electronic flowmeter
- Fibreglass construction
- 160 litres capacity

# 04. APPENDIX

## 04.3 EQUIPMENT

### DESCRIPTION

This product supplies a controlled flow of water to a wide variety of laboratory experiment modules (available separately). The body of the bench forms a reservoir or 'sump tank' with a submersible pump. Once filled, the bench needs no external water supply.

The top of the bench provides a working surface. This will hold one of a choice of experiment modules from TecQuipment's Fluid Mechanics range. Larger experiments usually stand next to the bench. A rim around the top contains any spilled or excess water. A small recess or 'Trough' in the top works with a removeable Drain Valve to trap a small volume of water. It also catches discharged water from some experiments in the fluid mechanics range.

A hand-operated control valve adjusts the water flow rate from the pump. An electrical box on the side of the bench includes the pump switch, circuit protection and a digital display of flow.

Four wheels allow the user to move the bench around the classroom. Two wheels have foot-operated locks to hold the bench in position.

A sight gauge to the lower side of the bench allows the user to check the water level inside the tank.

An electronic flowmeter measures the outlet flow from the submersible pump. The signals from the flowmeter pass to the digital display to show the flow rate. The viewing angle of the display allows the user to see it clearly from a normal standing position.

### STANDARD FEATURES

- Supplied with a comprehensive user guide
- Five-year warranty
- Manufactured in accordance with the latest European Union directives
- ISO9001 certified manufacturer

# 04. APPENDIX

## 04.3 EQUIPMENT

### AVAILABLE EXPERIMENT MODULES

**BENCH-MOUNTING:**

- Flow Visualisation (FC15)
- Flow Through an Orifice (H4)
- Venturi Meter (H5)
- Discharge Over a Notch (H6)
- Friction Loss in a Pipe (H7)
- Impact of a Jet Apparatus (H8)
- Flow Measurement (H10)
- Vortex Apparatus (H13)
- Francis Turbine (H18)
- Pelton Turbine (H19)
- Hydraulic Ram Pump (H31)
- Jet Trajectory and Orifice Flow (H33)
- Pipework Energy Losses (H34)
- Flow Meter Calibration (H40)

**FREE-STANDING**

- Losses in Piping Systems (H16)
- 2.5 Metre Flow Channel (FC50-2.5)
- Pipe Surge And Water Hammer (H405)
- Fluid Friction Apparatus (H408)

SHOWN WITH THE IMPACT OF A JET (H8)

SHOWN WITH THE LOSSES IN PIPING SYSTEMS (H16)

# 04. APPENDIX

## 04.3 EQUIPMENT

### DETAILED SPECIFICATIONS

TecQuipment is committed to a programme of continuous improvement; hence we reserve the right to alter the design and product specification without prior notice.

**NETT DIMENSIONS AND WEIGHT:**

1250 mm long x 780 mm wide x 950 mm high and 50 kg (no water)

**APPROXIMATE PACKED DIMENSIONS AND WEIGHT:**

1.4 $m^3$ and 120 kg

**SUMP TANK CAPACITY:**

100 Litres minimum and 160 litres maximum

**MAXIMUM FLOW:**

With no experiment module fitted:

50 litres/minute (220V)

47 litres/minute (110V)

**MAXIMUM PRESSURE:**

450 mbar at working surface height

**FLOWMETER DISPLAY:**

$L.s^{-1}$ and $L.min^{-1}$

**RESOLUTION:**

0.001 $L.s^{-1}$ and 0.1 $L.min^{-1}$

**ACCESSORIES (INCLUDED):**

- Water additive and datasheet
- All necessary pipes and pipe clips

### OPERATING CONDITIONS

**OPERATING ENVIRONMENT:**

Laboratory

**STORAGE TEMPERATURE RANGE:**

–25°C to +55°C (when packed for transport)

**OPERATING TEMPERATURE RANGE:**

+5°C to +40°C

### ESSENTIAL SERVICES

**SINGLE-PHASE, EARTHED ELECTRICAL SUPPLY (SPECIFY ON ORDER):**

- Single phase, 220 - 240 VAC, 50 Hz, 2.5 Amp **OR**
- Single phase, 110 -120 VAC, 60 Hz, 5 Amp **OR**
- Single phase, 220 - 240 VAC, 60 Hz, 2.5 Amp

**NOTE:** This product may produce small splashes of water in use, so you must use it at a safe distance from electrical supplies. TecQuipment recommends approximately 2.4 m.

FLORIDA POLYTECHNIC UNIVERSITY

# SECTION 05 - TECHNICAL REFERENCE SPECIFICATIONS

*SEE THE DESIGN CRITERIA REFERENCE SPECIFICATIONS UNDER SEPARATE COVER*