PART I: INTRODUCTION

1.1 PURPOSE

A. Mission Statement

We, the Yale Office of Facilities, are here for one basic reason: To serve as part of a team that provides the environment in which the mission of the University is achieved, in a cost effective and efficient manner. The value we add is in facilitating and managing the process of creating those environments. We strive for full satisfaction of all stakeholders' needs and requirements, at all times, for all activities. The portfolio of ongoing projects is the framework in which we manage our movement toward physical environments that reflect institutional ideals.

B. Designer's Role

Key to the delivery of a successful project is that all players work as a team. The designer plays a significant role in fostering the participation required to create an effective team. To this end, a proactive approach is expected to the interface with University representatives, such as Yale's Environmental Health & Safety, Building Services and Operations, Telecommunications, Security, Fire Marshal, among others. Secondly, the designer must take ownership of the project. The designer is expected to deliver an integrated design with fully coordinated architectural and engineering systems. The designer is also expected to embrace the scope, schedule, and budget and be responsible to keep these three parameters in focus when making decisions regarding the project design.

Finally, the designer is responsible for ensuring that the design proposed adheres to Yale's design standards. It is expected that the designer will embrace the design standards and have a proactive approach to using them. The designer should assume that no one else will be checking for conformance. The designer must apply these guidelines and notify the project manager if there is a proposed deviation verbally and through documentation by way of the Basis of Design.

C. Interface with Project Participants

To achieve a successful project, the designer must get input from, and coordinate with diverse groups. These groups include Yale representatives from Building Services and Operations, Office of Environmental Health and Safety, Fire Marshal, Telecom, Security, Client Support, and in addition, the officials from the City of New Haven.

When the Yale design team meets with the City of New Haven' building officials or fire marshal to review projects, the project manager must be present to monitor the discussion and field any questions regarding Yale University policy. A visit to the City of New Haven is required during preliminary design to familiarize city officials with the project and to get their comments and concerns early in the process.

In general, everyone can talk to everyone else, but the project manager must know about all communications via minutes or memos, reporting the interaction(s). The design team cannot act on a comment from another department, or from the user, if this is not approved by the project manager. If changes get incorporated that are not brought to the project manager's attention, and not approved by the project manager, the design team will "own" that issue and will be required to redesign it as required if the decision is not approved by the project manager. The project manager must be thoroughly informed of every aspect of the project, as they are responsible for its ultimate completion. Therefore, no decisions can be made without the project manager's approval.

D. Purpose and Use of Design Standards

Yale University's design standards establish the requirements for designing and building new structures and for remodeling existing structures at Yale. The standards are also intended to assist design architects and engineers in maintaining consistency on a particular project and continuity with existing Yale University facilities, systems, and equipment. Architectural and engineering firms as well as Yale staff must use these standards as the basis for developing all design and construction documents. For ease of reference, the numbering of the various sections and their organization by division correspond to the Construction Specification Institute's (CSI) MasterFormat structure. However, the University's design standards are not intended for use, in whole or in part, as specifications. Do not copy design criteria verbatim in specifications or in notes on drawings.

Review the relevant sections and references listed in each section of the standards and comply with all applicable design requirements. Comply with applicable federal, state, and local laws, codes, and regulations. When applicable laws, codes, or regulations are at variance with these standards, inform Yale's project planner of the variance to jointly decide on an approach that is compliant and meets University needs.

The Yale University project planner is responsible for ensuring that design and construction professionals adhere to these standards. Refer questions and comments regarding the content and use of these standards to the University's project planner. Submit proposed deviations from these standards, in writing, to the project planner for approval, before incorporating the proposed changes into the design and construction documentation. Yale representatives periodically revise and update these standards as technology changes and as codes, regulations, and legal mandates are revised or instituted. Submit suggested changes, additions, or deletions for these standards to the planner or project manager to share with Yale's Office of Facilities Design Standards Committee.

Architects and engineers doing work for Yale University are expected to utilize these standards as maintained on the Office of Facilities website. Do not rely on previously printed or downloaded versions.

1.2 CAMPUS PLANNING FRAMEWORK

A. Plan for Campus Development

Yale University has developed an approach to the long-term stewardship of the campus called *A Framework for Campus Planning*, published in March 2000, and prepared by Cooper, Robertson & Partners. The plan consists of two documents: the Framework Plan (1) and the Manual (2) provide design professionals with the proper context for campus building and renovation projects. In addition, supplemental documents to *A Framework for Campus Planning* have been developed and are noted below.

B. The Framework Plan

A Framework for Campus Planning is the general and public document that contains recommendations for: (1) the seven University planning precincts; (2) future development sites and open space for each precinct; and (3) campus systems, such as use, building form, landscape and open space, vehicular and pedestrian circulation, parking, signs, lighting, and neighborhood interfaces.

C. The Manual

The Manual is a specific and internal document containing development guidelines for the opportunity sites within each planning precinct and for campus systems. These development guidelines are the parameters for building design, including planning context, general character, use, density, building form, height, access, parking or service, and landscape areas.

D. The Framework Plan: Supplement (2009)

In August 2009, *A Framework for Campus Planning: Supplement* was published, including an overview new construction on central campus and the athletics fields since 2000 as well as providing updated planning methodologies and principles.

E. The Framework Plan: Sustainability Supplement (2013)

In June 2013, *A Framework for Campus Planning: Sustainability Supplement* was published, including an overview of the University's commitment to sustainable design, construction, and operation practices as well as providing updated methodologies and principles that align with Yale's pledge to reduce greenhouse gas emissions.

F. The Yale Sustainability Plan 2025

Yale's sustainability plan outlines the top-level sustainability commitments of the

University, priorities supporting these ambitions, and measurable methods for achieving sustainability goals.

G. Stormwater Management Plan (2018)

Documents the University's vision for campus stormwater management, which provides strategies and reports on recent progress.

H. Water Management Plan (2017)

Defines strategies and near-term progress, while providing direction for future development to actively and adaptively manage this highly valuable resource at Yale.

I. Office of Facilities Website

The above planning documents and additional standards can be found at https://facilities.yale.edu/contractors-consultants.

1.3 PROJECT PROCESS AND PLANNING

A. Capital Project Process and Handbook

In 2005, Yale University developed the *Capital Projects Handbook* to document and communicate the work processes and other important information needed to effectively complete capital projects at Yale. These processes are relevant and ongoing today.

Review the handbook to better understand the project delivery process, the roles of various project participants and how your services fit into the broader project delivery context.

B. Project Program and MOU

Unless a preliminary feasibility study or programming effort is a part of the architect's services, Yale University will prepare a project program or formal memorandum of understanding (MOU) setting forth the project requirements. The project program includes a program narrative, mission statement, site and building requirements, information about occupants, relationships between spaces, area requirements, environmental requirements, and space finishes and fittings.

C. Design Phases—Detailed Schedule

Upon completion of the preliminary design estimate, a variety of non-construction costs must be accurately budgeted to obtain a soundly based, reliable updated project budget. This requires a tight sequence of steps to assure that these costs are based on accurate information. The following illustrative schedule shows the steps that are required and the sequence in which they must occur.

Before the project kick off meeting, for all projects, Yale's project manager should meet with the architect, engineers, and construction manager to develop a project-specific preliminary design phase schedule with dates for each of the listed events. It is important to get buy-in from the architect and construction manager on these dates before issuing them. This detailed schedule should be reviewed at the kick-off meeting along with the overall project schedule. This schedule should be as aggressive as can be achieved without compromising the planning process.

Before each subsequent design phase kickoff meeting, the project team should develop the detailed schedule for the upcoming phase.

D. Kickoff Meetings

There are two types of design phase kickoff meetings. One is the preliminary design kickoff meeting, while the other is the kickoff meeting for subsequent phases. The preliminary design kickoff meeting initiates the project. All project participants are present, and it is a chance to educate the users on the design process. The project manager will review the scope, schedule, and budget for the project and briefly describe the overall process of design, review, and construction. The project manager will then turn the meeting over to the design team. The design team should then give an overview of their work and describe how information will be gathered and translated into the project design. The process and overall schedule for the preliminary design phase should be presented.

A schedule for subsequent meetings with the user should be established as part of the initial presentation. The design team can then begin their information gathering.

At subsequent kick-off meetings for the next phases of work, the design team will review comments from the previous phase, schedule the next series of meetings on specific topics, and begin the design process for the next phase of work.

During the design phases, the design team takes and distributes meeting minutes at each meeting. Please see the suggested format for meeting minutes that we have found to be quite easy to read and which clearly follow issues and their resolution (see Exhibit X at the end of this document).

This format keeps all previous comments on a particular issue and sets in bold the most recent. It also clearly indicates by whom action needs to be taken.

E. Progress Meetings

The architect schedules, prepares the agenda, chairs, and prepares minutes for all design progress meetings (see Exhibit X at the end of this document).

F. End of Phase Review Comments and Responses

It is important to punctuate the phases of the project by bringing closure at the end of each phase to reassess the status of the scope, schedule, and budget. At the end of each phase, documents are submitted and distributed to appropriate parties for review. Comments will come from the project participants described above, and the design team is expected to respond to the comments promptly. The design team should use this form to make responses to comments. The standard form is a Word document and can be transmitted electronically.

It is especially important that comments and responses be documented on the form so all participants know what issues are of concern and how they will be addressed. It should be noted that a project cannot proceed to the next phase if the scope, schedule, and budget are not within the project limits.

G. Yale Guidance and Review

During the design phase, the design team will need to meet with various Yale departments, including those listed in this section, to gain a detailed understanding of their requirements. Several of these departments have standards or requirements impacting design, including Engineering and Utilities, Environmental Health & Safety, Security, Yale Animal Resource Center, Resource Office on Disabilities, Custodial Services, Grounds Maintenance, Office of Sustainability, and Yale Hospitality.

H. Furniture Design and Procurement

The key to a successful purchase and installation of furniture is communication. From the very outset of a project, i.e., the preliminary kick-off design meeting, the project manager establishes the guidelines by which the design team, furniture vendor, Yale's Purchasing Services, and the project manager will interact. With so many parties involved, miscommunication can easily happen without the proper framework established. While all parties can talk to all other parties at any time, a key of the overall communication guideline is that the project manager must authorize any change that increases the cost of a furniture package.

There are two ways that the furniture design and procurement process occur: 1) minimal designer input for projects with straightforward furniture needs, and 2) in-depth designer involvement for larger projects with more complex furniture requirements. In the more complex situation, the architect's involvement will require additional fees as the work is not considered part of the basic services.

For the simpler project, the furniture procurement process can briefly be described as follows. A user meets with the furniture vendor, the project manager, and architect to review the project needs for furniture. The vendor will make a proposal based on a general layout generated by the architect working within the established budget. As part of the basic services, the architect is expected to advise on color selections that work with the colors chosen for other finishes within the space. A review of the proposed finishes, colors, and furniture should be scheduled with the Public Space Review Committee before any presentation is made to users to confirm that the direction is appropriate for selection and cost level. This review applies to all projects unless funded by the department and if it is a nonpublic space. The design team is also responsible for coordinating the electrical power and/or data outlets along with the proposed furniture so that they are accessible for use. This is especially important since outlets are repeatedly blocked by furniture.

The vendor will provide drawings, specifications, and an estimate. Once a user agrees to the layout and a proposed cost aligns with the budget, Yale's project manager takes the specification and attaches a purchase requisition which authorizes the furniture to be bid or bid and purchased. Following this step, the project manager forwards this package to Yale's Purchasing Services via AssetWorks. Yale's Purchasing Services then either competitively bids the furniture specification or, through an established buying agreement with a preferred vendor (for example Steelcase partnership through BKM Total Office), obtains a proposal and detailed specification. Once the specification meets the design intent, furniture is released for purchase via notification by the project manager to Yale's Purchasing Services. In turn, Purchasing Services tells the vendor.

For more complex projects, the furniture procurement process can briefly be described as follows. Working from an established budget, the design team meets with the user and project manager to determine the appropriate furniture required as well as the design, selection, and price parameters. A review of proposed finishes, colors, and furniture should be scheduled with the Public Space Review Committee before any presentation is made to users to confirm that the direction is appropriate for selection and cost level. This review applies to all projects unless funded by the department and if it is a nonpublic space. On larger projects requiring furniture with larger variations in cost, such as conference rooms and libraries, the Design Review Committee review should be scheduled before completion of the preliminary design phase estimate and end-product breakdown structure so that the furniture and equipment budget can be confirmed.

The design team specifies the furniture and submits a specification to the project manager. The specification need not be a full specification, in the sense that every manufacturer's part number needs to be identified, since the furniture vendor will produce a full specification. The project manager takes the specification as submitted by the design team and attaches a purchase requisition authorizing the furniture to be either bid, or bid and purchased, and forwards this package to Yale's Purchasing Services via AssetWorks. At this stage, Purchasing Services either competitively bids the furniture specification or, through the established buying agreement with a preferred vendor (for example Steelcase partnership through BKM Total Office), obtains a proposal and detailed specification.

Regardless of who the successful vendor is, a specification produced by a vendor will be reviewed in detail by the design team to ensure compliance with the design intent. Once the specification meets the design intent, furniture is released for purchase via notification by the project manager to Yale's Purchasing Services. In turn, Purchasing Services tells the vendor. When furniture arrives at a worksite, the design team needs to be present to review the shipped furniture versus the specified furniture to see if the order is complete and correct.

1.4 CONSTRUCTION PHASE PROCEDURES

A. Review of Contractor Invoices

Contractors' invoices are first to be submitted to the architect of record for review. It is the expectation of Yale University that design professionals will review this application for accuracy and conformance to the signed Owner/Contractor Agreement. Thus, the architect of record is "administering the contract" and needs to review the terms of the agreement between owner and contractor, particularly the agreed-upon allowable markups. Once approved and signed by the architect, an Application for Payment is submitted to the project manager for processing. Yale's project manager will only conduct a spot check of the invoice, in that the University is relying on the outside design professional to have reviewed the application.

B. Closeout Deliverables

During the closeout phase of a project archive document, deliverables are required from the design team. These include the Archive Drawings, Assignment Plans, and Specifications and Sustainability Documents along with the Basis of Design.

As part of the Record Archive Drawings and Specifications, and after substantial completion, the constructor will give the design team marked-up Field Record Drawings, which were kept onsite during the project. Using this set of documents to assess the number of changes that were made during the construction process, the designer should prepare a proposal to incorporate these changes into the original contract documents to be labeled as Record Archive Drawings. Changes made to these documents during this process need not be highlighted or called out in any way. They simply need to be incorporated into the base documents.

Changes that were made in the form of a prepared sketch by the design professionals during the construction phase need not be transferred to the original contract documents. These sketches can be grouped onto one large page, or multiple pages, and referenced within the original contract documents via notes. If this is done, the sketches should be scanned such that an electronic version can also be submitted.

In addition, the Mechanical Duct Layout Drawing does not need to be modified to reflect the final configuration of ductwork. Rather, this document should reference—in a bold way—a separate sheet metal shop drawing document, which needs to be scanned and included as part of the Record Archive Drawings set. In an analogous way, the fire protection drawings, as produced during the shop drawing process, should be scanned, and included within the Record Archive Drawing set electronically and in hardcopy. Please note that the finish schedule should be updated to reflect the final finishes selected and installed, including the paint manufacturer and color, base, carpet, etc.

As part of the Archive Drawing Submission, the design team must provide a final tabulation of total net assignable square feet (NASF) and gross square feet (GSF) of the project. As stated above, NASF is defined as the area bounded by the inside face of the demising walls for a given room. The total NASF will be the sum of all program space, but not including toilet rooms, custodial closets, and other nonprogram space. GSF is defined as the total area in which construction of any kind occurs, even if not contiguous, with the following exception. Do not include area outside of the primary construction area(s) through which ducts, pipes, or electrical service passes to connect to shafts, panels, or risers. If a project abuts an outside wall, gross floor area is measured from the inside face.

If you are unclear on how to calculate GSF for a particular project, check with your project manager.

1.5 PROCEDURAL REQUIREMENTS

A. Safety Issues

Safety is an essential component of design and construction at Yale University. Several projects on campus are in existing active laboratory environments, or other environments, which pose potential risks. It is important that designers understand these risks and conduct their work in a manner that ensures their safety and the safety of those who work in the laboratory. For tools and resources, learn more at the Yale Environmental Health & Safety website.

Yale Environmental Health & Safety provides a training session for designers and constructors which is offered at intervals. The following guidelines should be observed.

1. Eating, drinking, and/or smoking in any laboratory are prohibited.
2. Before entering any laboratory, always look for labeling at the entrance to the facility. There you may find any of the following elements.

   a) "Caution Radioactive Material" signage. This sign is an indication that radioactive material is either used or stored in the area. It does not necessarily mean, however, that there is an exposure hazard present.
   b) "BL2" or "BL3" signage, meaning biological safety levels two or three.
   c) Information sleeves containing specific information related to potential hazards in the facility, including biological, chemical, and/or radioactive materials.

3. Do not touch or move any containers, equipment, and/or items with any hazardous material label (i.e., "Caution Radioactive Material," "BL2," or "BL3").
4. Do not stand on or place tools on bench tops labeled with hazardous material labels.
5. Do not use sinks labeled with "Caution Radioactive Material" stickers, unless emergency situations arise (i.e., someone cuts themselves, the wound needs to flush, and there are no other sinks available). Please try to use sinks in the men's room for handwashing.
6. When situations arise where hazardous materials hinder your ability to perform your required task, please contact the Yale Environmental Health & Safety's research support coordinator at 203-737-2121. Please inform the research support coordinator of the potential hazard and an appropriate safety specialist will address the issue.
7. If hazardous exhaust ductwork, vacuum, and/or waste plumbing lines need to be penetrated, please contact the Yale Environmental Health & Safety's research

support coordinator at 203-737-2121. Please inform the research support coordinator of the required work to be performed and an appropriate safety specialist will address the issue.

8. If an emergency arises while in a laboratory relating to hazardous material, please contact the Yale Environmental Health & Safety's emergency line at 203-785-3555 (between 8:30 a.m.–5:00 p.m.). For all other emergencies and times outside of business hours, please call 911.

1.6 OFFICE OF FACILITIES ARCHIVED DOCUMENTS

A. In order to provide documents to consultants and maintain the quality and completeness of Yale's archive, the following procedures are to be observed.

1. Several Yale documents are available digitally. Documents can be requested through the project planner and will be sent to designers via file transfer.
2. Designers may also request an appointment to visit Yale's Office of Facilities Plan Room to search the drawing files.
3. All drawings removed from the drawers in the Plan Room must be refiled by the designer before leaving.
4. No original drawings (mylar, vellum, or print) shall leave the Plan Room in the possession of a non-Yale designer.

B. Project Photography

The following has been confirmed with representatives of Yale University's Office of Public Affairs & Communications for photographs taken by members of design and construction teams who work on our construction and renovation projects.

1. The project manager must be notified in writing before photographs are taken.
2. The photographer must be accompanied by a project manager or a representative of the occupant department's communications and/or business office.
3. No Yale faculty, staff, or students may be included in photographs without their written permission.
4. No patients or research subjects shall be included in any photograph.
5. Only photographs of projects specifically worked on may be included in documents such as annual reports or brochures for the purpose of obtaining new commissions.

C. Publications (in addition to the above)

1. No photographs of Yale property or projects will be used as part of any advertisement.
2. No photographs may be used of Yale buildings, settings, or scenes that are not specifically part of a renovation or construction commission.

PART 2: GENERAL GUIDELINES

2.1 SITE AND LANDSCAPE

A. Water Accumulation

Direct water runoff to green infrastructure or storm drains without splashing or dripping. Design with a primary and backup drainage system in mind. Drains in the roof field are preferred on low slopes. Interior drainage is discouraged.

2.2 BUILDING EXTERIOR

A. Thermal Performance

Provide the thermal resistance necessary to maintain specified interior comfort levels in accordance with code and the following thermal performance and energy efficiency requirements. When adding insulation to existing buildings, pay particular attention to altered thermal and moisture transmission characteristics of wall and roof assemblies, altered dewpoint and freeze/thaw locations, and potential impacts on existing materials.

B. Vapor Transmission and Condensation

There must be no condensation on interior surfaces under normal interior temperature and relative humidity conditions during 97.5 percent of the days in the coldest three months of the year. Design to prevent deterioration of materials due to condensation of moisture vapor inside assemblies.

1. If necessary, use a supplementary vapor retarder to meet moisture vapor transmission requirements.
2. Use a method of sealing joints between elements that is effective through available construction practices.

C. Appearance

Design and select materials to provide the following exterior appearance requirements and characteristics.

1. Cleanliness of exterior surfaces.

    a) Prevent the attraction and adherence of dust as well as airborne dirt and soot. Minimize the appearance of settled dust and dirt.
    b) Exterior surfaces must be washed reasonably clean by normal precipitation.

c) Prevent precipitation from washing settled dust and dirt over surfaces exposed to public view.
d) Select materials that will not result in heavy staining on building façades.

2. Conceal mechanical, plumbing, and electrical equipment as well as piping, conduit, and ducts from view from the street, from windows in the project that overlook the roof, and where possible, from windows in adjacent buildings overlooking the roof. Coordinate with the heating, ventilation, and air condition (HVAC) design engineer on concealments for lab fans or duct discharges.
3. Roof color must be compatible with energy efficiency and sustainability design requirements. Use materials on roofing surfaces exposed to view that will conceal dirt.

2.3 STRUCTURE

Designs must conform to the following structural standards.

A. Live Loads

Provide suspended interior fixtures, or portions of fixtures, designed for the storage or support of people or objects that have been engineered and installed to withstand one and one-half times the anticipated live loads without excessive deflection or permanent distortion.

B. Special Loads

In addition to loads defined by code, provide for adequate support of wall- or ceiling-mounted furnishings and equipment in spaces where such equipment is required by the project program or is likely to be installed after construction because of intended function. Adequate support is defined as the ability to sustain 150 percent of design loads without damage to the building or equipment.

Accommodate special loads as required by the project program.

1. In addition to loads defined by code, design for loads from moving elevators.
2. If the design method is not specifically prescribed by code, design in accordance with ASCE 7 standards.

C. Shell Elements

1. In instances where shell elements are engineered by their manufacturer or fabricator, rather than by the engineer-of-record, the manufacturer or fabricator must:

a) Employ a licensed structural engineer to design structural elements.
b) Have at least five years of experience in the design and manufacture of similar structures.

2. Elements engineered by their manufacturer or fabricator, rather than by the engineer-of-record, are not acceptable for the superstructure.

D. Seismic Design

1. Provide interior partitions at stairs and elevators that have been engineered and installed to withstand seismic forces that are 0.6 times the weight of the partition, applied non-concurrently in any horizontal direction at the partition's center of gravity.
2. Provide partitions at other than stairs and elevators that have been engineered and installed to withstand seismic forces that are 0.4 times the weight of the partition, applied non-concurrently in any horizontal direction at the partition's center of gravity.
3. Provide fire-rated ceiling assemblies that have been engineered and installed to withstand seismic forces that are 0.4 times the weight of the ceiling assembly, applied non-concurrently in any horizontal direction at the assembly's center of gravity.
4. Provide non-fire-rated ceiling assemblies that have been engineered and installed to withstand seismic forces that are 0.1 times the weight of the ceiling assembly, applied non-concurrently in any horizontal direction at the assembly's center of gravity.
5. Provide interior fixtures, or portions of fixtures, designed for the storage or support of people or objects that have been engineered and installed to withstand seismic forces that are 0.6 times the loaded weight of the fixture.

   a) Application: For design purposes, apply the component seismic force non-concurrently in any horizontal direction at the component's center of gravity.
   b) Exception: For design purposes, the contents included need not be more than 50 percent of the rated capacity of the interior fixture if the supports and framing of the fixtures are designed and connected to function as braced or moment-resisting frames.
   c) Design piping, hangers, and braces need to meet State of Connecticut building codes. The hanger supplier is not responsible for seismic design. The design of anchors, thrust restraints, guides, and other similar components is the responsibility of the engineer.

2.4 BUILDING INTERIOR

A. Basic Design

1. Interior construction comprises the following elements, which are necessary to subdivide and finish space enclosed within the shell, including applied interior surfaces of the exterior enclosure.

    a) Partitions: All types of space dividers, including demountable and operable partitions.
    b) Interior doors: All interior doors, except elevator doors, including the hardware and frames.
    c) Interior windows: All fixed and operable windows, including the frames and casings.
    d) Other interior openings: Include utility openings such as hatches and access panels, louvers, and vents.
    e) Stairs and ramps: The interior and exterior stair and ramp elements that are not part of the superstructure or exterior enclosure.
    f) Interior finishes: All functional and decorative applied interior finishes, including those for secondary support structures.

2. Interior fixtures comprise the following functional items, which are permanently attached to interior construction (walls, ceilings, and floors) and are necessary for the proper function of spaces required by the project program, except items classified as equipment or integral components of service systems.

    a) Identifying devices: Informational accessories, including room numbers, signage, and directories.
    b) Storage fixtures: Non-furniture items primarily intended for storing or securing objects, materials, and supplies, including cabinets, casework, wardrobes, closet fixtures, lockers, and shelving.
    c) Window treatment: Non-furnishing accessories for light control, solar heat gain, privacy, and view at interior and exterior windows, including blinds, shades, shutters, and curtain tracks.

    d) Accessory fixtures: Specialty items intended to provide service or amenity to building interiors, including toilet and bath accessories, postal fixtures, visual display surfaces, and telecommunications fixtures.
    e) Fixed seating: Single and multiple seating attached to the building.
    f) Other interior fixtures: Additional items fixed to interior construction that enhance comfort or amenity in building spaces, including service wall systems, planters, and fixed ladders.

B. Amenity and Comfort

Designs must conform to the following amenity and comfort standards.

1. Cross ventilation: If the building has operable windows, provide interior construction to facilitate natural cross ventilation.
2. View: Provide views to the building exterior or interior atria from most locations within primary interior spaces.
3. Natural and Artificial Light

   a) Provide ambient natural daylighting in primary spaces of an intensity adequate for essential tasks when measured on a typical overcast winter day in mid-afternoon.
   b) Provide minimum light levels no less than those recommended in the Illuminating Engineering Society's (IES) Lighting Ready Reference App for the types of tasks anticipated in each space. Provide interior fixtures that are not a source of direct or reflected glare.
   c) Provide ambient natural light in primary spaces that is free of excessive direct or reflected glare as defined in the IES's Recommended Practice of Daylighting Buildings (RP-5-13).
   d) Provide window shades to control brightness and glare from direct daylighting. Control of the shades is to be coordinated with the design and zoned within open work areas or per a building's heating and cooling systems design.

C. Interior Finishes

Use satin finishes (nonreflective rather than smooth, polished surfaces) on flat, exposed metal surfaces.

1. Coatings are not permitted on flat metal surfaces.
2. Use polished, satin, or high-performance organic coatings on hardware and other rounded metal surfaces.
3. Use matte, rather than glossy or polished finishes, on plastic surfaces.
4. Use low-gloss finishes, transparent or opaque, on flat wood surfaces.
5. Use transparent or opaque finishes, high- or semi-gloss, on curved wood surfaces.
6. Use honed or other textured, unpolished finishes on concrete and stone surfaces.

2.5 HEALTH AND SAFETY

A. Design and provide select materials for exterior and interior construction to protect pedestrians and building occupants in accordance with code in addition to the following requirements.

1. Provide permanent protection against the infestation of construction by ground-dwelling termites and other vermin.
2. Prevent ice and snow from falling off building elements onto pedestrians, building occupants, and vehicles. Consider designing paths to keep pedestrians away from such risks.
3. Protect pedestrians, building occupants, and vehicles from objects accidentally dropped from elevated observation decks, balconies, or plazas.
4. The ventilation area must be at least four percent of the total floor area for each room. This ventilation requirement is not applicable to bathrooms, toilet compartments, closets, halls, and storage or utility spaces.
5. The ventilation area must be at least 10 percent of the wall area for each floor, equally distributed on two elevations.
6. Design to prevent damage to occupants, structure, services, and contents from lightning strikes.

    a) Provide a protection equivalent to that specified in the most current National Fire Protection (NFPA) standards. Supplementary strike termination devices, ground conductors, and grounding electrodes are required only where the integral portions of the structure cannot perform those functions.
    b) Prevent lightning strikes from damaging or traveling along landscape features within ten feet (three meters) of a structure.
    c) Design and construct protections to comply with code and the requirements stipulated by Yale Environmental Health & Safety.

7. All upper-level windows at Yale's residential colleges must have opening controls to prevent someone from falling.

2.6 PHYSICAL SECURITY

In addition to any provisions that may be required by law or code, design and construct exterior and interior spaces to incorporate accepted principles of crime prevention through environmental design by using natural (as opposed to technological) methods of surveillance, access control, and territorial reinforcement, wherever possible. Coordinate the locations of physical barriers with the access control perimeters established by gated courtyards, building perimeters, and interior zones of keyed and electronic access control established by Yale's Security Department.

A. For purposes of physical security, elements at ground level are defined as any elements within 20 feet (six meters) of the ground, grade, or adjacent paving.

B. Security zones are defined as follows.

1. Public access zone: An area which the public has free access, including public corridors, grounds, and parking lots.
2. Reception zone: An area which the public has access but beyond where access is always restricted.
3. Operations zone: An area which only employees (and visitors with a legitimate reason to be there) have access.
4. Secure zone: An area which access is always controlled and monitored continuously.
5. High-security zone: An area indicated in the project program as "vault," "secure file room," or "cash room."

C. Design and construct to provide physical security in accordance with the following requirements.

1. For ground-level opaque elements use materials that give the impression of strength to discourage opportunistic attempts at intrusion. At a minimum, such materials must meet ASTM F1233 Class I and ASTM F476 (R96) Grade 10 forced entry resistance requirements adapted to suit the element.
2. Minimize the size of ground-level glazed elements and locate them in areas under surveillance by Yale University staff at their normal workstations.
3. Ground-level glazing must have a UL 972 burglary-resistant rating.
4. Doors must meet ASTM F476 (R96) or ASTM F842 Grade 10 requirements, as appropriate.
5. Windows at grade-level may require security screens or intrusion detection systems, as directed by Yale's Security Department.

2.7 ACCESSIBILITY AND CONVENIENCE

To the maximum extent possible, design all exterior and interior pathways, spaces, building components, fixtures, equipment, and furnishings to allow for fully convenient access and use by all persons.

Projects shall align with the Office of Facilities accessibility guidelines and recommendations from Yale's Advisory Committee on Accessibility Resources. Project stakeholders provide hardware and fixtures that persons with a diverse range of abilities can easily use without assistance, while also providing fixtures with fittings and controls that are manageable without special instruction or the need for excessive force.

A. Roof Worker Access and Safety

Provide permanent access to all areas of the roof in the form of stairs, or fixed ladders, with Yale University approval.

B. Access for Maintenance

1. Dunnage on Roofs

If structural steel dunnage is installed to support equipment above roofs a minimum of 30 inches of clearance must be provided between the roof surface and the lowest point of the dunnage. Do not locate anything requiring access on the underside of equipment on dunnage without prior approval from Yale's project manager.

2. Housing Equipment

The architect is expected to design spaces for housing equipment, such as mechanical, electrical, plumbing, and fire protection components so that the actual layout, when complete, will allow Yale University to service the equipment.

3. Access to Equipment

Select and locate all equipment and accessories with consideration for easy routine servicing and feasibility of major servicing, including the removal and replacement of equipment.

a) Elevator access to mechanical spaces on the lower and upper floors as well as the roof for maintenance purposes is preferred. Two means of access is required.
b) Provide a fixed ladder and/or catwalk for any equipment that requires maintenance access (including valves) and is not readily accessible from a six-foot-high portable ladder (interior only). To the extent possible, place valves and equipment so that a ladder is not needed.
c) Provide access to the equipment and pull spaces in addition to a means for removing and replacing the largest and/or heaviest equipment. Consider adding a beam attached to the structure to move or replace large motors, compressors, and other equipment.
d) Avoid roof-mounted equipment for critical applications. Access to roof-mounted equipment is difficult, and rooftop working conditions for maintenance personnel are not as safe as working conditions for indoor installations. Do not locate critical equipment in low-lying flood-prone areas.
e) Automatic control valves and damper operators must be exposed or equipped with access doors or panels.
f) Fans, fan coil units, and similar components located above hung ceilings must have adequate access for such services as lubrication and filter changes. Coordinate unit placement with the ceiling grid, walls, and doorways.
g) Locate thermometers and gauges, as well as thermometer wells and gauge taps, for simple reading and changing.

h) Where necessary, provide extended grease fittings for concealed or hard-to-reach bearings.
i) Provide adequate branch valving to allow for servicing without major shutdowns.
j) Equip branch piping that serves each floor with shut-off valves.
k) Equip branch mains serving fan-coil units, reheat boxes, induction units, convectors, and similar units with flow-measuring devices and balancing valves.
l) Avoid routing piping through rooms containing electrical or communications equipment. Where there is no other choice for routing, provide stainless steel drain pans under pipes that pass overhead and within two feet of any switchboard, motor, or controller. Drain pans must be 20 ounces and copper pans at least four inches wider than the outside edge of the pipes. Drain pans must be properly stiffened and braced with brass angles and supported to prevent sagging. Provide a turned-up edge with rolled over stiff brass wire on each side. Seams must be soldered and watertight. Provide a once-inch diameter drip pipe from the pan down to the nearest drain.
m) Locate equipment to allow the necessary clearance for removing coils and other subassemblies.
n) Provide conveniently located access doors to all enclosed areas housing mechanical equipment.
o) Provide lighting and power for servicing equipment.

4. Access to Piping Risers

Where required by the building design, access to valves and/or traps should be easy and practical. Access doors should be sectionalized, as necessary, for ease of removal and replacement. Install Lamacoid name plates on access doors to identify the services available in pipe chases.

2.8 HISTORIC PRESERVATION

The architect must review each project with Yale University to determine the project's objectives. Specific preservation treatment and design approach are dependent on several factors, including building age, historic value, types of existing materials, and desired outcome.

Yale University seeks to minimize the impact of updates made to historic buildings. Refer to the National Park Service guidelines for exterior and interior treatment to historic buildings, including such elements as stone, masonry, windows, and interior finishes. The Association for Preservation Technology, and other preservation organizations, also provide references for the best architectural and material preservation practices when specifying work to alter, repair, or protect historic materials and building elements.

2.9 DURABILITY

Designs must conform to the following durability standards.

A. Service Life Span

Service life span is the same as building service life with the following exceptions.

1. Load-bearing structural members should last a minimum of 100 years with no anticipated deterioration when protected as specified, including a minimum service life of 25 years for protective elements.
2. Wall primary weather-barrier elements should serve a minimum 50-year functional and aesthetic service life, excluding joint sealers.
3. Transparent elements (glazing) should be the same as other wall primary weather-barrier elements, except for accidental breakage, which is considered normal wear and tear.
4. Joint sealers should last a minimum of 20 years before replacement.
5. Surfaces exposed to view should serve a minimum 20-year aesthetic service life.
6. Roof covering weather barriers should last a minimum of 20 years, fully functional.
7. Interior doors and other operable elements should serve a minimum 15-year functional and aesthetic service life.
8. Interior ceiling finishes should serve a minimum 15-year functional and aesthetic service life, including suspended ceilings.
9. Interior wall and floor finishes should serve a minimum 10-year functional and aesthetic service life.
10. Other interior construction should serve a minimum 15-year functional and aesthetic service life.

B. Weather Resistance

Design and select materials to minimize deterioration due to precipitation, sunlight, ozone exposure, normal temperature changes, salt air, and atmospheric pollutants. Deterioration includes corrosion, shrinking, cracking, spalling, delamination, abnormal oxidation, decay, and rot.

1. For surfaces exposed to view, deterioration adversely affecting the aesthetic life span includes color fading, crazing, and delamination of applied coatings.

    a) Minimize the use of materials with separate coated finishes.
    b) At a minimum, coating performance must meet AAMA 2604 standards.

c) Coatings must be resistant to salt spray. There must be no deterioration of coatings when evaluated in accordance with ASTM B 117 standards for a 1000-hour exposure with 5 percent salt fog at 95°F (35°C).

2. Joint components and penetration seals must be capable of resisting expected thermal expansion and contraction. Wherever possible, use overlapping joints that shed water.
3. For transparent elements (glazing) there must be no change in haze, light transmission, or color during the entire expected service life. Test in accordance with ASTM D 1003 standards. There must be less than a one percent change in haze, light transmission, and color over two years of exposure when evaluated after natural exposure conditions or when evaluated after exposure to accelerated light and water conditions simulating natural exposure at the site. Accelerated exposure must be documented with a comparison to natural conditions.
4. The low service temperature is equal to the historically recorded low temperature. The high service temperature is equal to that expected due to any combination of air temperature and heat gain from solar and other sources.
5. Freeze-thaw resistance must be adequate for the climate at the site.
6. In locations exposed to outdoor air or in potential contact with moisture inside shell assemblies, use only corrosion-resistant metals as defined in this section.
7. Do not use materials that are adversely affected by ozone exposure.

C. Ultraviolet Resistance

In interior spaces exposed to direct sunlight, provide interior construction and fixtures that are inherently resistant to fading and discoloration.

D. Impact Resistance

Design and select materials to resist impact damage in accordance with code and the following requirements. Minimum performance values for individual shell elements are also specified in other sections of these standards.

1. Design and select materials to minimize damage from windborne debris propelled at up to 35 mph (56 km/h).
2. Design and select materials to resist damage from hail as large as half-inch (12 mm) in diameter.
3. At elements adjacent to traffic lanes, design and select materials to resist damage from accidental passenger vehicle impacts at a maximum velocity of 5 mph (8 km/hr.).
4. Design and select materials to resist damage from perching, nesting, and feeding birds.

E. Wear Resistance

Design and select materials to provide resistance to normal wear and tear in accordance with code as well as the following requirements.

1. Design and select materials to minimize degradation from rubbing and scratching
2. caused by pedestrians for elements within their reach.
3. Design and select materials to minimize degradation caused by windblown sand, acid, and rain.
4. Provide interior construction and fixtures with a level of durability suitable for the degree and type of anticipated traffic in each space.

F. Water and Corrosion Resistance

Provide sufficient supplementary protection for underground metal elements to completely prevent corrosion throughout their service life, without maintenance.

1. Three inches (150 mm) of concrete cover is considered to be permanent protection.
2. Provide cathodic protection if any of the following is true (coatings or wrappings are not considered sufficient protection for elements falling under these criteria).

   a) Metal elements are buried in a soil environment known to cause corrosion on similar nearby structures.
   b) Metal elements are buried in a soil environment in which stray DC electrical currents are present.

3. In interior spaces exposed to high humidity, such as swimming pool enclosures, provide interior construction and fixtures that will not be damaged by water or high humidity, and that are inherently resistant to corrosion and rot.

G. Vandalism and Theft Resistance

1. Design and select materials to minimize damage due to potential vandalism.
2. In spaces accessible to the public, and not subject to continuous surveillance, provide interior construction and fixtures that are inherently vandal resistant or designed to be difficult to access or damage.
3. Provide fixtures at all locations that are attached to substrates with concealed, tamper-resistant, or tamperproof fasteners to minimize theft and vandalism.

2.10 <u>EASE OF USE</u>

A. Ease of Relocation

When required by the project program, provide easily relocatable functional elements that define interior spaces. These may include systems furniture and demountable partitions.

B. Ease of Operation

Provide facilities, equipment, and systems that personnel can operate easily with a reasonable level of training. Minimize the need for specialized training in the operation of specific systems or equipment. Identify all equipment and systems for which the manufacturer recommends or provides training. See section 01 81 0 Commissioning and section 01 82 0 Demonstration and Training on Facilities' website

1. All text on identifying devices must be rendered in English.
2. Interior fixtures with movable components must be easy to use, without special instruction, and designed to prevent misuse.
3. Hinges and latches must be heavy-duty and easily adjustable, with a 20-year minimum anticipated service life.
4. Mechanical controls must be movable cranks, rotors, pulleys, and levers designed for trouble-free operation over a minimum anticipated service life of 20 years.

C. Ease of Maintenance and Cleaning

1. Minimize the amount of required maintenance.
2. For new buildings, provide a means of washing exterior windows.
3. Provide construction materials and fixtures that will clean satisfactorily using Yale's standard cleaning supplies and techniques which will not be damaged by ordinary cleaning and maintenance operations.
4. At swimming pool enclosures, steam rooms, laundry rooms, toilet rooms, shower rooms, trash collection rooms, and janitorial closets, provide interior construction that will allow harsh chemical cleaning without damage.

D. Ease of Repair

Provide interior fixtures at all locations that are designed to permit repair or replacement of individual components without removing the fixture. Elements that do not meet the specified requirements for ease of repair may be used under the following conditions.

1. They meet the specified ease of replacement requirements for elements not required to have a service lifespan equal to that specified for the project.

2. The service life expectancy analysis and life-cycle cost substantiation for the specified service life are provided.
3. Yale University accepts the elements.

E. Ease of Replacement

Provide interior fixtures at all locations that are modular in form and detachable from the substrate without damaging them. Design provisions for replacement without undue disruption of building operations for elements not required to have a service lifespan equal to that specified for the project.

F. Attic Stock

Provision for attic stock shall be at the discretion of Yale's planner and/or project manager. The consultant identifies attic stock materials for review by Yale. Also, the consultant identifies a temporary room to be available for storage of attic stock for a one-year period. Leftover supplies of acoustic ceiling tile and vinyl composition tile are to be turned over to Yale at the end of projects at the project manager's discretion.

2.11 EXPANSION CONTROL

Provide for an expansion and contraction of all construction materials for both interior and exterior applications based on temperature and humidity fluctuations.

Allow for daily expansion and contraction within and between elements caused by ambient temperature changes spanning a range from the most extreme low temperature to 70°F (39°C) greater than the most extreme elevated temperature, in any year, without causing detrimental effects to components and anchorage.

2.12 DIVERSITY AND ACCOMMODATION

Yale is an extraordinarily diverse and inclusive community, often requiring design sensitivity and architectural accommodations including, but not limited to the following.

1. Shared and inclusive restrooms
2. Sabbath gates and doorways
3. Prayer rooms
4. Foot washing basins
5. Lactation rooms*

*Lactation rooms should have an armchair, refrigerator, and sink. This room type should not be constructed within restrooms.

Consultants should coordinate program requirements with the Yale project manager.

2.13 ADJACENT OPERATIONS

Several activities on campus are sensitive to noise, vibration, utility shutdown, and other disruptions. The architect must be cognizant of adjacent occupants that may be negatively affected by construction and the ongoing operation of the completed facility. Architects need to work with the project team to mitigate such impacts and clearly communicate realistic expectations to potentially impacted parties. It may be necessary to place restrictions on construction activities to design a structure that can be built with low-impact techniques, and which isolates or relocates adjacent occupants until the project is complete.

A. Vibration Control

Assess local vibration requirements that may be present with adjacent facilities, including sensitive laboratory devices within buildings, particularly the School of Medicine, Science Hill, and School of Engineering and Applied Science areas. Give special attention to the need for pipe and conduit isolation from vibration sources.

B. Acoustical Standards and Control

Design spaces with acoustical properties that support all primary and anticipated ancillary functions. Provide acoustical barriers and attenuation to control sound migration and maintain desirable conditions within all spaces and the surrounding environment. Provide reverberation times in primary spaces for frequencies of 500–-1000 Hz as follows.

1. Classrooms: 0.6–0.8 seconds
2. Lecture and conference rooms: 0.9–1.1 seconds
3. Small theater: 1.2–1.4 seconds
4. Auditorium and multipurpose space: 1.5–1.8 seconds

Design and construct interiors based on the noise criteria values in tables 1, 2, and 3 included below to achieve the minimum airborne sound isolation class values between adjacent spaces when evaluated in accordance with ASTM standards.

See Table 1 for room background noise guidelines. Selection criteria depends on user or space sound quality needs. Higher or lower values might be appropriate and should be based on an analysis of space use, economics, and user needs. Engineer systems should achieve specified sound levels and use sound attenuation, as necessary. Also, see Table 1 for the maximum ambient sound guidelines.

Table 1: Room Background Noise Design Guidelines

Space	Noise Criteria (NC)	Room Criteria (RC)	Maximum dBA
Mechanical rooms			85
Primary electrical rooms			85
Stairs	45		
Toilet rooms	40		
Telecom data rooms		30–40	
Elevator machine rooms			85
Laboratory storage spaces		45–55	
Shipping and receiving spaces	45–55		
Breakout rooms		30–40	
Multi-purpose rooms		40–50	
Laboratories		40–45	
Laboratory workspaces		40–45	
Laboratory support spaces		40–50	
Laboratory equipment rooms		45–55	
Private offices		30	
Open-plan offices		30–40	
Corridors		40–45	
Conference and seminar rooms		25–35	
Instrumentation rooms		30–40	
Classrooms		25–30	
Large lecture rooms		25–30	
Gymnasiums and natatoriums	40–50		
Music practice rooms		30–35	
Drama theaters		25	
Outdoor ambient			60 (1)

(1) At 120 feet

Limit sound transmission through the substructure as follows.

Maintain ambient sound levels in enclosed, occupied, and substructure spaces within the noise criteria ranges indicated in tables 2 and 3 below.

Table 2: Airborne Sound Design Guidelines—Interior Space to Interior Space

Space	Noise Criteria	Space	Noise Criteria	Minimum Noise Isolation Class
Similar function		Similar function		36
Quiet space	20-30	Moderate	30-40	39
Quiet space	20-30	Noisy	40-50	42
Quiet space	20-30	Very noisy	50-60	48
Moderately noisy space	30-40	Noisy	40-50	36
Moderately noisy space	30-40	Very noisy	50-60	42
Adjacent music practice rooms				55
Adjacent theatres				45
Adjacent offices requiring high speech confidentiality				50

Table 3: Airborne Sound Isolation—Outdoor Source to Interior Space

Space	Noise Criteria	Exterior Source	dBA	Outdoor–Indoor Level
Quiet space	20–30	Low	<40	30
Quiet space	20–30	Moderate	40–60	33
Quiet space	20–30	Loud	60–70	36
Quiet space	20–30	Very loud	70–80	42
Quiet space	20–30	Extremely loud	>80	52
Moderately noisy space	30–40	Moderate	40–60	30
Moderately noisy space	30–40	Loud	60–70	33
Moderately noisy space	30–40	Very loud	70–80	36
Moderately noisy space	30–40	Extremely loud	>80	37
Noisy space	40–50	Loud	60–70	30
Noisy space	40–50	Very loud	70–80	33
Noisy space	40–50	Extremely loud	>80	36
Very noisy space	50–60	Very loud	70–80	30
Very noisy space	50–60	Extremely loud	>80	33

C. Odor Control

Prevent unpleasant odors generated within a space from affecting the occupants of adjacent spaces by providing physical isolation of the spaces, separate ventilation, or a combination of isolation and ventilation.

PART 3: DEPARTMENTAL STANDARDS AND GUIDELINES

3.1 OFFICE OF FACILITIES

Refer to the design standards published on the Office of Facilities website for detailed requirements in subject areas organized by the MasterFormat method. Yale requires the consultant to document where the project design deviates from the design standard. Deviations should be noted in the Basis of Design at each submission. The consultant also tracks the pending, acceptance, or rejection of deviations per the Yale Office of Facilities requirements.

Buildings and grounds landscape management standards and grounds maintenance design standards are available on the Office of Facilities website under Division 32: Exterior Improvements.

And custodial accessories used for janitorial and supply closets, toilet rooms, and trash and recycling areas are also available on the Office of Facilities website under Division 10: Specialties.

3.2 INFORMATION AND TECHNOLOGY SERVICES

Yale ITS should be consulted to determine the need and design requirements for telecommunication, audio/visual, and other information technologies at the University. ITS has prepared the following standards for reference on the Office of Facilities website under Division 27: Communication.

A. IT/DATA/Telecommunications/WI-FI

The consultant coordinates all end of line device locations based upon the program. Reflect in interior design drawings for coordination with furniture, fixtures, and equipment as well as programmatic use. Interview and survey Yale IT for standards feedback and connections to the infrastructure demarcation point(s).

1. Provide full infrastructure documents, including conduit pathways, pull boxes, and power service points for infrastructure needs. Reflect all blocking needed for devices if not feasible from the back box.
2. Coordinate the point of connection to Yale's network or a MDF location in project with specific coordination needs that defines the limit of project scope and connections to University infrastructure.
3. Generate a unique design package for a low voltage request for proposal by the contractor and separate from the electrical subcontractor.

B. Audio/Visual Technology

The consultant utilizes an audio/visual (AV) subconsultant, as required by the program narrative, to define full AV system needs that are in addition to IT/DATA/Telecommunications/WI-FI requirements mentioned in section A.

1. At the schematic design (SD) and enhanced schematic design (ESD) levels, provide a space-specific design narrative that confirms the use of space and the objectives of an AV program benefit to the end user group.
2. At the design development (DD) level, confirm budgetary guidance and Yale AV system coordination with the projected University guidelines.
3. As the construction document (CD) level, a full system design includes all conduits, back boxes, and point-to-point wire pathways with preferred conduit structure. Include all detailed power connections and heat load calculations for use by the Engineer of Record (EOR) in HVAC design. As needed, post CDs during the construction administration (CA) phase and update design specifications to accommodate the evolution of specified equipment. All specified equipment shall include a provision for approved alternate by the contractor.
4. The CA phase shall include full system commissioning and training of the end user group as part of this phase.

C. Cell Phone/DAS

If specifically required by the program, this scope is reflective of the same tasks and detailing as the IT/DATA/Telecommunications/WI-FI scope mentioned in section B.

3.3 ENVIRONMENTAL HEALTH & SAFETY

For every project, the Office of Environmental Health & Safety (EHS) surveys and tests existing building materials and soils to identify hazardous materials. If required, EHS develops a remediation plan to remove, encapsulate, and manage the contact and disturbance of such materials, delineating the responsibilities of the contractor, owner, and licensed environmental professional (LEP) hired by the owner. Include the remediation plan in the bid and construction document sets.

EHS prepared the Contractor Health and Safety Guidelines, which are applicable to every construction contract. Review these guidelines and avoid creating conflicting requirements in the contract documents. Also review the information on the EHS website, including the section dedicated to Design Issues and Review.

EHS provides consultation services through its online materials but consult them directly with specific questions or problems dealing with health and safety issues. These consultations, considered essential for the design of any construction project at Yale, should be requested and completed during the schematic design stage of a project. Contact them by email or phone at 203-785-3550.

Based on the nature of the project, request consultation with the following EHS sections per Yale's requirements.

1. Biological Safety

   a) School of Medicine
   b) Yale Science Building
   c) Any other area where work with infectious agents is conducted
   d) Any area where animal experiments are conducted

2. Environmental Health

   a) Food service and storage and/or processing facilities
   b) Swimming pools
   c) Potable water systems
   d) Solid waste handling (garbage and rubbish)
   e) Dormitory facilities
   f) Sewage disposal at off-campus sites

3. Occupational Safety

   a) All laboratory facilities
   b) Walking and working surfaces
   c) Ventilation systems
   d) Fume hood systems
   e) Stairways
   f) Shop facilities
   g) Storage facilities
   h) Electrical services
   i) Plumbing services
   j) Mechanical rooms
   k) Confined spaces
   l) Accessible roofs, ladders, safety railings, and fall restraint systems

4. Radiation Safety

   a) Research laboratories

b) Clinical laboratories
c) Patient care facilities (including radiation services)
d) X-ray facilities
e) Accelerator laboratories
f) Laser facilities
g) Microwave facilities
h) Ventilation systems
i) Drainage systems
j) Shielding and shielded facilities

3.4 SECURITY DEPARTMENT

A. The Yale Security Department should be consulted on requirements for the following systems.

a) Access control systems
b) Emergency "blue phones"
c) Security cameras
d) Intrusion alarm systems
e) Window security screens

B. Central Security/CCTV/Blue Lights/Access Control

Full documentation of the CD level scope needs to be provided by the contractor through the CA phase.

1. In the SD and ESD phase, interview Yale Security representatives for the proper locations of devices and detailed access control expectations of user groups.
2. The DD phase spans full infrastructure design, including end of line device locations in coordination with all finish elements. Reflect all devices on the interior design documents.
3. The CD phase includes all equipment selection and wire pathway coordination with University infrastructure to a connection point(s) and at the proper demarcation point. Some systems may sole source equipment as directed by Yale Security representatives.
4. Access control shall be fully coordinated with door schedules and include all conduits and back boxes to host access control equipment. List all access control on unique design drawings and on door schedules.
5. The CA phase includes full system commissioning and end user training by through the subconsultant.

3.5 YALE ANIMAL RESOURCE CENTER (YARC)

YARC should be consulted to determine the need and design requirements for animal care and research facilities at Yale.

3.6 ADVISORY COMMITTEE ON ACCESSIBILITY RESOURCES

In addition to applicable codes, the consultant should review the Accessibility Guidelines on the Office of Facilities website. These guidelines articulate requirements above code minimums related to pathways, parking, ramps, stairs, elevators, lifts, doors, entrances to buildings, toilet facilities, classrooms, dining areas, and living quarters. Projects are reviewed by the Advisory Committee on Accessibility Resources at design milestones.

3.7 YALE HOSPITALITY

Yale Hospitality should be consulted to determine the need and design requirements for dining halls, kitchens, cafeterias, cafes, and other foodservice facilities.

PART 4: SCHOOL OF MEDICINE GUIDELINES

4.1 LABORATORIES

A. Generic Laboratory Design

Generic laboratory design concepts are utilized throughout the University, and in particular, at the School of Medicine. Generic design has been found to minimize retrofits, recognizing that during the life of a project, from inception to occupancy, there might be changes in assignment.

At the School of Medicine, generic laboratory design reflects the needs of wet bench scientists and allows for appropriate specificity within a structured framework. The concept has been used on laboratory renovations at the School of Medicine since 1990, from small one-room renovations to major renovations.

B. Lab Group Definition

On Yale's central campus and at the School of Medicine, the organizational unit of research is the academic department or section. Each department or section consists of a group of faculty members who are conducting research within a thematically related area. At central campus, departments include areas such as chemistry, biology, and physics. At the School of Medicine, departments include areas related to basic biomedical science (e.g., genetics, cell biology, physiology) or clinical science (e.g., dermatology, neurology, orthopedic surgery).

C. Laboratory Accessibility Standards: Yale School of Medicine

The Yale School of Medicine received a handicap waiver for laboratory stations. This waiver was approved by the State of Connecticut's Office of Protection and Advocacy for Persons with Disabilities, Department of Public Safety, Division of Fire, Emergency and Building Services, and Office of the State Building Inspector with support from the New Haven Office of Building Inspection & Enforcement. The alternative described below allows for an adaptable approach to meet the needs of a person(s) with a physical disability in laboratories. It is key that all adaptable elements of the lab workstation be identified and labeled clearly on the construction documents for compliance with the waiver.

D. Adaptable Approach to Laboratory Accessibility

Please note that a workstation can include 1) four to six linear feet of laboratory bench, including bench utilities; 2) a carrel; 3) access to a sink and, in some cases only;

4) access to a fume hood. The requirement for accessibility in the current and former code is the provision of required accessibility per lab group.

1. To provide accessibility at a laboratory bench, the carrel would become the laboratory bench for the person with a physical disability. When the carrel is part of the bench it is provided with a chemical resistant laminate top. Alternatively, when the carrel is not part of the bench, an area of bench countertop would be provided with a seam to allow for easy removal of a countertop area. Alternate heights can be provided by simply exchanging different height casework that supports the countertop. In this way an appropriate height bench space would easily be installed in the event a person with a physical disability is employed in the lab.

2. To provide accessibility at the carrel, an additional carrel would be assigned to a person with a physical disability. Alternatively, when a carrel is not available, an area of bench countertop with a seam shall be provided to allow for easy removal of an area of countertop. An alternate height can be provided for a carrel by simply exchanging different height casework that supports the countertop. In this way an appropriate height carrel would be installed in the event a person with a physical disability is employed in the lab.

3. To provide accessibility at the laboratory sink, Yale proposes the provision of an area of bench countertop adjacent to the sink with a seam to allow for easy removal of an area of countertop. Alternate heights can be provided by simply exchanging

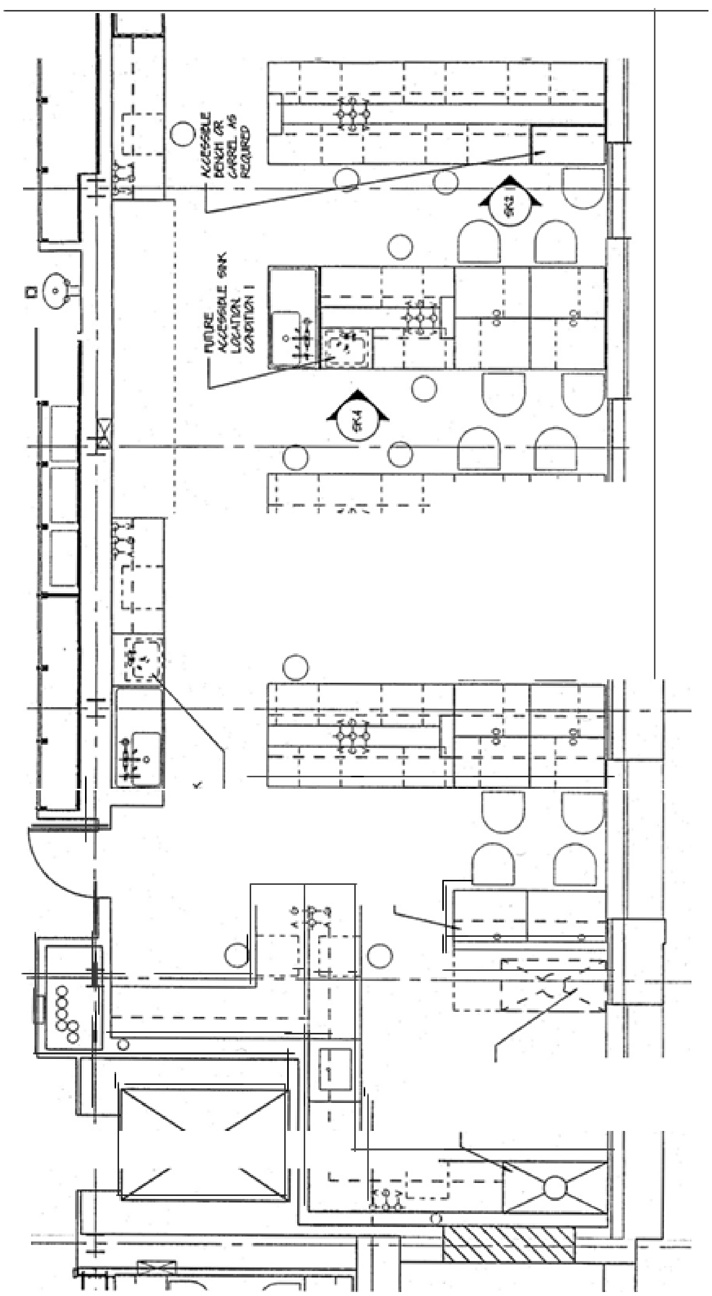
different height casework that supports the countertop. In this way the contractor would install an appropriate height hand-washing sink in the event a person with a physical disability is employed in the lab. The adjacency of a seamed countertop (and future location of the accessible sink) to the existing sink would allow for easy tie-ins to the existing piping. This arrangement would work when the sink is located at the end of a bench or when it is located against a wall. (See item SK-1 below).

4. To provide accessibility at the fume hood, Yale proposes that an area be designated within the laboratories of a particular lab group for the location of a future accessible fume hood shall be installed in the event that a person with a physical disability is employed in the lab. Alternatively, if an area is not designated an existing fume hood could easily be changed out to an accessible fume hood in the event a person with a physical disability is employed in the lab.

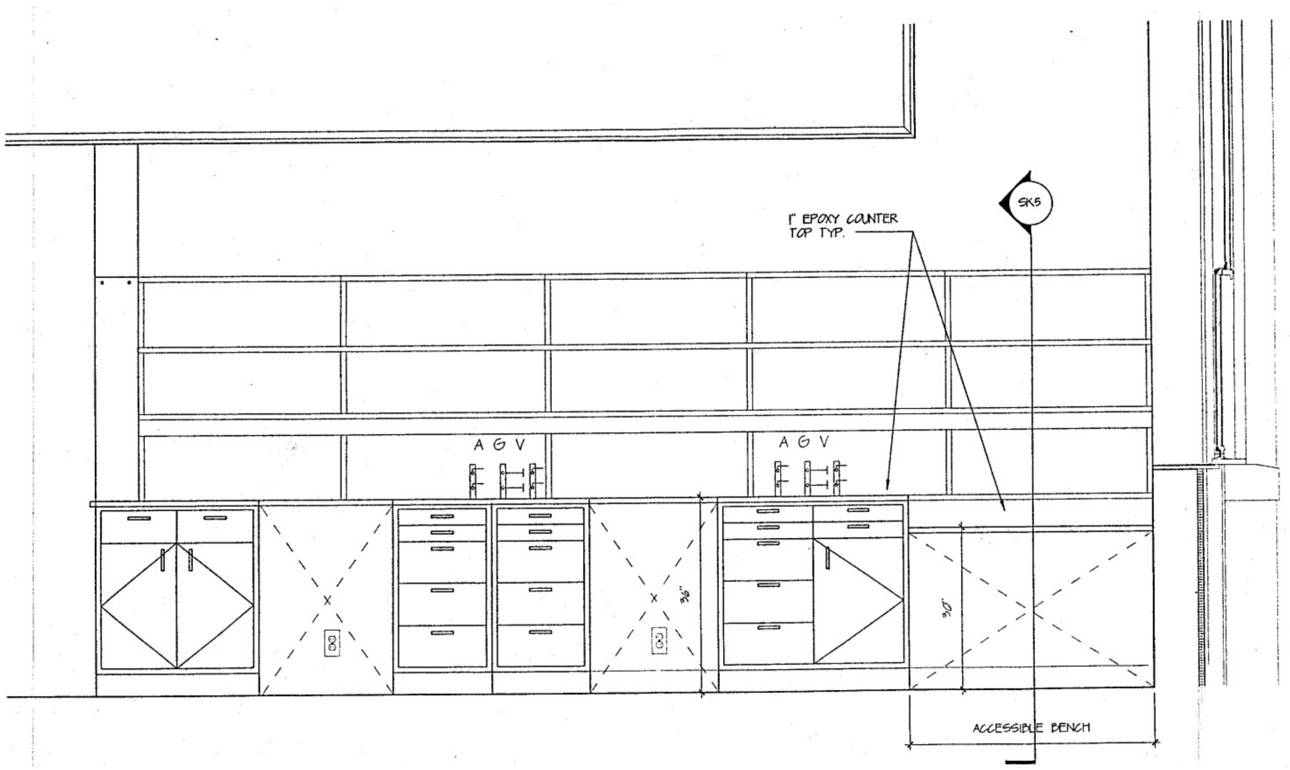
5. Review the following sketches of sample layouts.

   a) SK 1: School of Medicine, Sample Laboratory Plan
   b) SK-2: School of Medicine, Accessible Bench/Carrel Elevation
   c) SK-3: School of Medicine, Accessible Sink Elevation
   d) SK-4: School of Medicine, Section at Typical Accessible Drop Bench

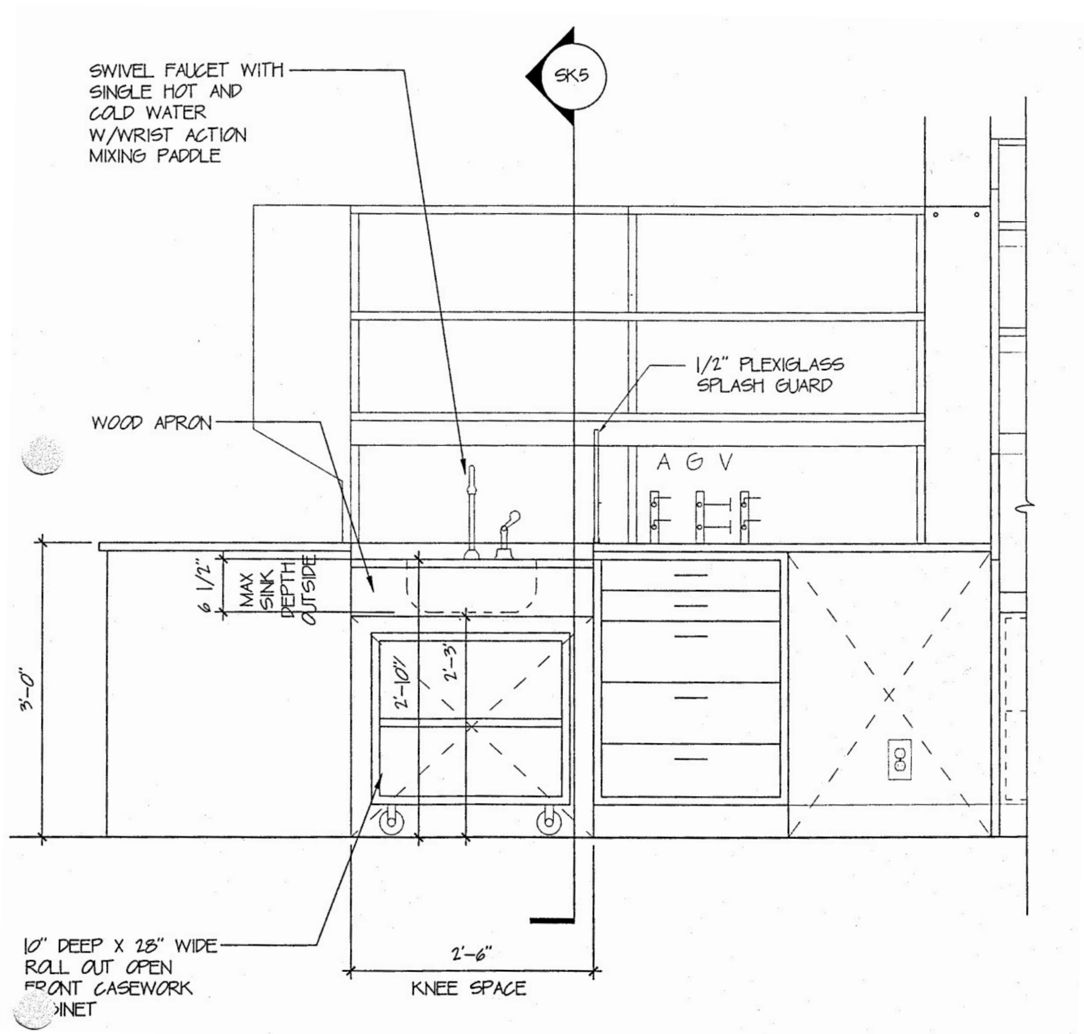
SK-1: School of Medicine, Sample Laboratory Plan (not to scale)



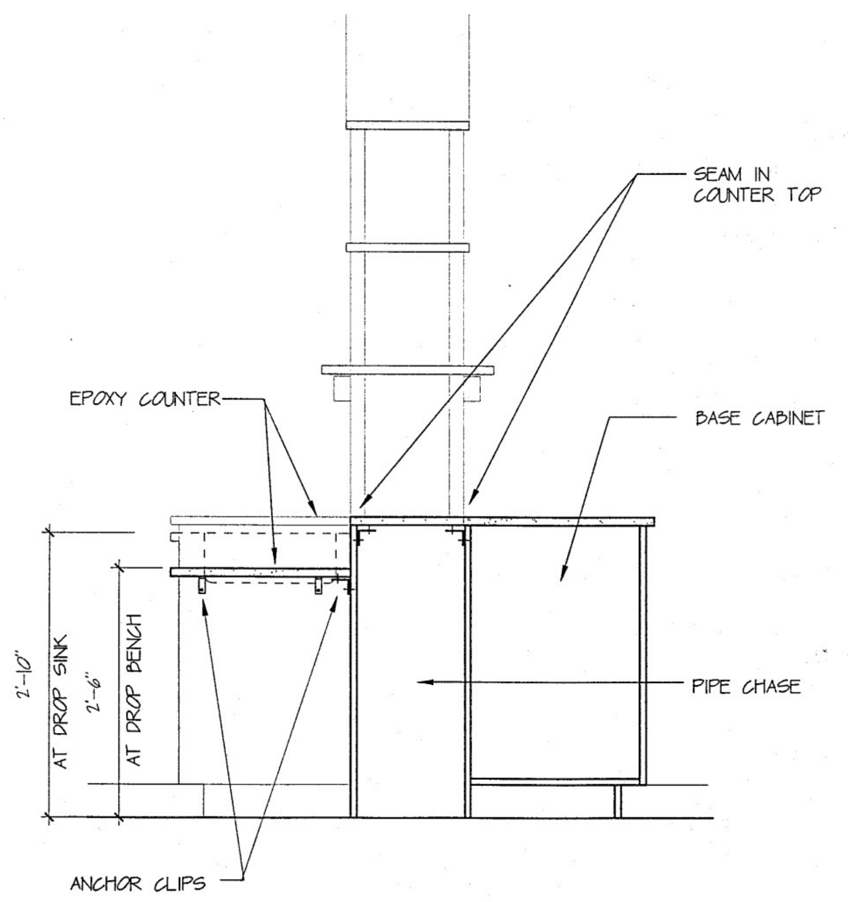
SK-2: School of Medicine, Accessible Bench/Carrel Elevation (not to scale)



SK-3: School of Medicine, Accessible Sink Elevation (not to scale)



SK-4: School of Medicine, Section at Typical Accessible Drop Bench (not to scale)



E. Laboratory Room Layout

1. Island benches shall be perpendicular to the exterior wall with carrels at the exterior wall.
2. The aisle between laboratory benches shall be five feet (5')-wide at minimum.
3. Sinks shall be located on the exterior and/or corridor wall, not on the bench, to allow for flexibility. Provide one sink per eight (8) to ten (10) workstations.
4. Separate rooms shall be provided if required for "hot" (i.e., radioactive) work. Provide one "hot sink" and one handwashing sink.
5. Utility drop shall be located at the carrel/bench intersection.
6. Fume hoods shall be located away from the exit door(s) of a lab(s) and shall not be directly opposite carrels.
7. Light level of 70-foot candles minimum shall be maintained at the carrel/bench.
8. LED lights shall be parallel to lab benches, centered on the edge of benches.
9. No incandescent lighting shall be used.
10. New windows and existing refurbished windows shall be fixed.
11. Radiant ceiling panels shall be installed at the exterior walls.
12. Labs more than 1,000 square feet require two exit doors.
13. All corridor doors shall have magnetic hold opens if open doors are desired.
14. The corridor wall inside lab is the equipment wall.
15. Emergency gas shut offs are to be provided within the lab, by the entry door, and within the corridor demising wall.
16. Labs will be open in design. No subdivisions within laboratories shall be installed by researchers.

F. Deionized Water at Laboratories

Provide one (1) deionized water for every two (2) sinks. If additional local processing is required, the department is responsible for providing it.

G. Smoke Detectors at Laboratories

1. At laboratories, provide one (1) central station smoke detector at the egress door.
2. At lab support spaces, provide one (1) central station smoke detector in the room.
3. Do not install heat detectors, unless occupancy during normal use might produce vapors that would trigger the smoke detectors.

H. Bench and Carrel

1. Lab benches: Wood or metal casework is acceptable.
    a. Lab benches shall be five feet (5') wide.

2. No Unistrut shelving.
3. Gray epoxy counters and wood reagent shelving shall be provided.
4. No cup sinks.
5. Knee spaces are provided for waste containers and refrigerators.
6. No task lighting at the benches. Task lighting shall be provided at the carrels.
7. Provide two phone/data drops per office and one per carrel plus one wall phone per lab, in a star pattern to the data and telephone closet.
8. Sinks are to be stainless steel, not epoxy.
9. Carrels shall be three and a half feet (3' 6") wide at minimum.
10. The sum of a bench plus a carrel should equal ten (10') linear feet.
11. One handheld, deck mounted eyewash or shower shall be installed at all non-radioactive sinks.

I. Finishes and Services to Laboratories

1. Air, gas, and vacuum are provided at all benches as required. Gas and air outlets shall be minimized dependent on the program's particular needs.
2. Automated guided vehicle (AGV) turrets are the double-height type (i.e., two outlets per service, per location).
3. Duplex outlets spacing is 18 inches on-center at lab benches and 24 inches on-center at the equipment wall.
4. Ceiling tiles are to be two inches (2") x two inches (2") or two inches (2") x four inches (4") lay-in tile, which are Yale's standard tile sizes.
5. No exposed ceilings due to maintenance cost premium.
6. Provide vinyl composite tile (VCT) flooring in laboratories and corridors. Standard colors are required in corridors.

   a) Please note for future flexibility (bench reconfiguration/removal), VCT flooring in laboratories shall not be laid out using bench locations to frame floor patterns, rather the lab flooring shall be a continuous, undifferentiated pattern unrelated to bench locations. In addition, VCT flooring shall be continuous under all casework.

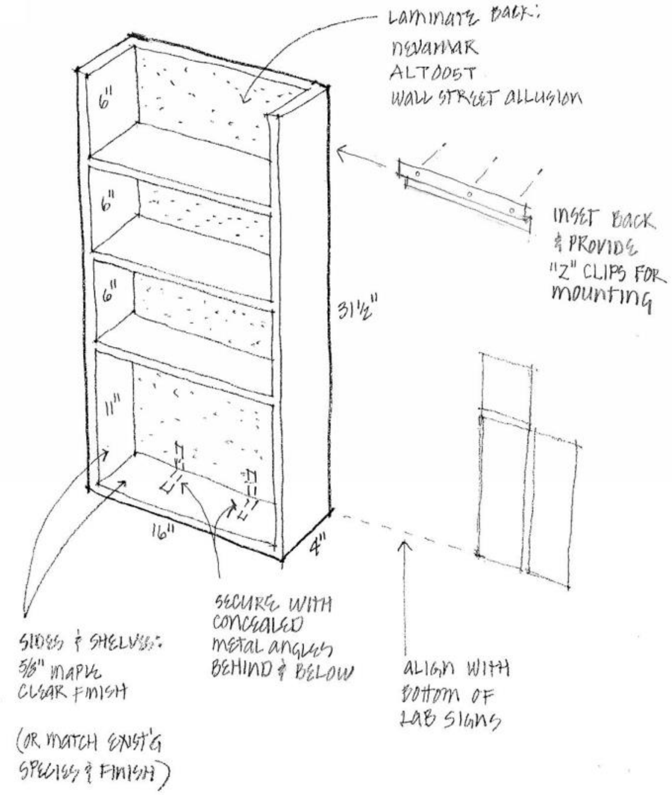
J. Material Management

Waste stream management (inbound boxes, outgoing containers) shall be stored in closets, in corridors, or autoclave room.

K. Laboratory Corridor Finish Treatments

The typical finish treatments within a wing corridor should comply with the following standards.

1. Walls: Gypsum wallboard shall be painted with stainless steel corner guards.
2. Wall finishes: Linoleum sheet Wainscoting shall be installed in accordance with Division 09: Finishes, Section 09 67 0 standards, which extend to the floor and behind the rubber base.
3. Wood chair rails are to be mounted directly above sheet wainscoting.
4. Base: Maintain a four (4)-inch rubber base.
5. Recycling center: One shall be installed per corridor.
6. Hazardous waste closets: A minimum of two (2) four-foot (4’) wide closets within a given corridor shall be given over to administration as hazardous waste closets. These closets will not have locks on the closet doors and will have a shelf within the closet to allow for stacking of biowaste boxes.
7. Acoustic ceiling tile: No concealed spline systems are to be used.
8. Wood coffee cubbies: Coffee cubbies, in accordance with following sketch, are to be provided in renovated corridors except when the corridor is demolished as for a full floor renovation. Provide sufficient shelf length so that each occupant has convenient access and space for at least one beverage container. When corridors are fully demolished and rebuilt, coffee cubbies are to be integrated into the corridor design in sufficient quantities to meet the above criteria.



L. Glass Pipe Removal Policy

1. Glass waste piping should be removed wherever possible and practical. Field conditions and budget restrictions may limit the extent of removal.
2. In large, multi-room renovations where the space above the ceiling is exposed, remove all glass piping back to the fixture and the riser.
3. In small, single room renovations where the space above the ceiling is exposed and the glass piping connects to fixtures above, remove all glass piping within the room, back to the fixtures above, and back to the riser (if the riser is in the space). If the glass piping passes through the space without any connections to fixtures above, and does not show signs of leaking, leave the glass pipe in place. If the glass piping passes through the space and shows signs of leaking, remove the glass piping in the room and back to the riser (if the riser is in the space).

M. Laboratory Airflow Rate

Air changes per hour for laboratories are to be approved by Yale's Engineering Department and Environmental Health & Safety.

N. Autoclave Room Requirements

Floors must be either a monolithic troweled on epoxy resin (see section 09 65 0) or, a continuously welded seam vinyl sheet floor, such as Armstrong Flooring's "Medintech," with an integral core base.

Provide a floor drain within the room. If possible, the floor should be modified to pitch to a drain.

4.2 X-OMAT FILM PROCESSOR EQUIPMENT POLICY

This policy was established to reduce the number of flooding incidents caused directly or indirectly by X-OMAT film processor equipment. Drains clogged from X-OMATS cause substantial flooding damage to occupants on the floor below. The costs to comply with this policy are the responsibility of the department using the X-OMAT film processing equipment. All new and existing installations will have the following.

A. Ventilation

Prior to installation of a processor, a building's safety advisor retains the services of a licensed air-balancing contractor to determine if the ventilation rates are adequate. If the report shows the room to be deficient, HVAC modifications will be made prior to the installation of the film processing equipment with charging instructions from the department.

B. Floors and Drains

Floors shall be sealed with the Medintech welded seam solid vinyl flash cove system or equal and pitched from the door, walls, and cabinets to the drain. A four-inch (4”) drain shall be installed and located close to, but not obstructed by, the film processor.

C. Locks

The locksets used for rooms with film processing equipment shall allow both the user and safety advisor access. This enables the safety advisor to secure the area if there is a flood.

D. Equipment Connections

1. All flexible hoses used to connect utilities to the film processor are made of a non-burstable reinforced material.
2. A stainless steel or aluminum drain pan shall be installed under the processor. The drain from this pan should be piped into the floor drain.

E. Drain Service

1. The services of a commercial firm (Parker X-Ray or approved equal) shall be contracted to assure that all the drains from the processor are regularly cleaned. This contract is held by the department and includes as a minimum:

    a) Cleaning the drain that is located after the developer monthly, or more often if needed.
    b) Cleaning process includes the application of granular "fotex" powder for 15 to 20 minutes, and then flushing with water through the drain to dissolve any developer hardening and clogging the drain trap.
    c) A method of documentation for the monthly services contracted.

4.3 BIOLOGICAL SAFETY CABINET INSTALLATION

A. Clearances

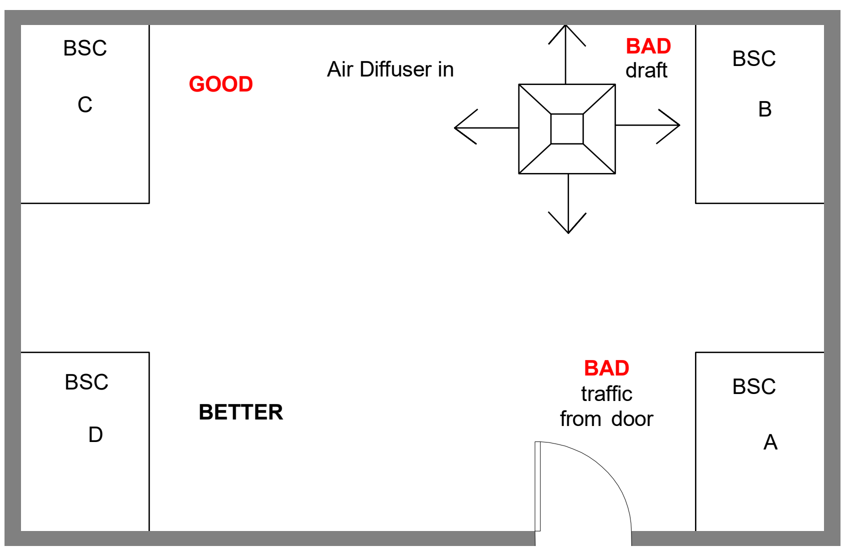
1. The minimum clearance required from the top of the biological safety cabinet (BSC) to the ceiling is ten inches (10”). This allows for proper exhaust airflow and repair of the BSC, when necessary. A minimum three-inch (3”) clearance on its side and one and one-half-inch (1.5”) clearance in the back are recommended.

2. BSCs must be placed away from doors as well as ventilation supply and exhaust vents to reduce air currents around the cabinet.

B. Services

1. The electrical outlet for a BSC must be a 20-amp dedicated circuit that is readily accessible for service and electrical safety testing.
2. If a BSC is connected to a gas supply, a flexible connector shall be used. The connector must comply with the Standard for Connectors and Moveable Appliances: ANSI z21.69. A quick-disconnect device is not recommended. An accessible manual shutoff valve must be installed at the outlet for the gas supply piping system, upstream of the connector, as required by ANSI z21.69.
3. If a BSC is connected to a vacuum, an appropriate flexible connection should be used.

C. Evaluation of Proposed Biological Safety Cabinet (BSC) Locations



Biological safety cabinets can easily be located in most facilities. They should be kept away from drafts, convection currents, diffusers, and traffic paths.

For further information or assistance, contact the Yale's Office of Environmental Health & Safety.

4.4 BUILDING SERVICES ROOMS AND SPACES

A. Building services spaces include maintenance shops and loading docks as well as those used for service sinks, maintenance equipment, trash collection, and trash removal.

B. At least one janitor's closet is required on each floor of a building and on each wing, if applicable. Janitor's closets must be accessible from a public corridor and contain a utility (slop) sink and storage for custodial equipment, such as mops and buckets, water vacuums, rug shampooers, floor scrubbers, cleaning supplies, and toilet paper stock.

C. Provide areas for the storage and pickup of trash and recyclable materials. Provide outside storage areas for rollout trash dumpsters and recycling bins.

PART 5: MECHANICAL AND SUPPORT SPACE GUIDELINES

5.1 GENERAL

This section addresses the requirement for mechanical and support spaces that are inherently safe for construction, operation, and maintenance. By designing safe mechanical and support spaces, the designer can eliminate or minimize confined spaces or design confined spaces that are easily and safely accessed. These guidelines focus on the design of safe mechanical and support spaces by avoiding the hazards associated with such spaces. Such hazards include the following.

1. Inadequate dimensions, entries, and exits
2. Toxic atmosphere or oxygen deficiency
3. Moving parts
4. Electrical shock hazard
5. Heat and chemical hazards
6. Structural hazards that can cause injury
7. Combustible dust
8. Irritant or corrosive agents
9. Moisture or water
10. Noise and vibration
11. Surface residues making the floor unsafe for walking

5.2 MECHANICAL DESIGN GUIDELINES

A. Allocate sufficient space within the building footprint for utilities and for mechanical, electrical, telecommunications, and other equipment, including mechanical rooms rather than designing such features as vaults, hatches, and tunnels outside of buildings.

B. Design mechanical rooms large enough for the intended equipment with sufficient:

1. distances and clearances for each piece of equipment.
2. work area around the equipment.
3. space for removal of equipment components for repair and replacement.
4. space for removal of the entire unit for replacement.

C. Design access doors, corridors, ventilation, lighting, and other mechanical room components to meet applicable code requirements, while also designing safe working conditions. Requirements for safe working conditions must apply to both normal and emergency operating conditions.

D. Design entries, exits, ventilation, and other mechanical room components with consideration for the conditions inside the room as well as conditions inside adjacent spaces.

E. Design mechanical rooms with the proper penetrations and seals for cable and piping entries to prevent the penetration of water, moisture, fumes, gases, and heat.

F. Design appropriate doors, rather than hatches, for mechanical rooms and support spaces.

G. Lay out equipment in the mechanical rooms and support spaces for safe service and repair under normal and emergency operating conditions. Ensure that there are sufficient distances and clearances for each piece of equipment, sufficient work area around the equipment, space for removal of equipment components for repair and replacement, and removal of the entire unit for replacement.

H. Design mechanical rooms and support spaces with adequate lighting, ventilation, insulation, noise attenuation, drainage, flood alarms, means of communication, and other safety measures to ensure safe working conditions under normal and emergency operating conditions.

I. Locate cable splicing and other items that require periodic inspection and service within the building, rather than outside of the building, in a confined space.

J. Locate utilities distribution systems equipment that require periodic inspection and service within the building, rather than outside of the building, in a confined space.

K. Provide adequate spacing of equipment, piping, and cables as well as a safe working environment for their installation, inspection, and service under normal and emergency working conditions. Provide coordination drawings in the design documentation—the coordination and layout of equipment in mechanical rooms and support spaces should not be left to the construction manager to configure.

5.3 CONFINED SPACES

A. General

1. Confined spaces can pose serious health and safety hazards to persons performing inspection, service, maintenance, or related activities. Use the following information about confined spaces in the building design, construction, and renovation process to eliminate such spaces or, where not feasible, to design confined spaces that are easily and safely accessed. Also, follow Occupational Safety and Health Administration (OSHA) standards.
2. OSHA's standard on confined spaces (29 CFR Part 1910.146) defines a confined space as one that meets all of the following criteria.

   a) Large enough and configured that it can be entered to perform work.
   b) Has a limited or restricted means of entry or exit.
   c) Is not designed for continuous employee occupancy.

3. Common examples of confined spaces include below ground electrical vaults that are accessible by a ladder, various tanks and pits, boiler interiors, and crawlspaces. For more information, refer to applicable OSHA publications online.

B. Types of Confined Spaces and Basic Design Options

The following paragraphs describe the major types of confined spaces, including the type of space, typical hazards, and the means for minimizing or eliminating the hazards. One of the most frequent safety issues associated with confined spaces involves entry and exit access. Additionally, the materials introduced into confined spaces, and the operations performed with them, can create unsafe conditions by releasing toxic materials (i.e., welding, cleaning, painting) or reducing oxygen levels below safe levels. Such hazards are possible within any confined space, as is the ever-present danger of an oxygen-deficient environment.

1. Telecommunication or Electrical Distribution Vaults

   a) Telecommunication and electrical distribution vaults typically consist of a below-ground, poured concrete vault accessible by a grade-level access hatch. Depending upon its inner depth, portable ladders or a fixed rung ladder are used to reach the base.
   b) Although telecommunication and electrical distribution vaults rarely contain hazardous processes, provided the electrical cabling is sheathed or enclosed in conduits, their physical location below-grade carries the risk of oxygen deficiency, which falls during entry or exiting and water accumulation. Operations performed in, and materials introduced into these spaces can also

create unsafe conditions by releasing toxic materials (i.e., welding, cleaning, painting) or by reducing the oxygen level below a safe level.

c) Basic safety design options include the following.

   1) Incorporating new vaults as part of a building basement and providing a full-size door to eliminate the confined space (preferred).
   2) Ensuring an access or hatchway diameter of no less than 30 inches (36 inches or larger is preferred for equipment and materials transfer).
   3) Providing an OSHA-compliant fixed stairway or ladder with an extendable grab bar or rail.
   4) Grading the floor and including a small sump pit to collect any water seepage that accumulates within the space and permits easier pump-down before entry. The sump pit should be located away from the ladder base.

2. Electrical Transformer Vaults

a) Electrical transformer vaults are similar in structure to telecommunications or electrical distribution vaults, but with the added potential hazard from electricity during periodic manual interactions with switches.

b) Basic safety design options include all those for telecommunications or electrical distribution vaults, plus the following.

   1) A minimum clearance of 36 inches from all breakers, switches, and other components.
   2) Passive ventilation of the space to avoid accumulations of ozone or an oxygen-deficient atmosphere.
   3) Providing vaults with frequent need for access with permanent, moisture-protected lighting.
   4) Placing transformers and the switchgear away from access doors or hatches.

3. Steam Distribution Systems

a) Steam distribution systems include large horizontal and vertical pipe chases (tunnel sized), valve access vaults, and condensate return pits.

b) The hazards associated with steam distribution system components include all those for telecommunications or electrical distribution vaults, plus exposure to elevated levels of heat and humidity as well as the potential for exposure to steam leaks and steam explosions.

c) Basic safety design options include all those for telecommunications or electrical distribution vaults, plus the following.

1) Maximizing clearances from all steam pipes and other obstructions to provide a greater distance from hot surfaces and to reduce head and face injuries.
2) Ventilating the space to reduce heat and humidity loads. For vaults, the preferred method is the use of a dual-pipe or duct system to induce convective airflows. For tunnels, provide outdoor access grilles or panels at regular tunnel intervals to enhance natural airflows through individual tunnel sections.
3) Ensuring that all pipes that must be stepped over to reach a confined area have metal guards around the insulation, and/or steps and platforms.

4. Power Plants

a) Power plants contain a considerable number and wide variety of confined spaces due to their complex and interconnected operational systems. Examples of confined spaces in the power plants include the following.

1) Boilers
2) Turbines or generators
3) Liquid storage and other types of tanks
4) Water and cooling towers
5) Pits and recessed floor or grade channel ways
6) Large ventilation system components (i.e., ductwork, filter houses, plenums)

b) The hazards in specific power plant confined spaces vary by system. However, access to a few power plant spaces is difficult due to elevated heights and narrow entry or exit ways and should be designed with ease of access and safe maintenance in mind.

5. Elevator Systems

a) Building elevator systems consist of a vertical elevator shaft, a motor or service room, and a pit at the bottom of the elevator shaft.
b) Hazards associated with elevator systems include the following.

1) Elevator shaft: Access hazards, physical hazards from moving cables and counterweights, and fall hazards.
2) Motor or service room (those located in rooftop penthouses or other

locations without an ordinary door entry): Physical hazards from the cable winding, potentially exposed mechanical components on the motor and gear shafting, and electricity, including an accumulation of ozone in poorly ventilated rooms.
3) Pit: Access hazards, oxygen deficiency, falling objects, and drowning from engulfment in accumulated water.

c) Basic safety design options include the following.

1) The installation of a lockable door, rather than a hatch to the shaft and pit.
2) Fall protection attachment points for shaft work.
3) Passive or active ventilation of the motor or service room.
4) Fixed permanent lighting for the motor or service room.
5) Machine and equipment guarding, where possible, on all exposed moving motors and gears or winding parts.

6. Sump Pump and Sewage Ejector Pits

a) Although the liquid materials that may be pumped vary, sump pump and sewage ejector pits share many common features. Both consist of concrete or lined pits, often with a liquid holding tank and pump (either submersible or remote). These pits are generally located below-grade in a basement area or outdoors inside a vault. Access is typically made by either a metal grating cover, solid hatch, or manhole cover. A few of these systems possess a fixed ladder.
b) Hazards include oxygen deficiency, the potential for accumulation of toxic vapors (including those from materials discharged to domestic waste lines), falls during entry or exit, and drowning from engulfment in liquid.
c) Basic safety design options include the following.

1) The installation of remote pumps, or pumps that can be easily retrieved without requiring pit entry (also requires means for pump retrieval or attachment of retrieval means).
2) The installation of permanently fixed ladders.
3) A means of valving-off and locking-out water or wastewater inputs into the pit during entry.
4) Lockable access to prevent unauthorized entry.

7. HVAC Systems

a) Larger HVAC systems may contain remote supply air plenums, larger diameter ductwork, filter and coil “houses,” mechanical rooms, and related components that qualify as confined spaces. These remote areas are often elevated in height with a restrictive means of access.

b) The most common hazards of HVAC confined spaces are restricted access, vertical shafts and plenums or ducts, and mechanical and electrical energy sources.
c) Basic safety design options include the following.

1) Providing fall protection for elevated walkways (preferably railings).
2) Guarding any exposed mechanical elements (i.e., belts and drive shafts).
3) Installing adequately sized drains for condensate collection pans and basins.
4) Providing adequate clearance around all moving parts, electrical transformers, high voltage switches, and other similarly hazardous systems.
5) Providing adequate access and clearance space for repairs and the movement of new or replacement equipment.
6) Providing fixed ladders or stairs (preferred) for air supply intake plenums and related building “moats.”
7) Providing filter rooms and mechanical rooms with permanent, moisture-protected lighting.
8) Installing true doors rather than hatches, where possible.
9) Lockable access to prevent unauthorized entry.

8. Crawlspaces and Chases

a) Although not generally identified as confined spaces, a variety of crawlspaces, pipe chases, ceiling plenums, and related areas require periodic entry for inspection and repair. Difficult access to these spaces, coupled with their general layout, can create significant confined space hazards.
b) Most hazards associated with crawlspaces and chases pertain to restricted access, entrapment, and head and face injuries from obstructions and falls, either directly to the individuals entering these areas or indirectly by dropping tools or other objects. In certain cases (i.e., pipe chases), high-pressure steam can also be a hazard if piping is leaking, or a valve is damaged.
c) Basic safety design options include the following.

1) Eliminating crawlspaces wherever possible. Where crawlspaces are necessary, maximize their cross-sectional area and minimize any obstructions.
2) Installing floor gratings in large vertical pipe chases at each entry point or grade.
3) Installing permanently fixed ladders in large building-wide pipe chases.

4) Providing designated access hatches for above-ceiling MEP system components that will likely require regular service (i.e., variable air volume mixing boxes).

9. Tanks and Vessels

a) A wide variety of tanks and vessels are used for storage, collection, and distribution, including fuel tanks, boiler vessels, and wastewater neutralization tanks as well as tanks used for the temporary retention of domestic water, chilled or cooling water, and those used in research applications (i.e., liquid nitrogen bulk storage and the Van de Graaff accelerator at the Wright Nuclear Structure Laboratory). The confined nature of these spaces is generally well understood by service and maintenance staff. Those tanks that are located below-ground (i.e., fuel tanks) have limited or no direct means of entry, except after a partial excavation.

b) The hazards associated with tanks and vessels include their material contents or residue, atmospheric hazards (oxygen deficiency, toxicity, flammable, or explosive) and access, including falls upon entry or exit.

c) Basic safety design options include the following.

1) Boltable or lockable access to prevent unauthorized entry.
2) A means of removing the contents prior to entry.
3) Fixed ladder and railing access systems for elevated tanks requiring regular entry or inspection.
4) A means for remote assessment of contents level.
5) A means for valving-off and locking-out inputs into the tank or vessel during entry.

10. Miscellaneous Areas

Other areas and locations present access problems that can create confined spaces and their related hazards, including tunnels, platforms, and attic areas where fall hazards can exist because of inadequate or nonexistent railings as well as the absence of a fixed ladder or stairway, or exceptionally low clearance within the space. These kinds of issues are best addressed by providing a standard means of access (preferably stairs), incorporating hand and toe rail protections, and installing larger entryways or doors instead of hatches.

C. Basic Design Guidance for Confined Spaces

1. The most effective means of reducing the hazards associated with a confined space, as well as the long-term operational and procedural requirements associated

with these spaces, is to eliminate the confined space from the start. Depending upon the space, this can be accomplished by several means, including:

a) incorporating the space as an element of a building,
b) providing a true full-size door instead of a hatch or manhole for access, and
c) installing a stair rather than a ladder.

2. Where these steps are not feasible, the following is a brief listing of preferrable design practices that can significantly reduce the hazards associated with most confined spaces.

    a) Provide as-built drawings of all confined spaces depicting all penetrations and systems contained within them.
    b) Ensure space is sufficiently large enough to provide adequate clearances.
    c) Design the space to be linear in configuration with a clear line of sight.
    d) Minimize obstructions and penetrations to provide clear and safe paths of travel.
    e) Adopt a standardized hinged and counterweighted cover in lieu of ordinary manhole covers or large grates.
    f) Ensure that access ways are sufficiently large enough to accommodate anticipated supplies and equipment transfers into and out of the space.
    g) Provide a means of fall protection, preferably through the use of railings and gratings.
    h) Provide a safe and easy means for collecting and removing accumulated water in below-grade vaults by using sloped flooring and small sump pits away from the ladder landing.
    i) Where possible, provide high-quality fixed ladders per OSHA guidelines.
    j) Install moisture- or weather-protected fixed lighting in frequently accessed spaces.
    k) Provide a means for passive or active ventilation for hot or humid locations and all other locations with anticipated atmospheric hazards.
    l) Provide an easily accessible means for locking or tagging out power supplies and liquid inputs in the space to prevent accidental engulfment, electrocution, or physical injury during entry.

D. Design Document Review and Approval for Confined Spaces

1. Yale University departments assigned to project reviews consider all phases of a design's documentation, giving special attention to safe design and the elimination of confined spaces.
2. If a confined space is unavoidable, the project manager must obtain approval for the design from managers of the departments servicing the confined space —Yale's Facilities Operations and/or Telecommunications.

3. Submit the final design documentation to Yale University's Office of Environmental Health & Safety for review and approval to ensure the design of safe mechanical, support, and confined spaces.

PART 6: ATHLETIC SPACE STANDARDS

6.1 INTERIOR

The design and construction of athletic spaces must conform to the following rules for all listed sports.

- Basketball: USA Basketball rules
- Fencing: U.S. Fencing Association rules
- Gymnastics: USA Gymnastics rules
- Handball: USA Team Handball rules
- Ice hockey: USA Hockey, Inc. rules
- Ice skating (figure and speed skating): U.S. Figure Skating rules
- Racquetball: U.S. Racquetball Association rules
- Squash: U.S. Squash Racquets Association rules
- Volleyball: USA Volleyball rules
- Track and field: IAAF Rules (International Association of Athletic Federations)

6.2 EXTERIOR

The design and construction of outdoor athletic spaces must conform to the following rules for all listed sports.

- Baseball (turf surface): USA Baseball rules
- Equestrian: American Horse Show Association rules
- Field hockey: U.S. Field Hockey Association rules
- Football (turf surface, scoreboard): NCAA rules
- Lacrosse (turf surface): NCAA Men's rules
- Rowing: United States Rowing Association rules
- Rugby (turf surface, scoreboard): USA Rugby rules
- Sailing: United States Sailing Association rules
- Soccer (turf surface): U.S. Soccer Federation rules
- Softball (turf surface): Amateur Softball Association rules
- Tennis: U.S. Tennis Association rules
- Track and field: IAAF Rules (International Association of Athletic Federations)

6.3 SWIMMING POOLS AND WATER SPORTS FACILITIES

A. Comply with the technical requirements of the SBCCI Standard Swimming Pool Code.

B. The design and construction of swimming pools and water sports facilities must conform to the following rules for the listed sports.

- Diving: United States Diving, Inc. rules
- Swimming: USA Swimming, Inc. rules
- Synchronized swimming: U.S. Synchronized Swimming, Inc. rules
- Underwater swimming: Underwater Society of America rules
- Water polo: U.S. Water Polo rules

PART 7: DOCUMENTATION STANDARDS

7.1 CAD STANDARDS

All CAD Record Condition Assignment Plans and CAD Record Condition Construction Drawings submitted to Yale University must conform to the drawing standards and be submitted as described in the Yale Office of Facilities CAD Standards (Division 01: General Requirements).

7.2 SPACE INVENTORY AND ROOM NUMBERING STANDARDS

All drawings must follow the designation and numbering guidelines for floors and rooms established in Yale's Floor and Room Numbering Standards and Process.

7.3 SPECIFICATIONS

Comply with the following specification requirements. Deviation from these requirements is not permitted without formal notice and written approval from Yale University.

A. Format

Arrange project specifications per the Construction Specifications Institute's (CSI) MasterFormat, which arranges subjects in numbered sections within 16 established divisions. Precede these specifications with the general documents containing bidding documents and general conditions. Use of the CSI MasterFormat saves all users time and effort. This feature is important to an institutional owner. Therefore, the arrangement of specifications on Yale University projects by CSI division is mandatory, unless there is a valid reason for not doing so and that reason is approved by the University.

B. Practice

Unless policy is dictated by a funding agency, Yale University favors the following practices.

1. Submit performance specifications or specify acceptable manufacturers (usually a minimum of three) and omit the term “or equal.”
2. Insert specific product approval standards under the consultant’s general requirements covering the following item: “Where performance specifications are used, the contractor is obligated, on request of the architect, to present an affidavit from the manufacturer certifying compliance prior to incorporation in the project.”

C. Shop Drawings and Samples

Each specification section should state if shop drawings and samples are required as well as the quantities required.

D. Testing

When the specifications require testing, excluding structural tests identified in the consultant’s statement of special inspections, such tests shall be included in a main list of required tests with the responsible party and relevant specification section(s) identified.

E. Drawings

1. Size and Scale

   Sheets should not be larger than 30 inches high x 42 inches wide. The preferred scale for all the overall plans and sections, except where limited work is shown, is a quarter inch (1/4") to one foot (l'). To avoid a conflict in these requirements for larger buildings, use multiple sheets with suitable match lines.

2. Numbering

   An attempt should be made to have drawing numbers (such as SB, B, 1, 2, 3, 4, 5) as well as showing plans for sub-basement, basement, first, second, third, fourth, and fifth floors, among others. A logical extension of this scheme involves P, M, and E prefixes to these numbers for the appropriate mechanical and electrical floor plans. Drawing numbers should be located in the lower right-hand corner of a title block appearing in the lower right-hand corner of each drawing.

3. Room Designation

   Rooms should be designated on plans by name and room number as described in Yale's Room and Floor Numbering Process Standards. Room numbers are important, and they should be approved before the design development phase and remain unchanged.

4. Room Finish and Painting Schedules

   Locate individual floor schedules on the same sheet as the associated floor plan.

5. Drawing Index

   In addition to the complete face sheet index, repeat a partial index on other drawings. For example, on plan drawings the local index should refer to sheet locations for items most wanted when looking at the plans (see below).

6. Example

Item	**Dwg. No.**
Equipment schedules	10
Plumbing details	14
Lab. equipment details	35

7. Standard Abbreviations List

   The face sheet should include a list of all standard abbreviations.

F. Project Document Inclusions

1. Place the following note in **bold type** on each MEP sheet.

   All control boxes, valves, control valves (of every type, shape, and function), and DDC control boxes must be installed to be fully and reasonably accessible and free from insulation or other construction components.

   "Fully and reasonably accessible" is defined as capable of being accessible for repair or replacement by an average-size individual, on a ladder if necessary, and capable of being removed without removing, modifying, or distorting other components of the work.

2. Elements of the work shall be installed in a manner that at the substantial completion of a project the following items, new or existing, shall be fully and reasonably accessible, including all HVAC control boxes, junction boxes, valves (of every shape, sort, and function), DDC control boxes, electrical panels, filters, belts, water coils, disconnect switches, and maintenance access elements, including pull space.

   Conflict with meeting these requirements shall be brought to the attention of the owner's representative, in a timely manner, and shall be changed at no cost to the owner.

3. Statements similar to the following should be included on drawings or in a specification section on special requirements for mechanical and electrical work.

   a) Mechanical and electrical drawings show pipe, duct, and conduit runs as well as the locations of equipment, valves, panels, and other components. Dimensions not shown must be obtained from the architect, and not scaled from the drawings. Lay out routing and locations to meet field conditions, to provide easy access for service and maintenance, and to avoid conflict between the work of all trades. Submit proposed routings and locations to the architect for approval, and modified or relocate them within reasonable limits, as directed, without extra cost.
   b) Provide equipment and apparatus complete with all the usual and necessary fittings and accessories not normally shown or specified, but which are required for proper installation and operation. Place gauges, thermostats, thermometers, and other accessories, not specifically located on the drawings, where directed by the architect.
   c) Provide written operating and maintenance instructions for all equipment and systems, in an approved form, to the architect before final acceptance of the work.

4. Provide at least one drawing section in every mechanical room.

G. Exhibit X: Format for Meeting Minutes

PROJECT REPORT NO. XX

12345 Melody Lane
Harmony, TM 98765
t: 123 456-7890
f: 123 456-7890

DATE:

PLACE:

PROJECT:

DISTRIBUTION:	Name	Company	Attending
	Jane Doe	Yale University	Y
	John Doe	Yale University	Y
	Jane Doe	Yale University	Y
	John Doe	Yale University	Y
	Jane Doe	Yale University	Y
	John Doe	Yale University	N
	Jane Doe	Yale University	Y
	John Doe	Yale University	Y
	Jane Doe	Yale University	Y
	John Doe	Architect XYZ	N
AUTHOR:	John/Jane Doe	Architect XYZ	EMAIL:

XYZ ARCHITECTS

PURPOSE OF MEETING: PROJECT DESIGN REVIEW DISCUSSION:

BY WHOM -
DEADLINE
DATE/NO. DESCRIPTION/STATUS

RECORD 12/5-1 SCHEDULE:
01/04 Jane D. presented YXY's project schedule Critical Dates:
1/12 CD issue to YSM for review
1/17 YSM signoff of CDs
1/23 Issue CDs for Bid 1/23
Completed
1/23 Addendum Issue
2/2 present GMP to YSM
2/19 Construction starts on 2/23

12/19 DISCUSSION

XYZ	12/19-1	Area 2 comments: 1. XYZ to clarify the equipment identified in the northwest corner of room 8201. 2. In rooms 8200B, 8200E, and 8201 provide adjustable shelving at all available wall surfaces. 01/23 Complete
01/04 DISCUSSION		
YALE UNIVERSITY	01/04-1	John D. to provide additional spec information on sterilizing equipment in glass washroom. 01/09 In progress 01/16 In progress 01/23 John D. working with manufacture to determine requirements for the steam generator. 01/23 Jane D. working with allowance numbers for the time being till all spec information is available then final quotes will be determined and approved for purchase.
DEPT X	01/04-2	Jane D. and G+E to identify future hood locations. 01/09 In progress 01/16 In progress 01/23 John D. has met with Jane D. and is working on the users of department X future hood requirements.
RECORD	01/04-4	John D. distributed plan with Jane D. comments to XXX. John D. requested a copy of the plan be returned to him.
G+E, ABC, XYZ	01/04-5	John D. requested plan and area calc's. indicating lab to office ratio. G+E, ABC and XYZ to determine lab zones. XYZ to provide plan indicating area and calculations. 01/23 Done
01/09 DISCUSSION		
XYZ	01/09-1	XYZ to submit comparison between George Street 300 Labs and YSM Labs at Science Park 01/23 Complete
RECORD	01/09-2	Telecom room #8103 requires plywood on all four walls. 01/23 Indicated on drawings
RECORD	01/09-3	Electrified hardware required in door to stair 01/23 Indicated on drawings
01/16 DISCUSSION		
YALE	01/16-1	YSM to pursue permit for emergency generator 01/23 In progress

RECORD	01/16-5	Submittal: MEP submittals shall be sent directly to BVH. Architectural submittal shall be sent directly to XYZ. One set of all submittals shall be sent to YSM for review. Approvals shall be by the design team. All responses shall be forwarded through XYZ to XX. 01/23 No change
01/23 NEW BUSINESS		
XYZ	01/23-1	XYZ to verify millwork nosing.
XYZ	01/23-2	XYZ to confirm that workplace furniture has extensions on top and shelves similar to Science Park installation. Also, color and finishes to be the same.
NEXT MEETING		**01/30/2001, 10:30 AM at YALE**

Report prepared by: John Doe
NOTE: Unless the architect is informed to the contrary in writing within five (5) days, these minutes will be considered an acceptable transcription of the meeting.
Architect's job
no. here
Date: 1/09/01

Date	Description of Change	Pages / Sections Modified	ID
10/2022	Copy and formatting revision	All	Ronnie Rysz