Introduction

Mission Statement

We, the Facilities Planning and Construction Department, 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 & managing the process of creating those environments. We strive for full satisfaction of all stakeholders′ needs and requirements at all times, on all activities. The portfolio of ongoing projects is the framework in which we manage our movement toward physical environments that reflect institutional ideals.

Designer's Role

Key to the delivery of a successful project is that all players work as a team. The Designer plays an important role in fostering the participation required to create an effective team. To this end, a proactive approach is expected to the interface with Yale representatives, such as the Office of Environmental Health and Safety, Building Services and Operations, Yale Telecommunications, Yale Security, Yale Fire Marshal, and 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 the Yale 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 will be checking for conformance. The Designer must apply the guidelines and notify the Project Manager if there is a proposed deviation verbally and through documentation in the Basis of Design.

Interface with Project Participants

In order to achieve a successful project, the Designer must get input from, and coordinate with, a number of different groups. These groups include Yale representatives from Building Services & Operations, the Office of Environmental Health& Safety, the Yale Fire Marshal, Yale Telecom, Yale Security, Client Support, and in addition, the New Haven City Officials.

When the Design Team meets with the City Building Official or Fire Marshal to review projects, the Project Manager must be present to monitor the discussion and to field any questions regarding Yale University policy as a whole. A visit to the City 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. 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 re-design 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 forits ultimate completion. Therefore, no decisions can be made without the Project Manager's approval.

Purpose and Use of Design Standards

The Yale University Design Standards establish the requirements for designing and building new structures and for remodeling existing structures at Yale University. The standards are also intended to assist design architects and engineers in maintaining both consistency on a particular project and continuity with existing Yale University facilities, systems and equipment. Architectural and engineering firms and Yale University 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 MasterFormat structure. However, these 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 the Yale Project Planner of the variance to jointly decide on an approach that is compliant and meets Yale’s 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 Yale University 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 University periodically revises and updates these standards as technology changes and as codes, regulations, and legal mandates are revised or instituted. Submit suggested changes, additions, or deletions to these standards to the Yale University Office of Facilities Design Standards Committee.

Architects and engineers doing work for Yale University are expected to utilize these standards as maintained on the http://facilities.yale.edu/ website. Do not rely on printed or downloaded versions.

Campus Planning Framework

Plan for Campus Development

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

The Framework Plan

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

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 the building design including planning context, general character, use, density, building form, height, access, parking or service, and landscape areas.

The Yale Sustainability Plan 2025

Outlines the top-level sustainability commitments of the University, priorities supporting these ambitions, and measurable methods for achieving sustainability goals.

Stormwater Management Plan, 2018

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

Water Management Plan 2017

Defines strategies, near term progress and provides direction for future development to actively and adaptively manage this highly valuable resource.

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

Project Process and Planning

Capital Project Process & Handbook

Yale University developed the Capital Projects Handbook in 2005 to document and communicate the work processes and other important information needed to effectively complete capital projects at Yale University. These processes are relevant and ongoing today. The manual may be found at https://facilities.yale.edu/sites/default/files/files/CapitalProjectsHandbook.pdf. Review the manual to better understand the project delivery process, the roles of various project participants and how your services fit into the broader project delivery context.

Project Program/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 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.

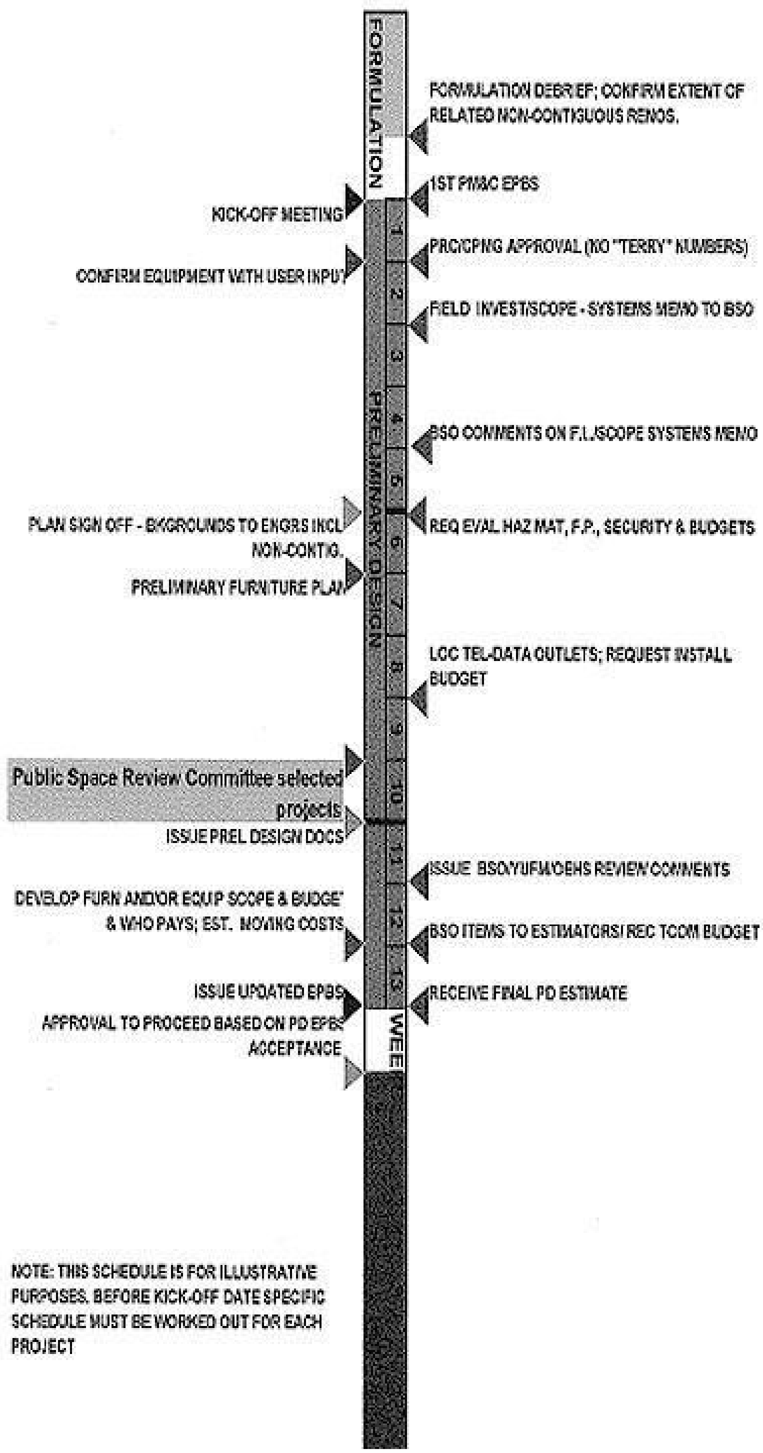
Design Phases – Detailed Schedule

At completion of the Preliminary Design (PD) 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 many steps that are required and the sequence in which they must occur.

Before the project kick off meeting, for all projects, the PM should meet with the architect, engineers and CM to develop a project specific detailed PD phase schedule with dates for each of the listed events. It is important to get buy-in from both the architect and CM 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.

PRELIMARY DESIGN PHASE - DETAILED SCHEDULE



Kickoff Meetings

There are two types of Design Phase Kickoff Meetings. One is the initial 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 design. The process and overall schedule for the PD phase should be presented.

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

The Design Team, at subsequent kick-off meetings for the next phases of the work, will review comments on the previous phase, schedule the next series of meetings on specific topics and begin the design process of the next phase of work.

During the Design Phases of the work, 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 very easy to read to follow issues and their resolution (see Exhibit at the end of this document).

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

Progress Meetings

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

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 re-assess 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. A copy of the standard form that is used by Yale University School of Medicine is in the Appendix. This form should be used by the Design Team to make responses to comments. The standard form is a Word document and can be transmitted electronically.

It is very 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.

Yale Guidance & Review

During the course of design, 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. A number of these departments have standards or requirements impacting design, including: Engineering and Utilities, Environmental Health & Safety, Security Department, Yale Animal Resource Center (YARC), Resource Office on Disabilities (ROD), Custodial Services, Grounds Maintenance, Office of Sustainability and Yale Hospitality.

Furniture Design and Procurement

The key to a successful purchase and installation of furniture is communication. From the very outset of the project, i.e., the Kick-off Preliminary Design meeting, the Project Manager will establish the guidelines by which the Design Team, the furniture vendor, Yale's Purchasing Department, 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 the furniture package.

There are two ways that the furniture design and procurement process occurs: 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: The 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 the general layout generated by the Architect working within the established budget. The Architect is expected as part of the basic services to advise on color selections to work with the colors chosen for the other finishes in the space. Review of proposed finishes, colors and furniture should be scheduled with the Public Space Review Committee (PSRC) *before* any presentation is made to users to confirm that the direction is appropriate both for selection and cost level. This review applies to all projects unless funded by the Department and it is a non-public space. The Design Team is also responsible for coordinating the electrical power/ data outlets with the proposed furniture so that they are accessible for use. (This is very important as repeatedly outlets are blocked by furniture.) The vendor will provide drawings, specification and estimate. Once the user agrees to the layout and the proposed cost is in line with the budget, the Project Manager then takes the specification and attaches a Purchase Requisition authorizing the furniture to be either bid, or bid and purchased, and forwards this package to Yale Purchasing via Asset Management. Yale Purchasing then either competitively bids the furniture specification or through the established buying agreement with a preferred vendor (for example Steel Case Partnership through BKM) obtains a proposal and detailed specification. Once established that the specification meets the design intent, the furniture is released for purchase via notification by the Project Manager to Yale Purchasing. Yale Purchasing in turn tells the vendor.

On larger 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 the Project Manager to determine the appropriate furniture required and the design, selection and price parameters. 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 both for selection and cost level. This review applies to all projects unless funded by the Department and it is a non-public space. On larger projects requiring furniture with larger variations in cost – such as conference rooms and libraries the PSRC should be scheduled before completion of the PD phase estimate and EPBS so that the furniture and equipment budget can be confirmed.

The Design Team specifies the furniture and submits the 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 full specification will be produced by the furniture vendor. 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 Purchasing via Asset Management. Yale Purchasing then either competitively bids the furniture specification or through the established buying agreement with a preferred vendor (for example Steel Case Partnership through BKM) obtains a proposal and detailed specification.

Regardless of who the successful vendor is, specification as produced by vendor needs to be reviewed in detail by the Design Team to insure compliance with design intent. Once established that the specification meets the design intent, the furniture is released for purchase via notification by the Project Manager to Yale Purchasing. Yale Purchasing in turn tells the vendor. When the furniture arrives at the site, the Design Team needs to be present and review the shipped furniture versus the specified furniture to see if the order is complete and correct.

Construction Phase Procedures

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 the Design Professionals will review this application for its accuracy and for its 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 Constructor, particularly the agreed-upon allowable mark-ups. Once approved and signed by the Architect, the Application for Payment is submitted to the Project Manager for processing. The Yale University Project Manager will only be doing a spot check of the invoice, in that we are relying on the outside Design Professional to have reviewed the Application.

Close-out Deliverables

During the close-out phase of a project three deliverables are required of the Design Team – three are required as part of base services, Assignment Plans and Basis of Design As Built Submission, and Record Archive Drawings and Specifications.

Record Archive Drawings and Specifications: After Substantial Completion, the Constructor will give to the Design Team the marked up Field Record Drawings which were kept on-site 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 the documents during this process need not be "bubbled" 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 page or multiple large 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 Contract Document 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 document, the sheet-metal shop drawing document, which needs to be scanned and included as part of the Record Archive Drawings set. In the same way, the fire protection drawings, as produced during the shop drawing process, should be scanned and included within the Record Archive Drawing set, both electronically and in hard copy. Please note that the Finish Schedule should be updated to reflect the final finishes selected and installed (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. Total nasf will be the sum of all program space (i.e., not toilet rooms, custodial closets, etc.). Gross square feet (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.

Procedural Requirements

Safety Issues

Safety is an essential component of design and construction at Yale University. Many projects on campus are in existing active laboratory environments, or other environments, that 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. See the Yale Environmental Health and Safety website for tools and resources at https://ehs.yale.edu/building-construction-renovation

The Office of Environmental Health & Safety provides a training session for Designers and Constructors which is offered at intervals. The following guidelines should befollowed:

1. Eating, drinking and/or smoking in any laboratory are strictly prohibited.

2. Before entering any laboratory, always look for labeling at the entrance to the facility. There you may find any of the following:

a) "Caution Radioactive Material" sign: This sign is an indication that radioactive material is either used or stored in the area or item containing the sign. It does not necessarily mean, however, that there is an exposure hazard present;

b) "BL2" or "BL3" – Biological Safety Level 2 or 3;

c) Information Sleeve 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 forhand washing.

6. When situations arise where hazardous materials hinder your ability to perform your required task adequately, please contact the Office of Environmental Health & Safety at 737-2121 (Linda Mouning). Please inform Ms. Mouning of the potential hazard and an appropriate safety specialist will address the issue.

7. If hazardous exhaust ductwork, vacuum, and/or waste plumbing line needs to be penetrated, please contact the Office of Environmental Health & Safety at 737-2121 (Linda Mouning). Please inform Ms Mouning of the required work to be performed and an appropriate safety specialist will address the issue.

8. Emergency response: If an emergency arises while in a laboratory relating to a hazardous material, please contact the Office of Environmental Health & Safety emergency line at 203-785-3555 (between 8:30 a.m. – 5:00 p.m.). All other emergencies and times, please contact 911.

Office of Facilities Archived Documents

In order to provide documents to Consultants and maintain the quality and completeness of our archive, the following procedures are to be followed:

1. Many 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 the Yale Office of Facilities Plan Room to search the drawing files.
3. All drawings removed from the drawers must be re-filed by the designer before leaving.
4. No original (mylar, vellum, or print) shall leave the Yale Plan Room in the possession of an outside designer.

Project Photography

The following has been confirmed with representatives of the University's Office of Public Information 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 aretaken.
2. The photographer must be accompanied by a project manager or a representative of the occupant department's business office.
3. No Yale University faculty, staff or student may be included in photographs without their written permission.
4. No patients or research subjects will be included in anyphotograph.
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.

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.

General Design Guidelines

Site & Landscape

Water Accumulation

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

Building Exterior

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.

Vapor Transmission and Condensation

There must be no condensation on interior surfaces under normal interior temperature and relative humidity conditions during 97.5% 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 given available construction practices.

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 and airborne dirt and soot. Minimize the appearance of settled dust anddirt.
    b) Exterior surfaces must be washed reasonably clean bynormal precipitation.
    c) Prevent precipitation from washing settled dust and dirt over surfaces exposed to view.
    d) Select materials that will not result in heavy staining on building facades.

2. Conceal mechanical equipment, plumbing equipment, electrical equipment, 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 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 concealdirt.

Structure

Designs must conform to the following structural standards.

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 1.5 times the anticipated live loads, without excessive deflection or permanent distortion.

Special Loads

In addition to loads defined by code, provide for adequate support of wall-mounted 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% 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 ANSI/ASCE 7.

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.

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 ofgravity.
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 ofgravity.
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 thefixture.
   a) Application: For design purposes, apply the component seismic force non- concurrently in any horizontal direction at the component's center ofgravity.
   b) Exception: For design purposes, the contents to be 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 act as braced or moment-resisting frames.

Design piping, hangers, and braces 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.

Building Interior

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 supportstructures.
2. Interior fixtures comprise the following functional items, which are permanently attached to interior construction (walls, ceilings, and floors) and are necessary for complete and proper functioning 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 intended primarily 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—other items fixed to interior construction that enhance comfort or amenity in building spaces, including service wall systems, planters, and fixed ladders.

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 not less than those recommended in Illuminating Engineering Society Lighting App, IES Ready Reference, 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 IESNA RP-5-13, Recommended Practice of Daylighting, 2013.

   d) Provide window shades to control brightness and glare from direct daylighting. Control of shades is to be coordinated with the design, and zoned in open work areas or per the buildings heating and cooling systems design.

Interior Finishes

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

1. Coatings 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, non-polished finishes on concrete and stone surfaces.

Health and Safety

Design and provide exterior and interior construction to protect building occupants in accordance with code.

1. Provide permanent protection against the infestation of construction by ground dwelling termites and other vermin.
2. Design and select materials to protect pedestrians and building occupants in accordance with code and with the following additional requirements.
   a) Prevent ice and snow from falling off building elements onto pedestrians, building occupants, and vehicles – or design paths to keep pedestrians away from suchrisks.
   b) Protect pedestrians, building occupants, and vehicles from objects accidentally dropped from elevated observation decks, balconies, or plazas.
3. Design and select materials to provide natural ventilation in accordance with code and with the following additional requirements.
   a) The ventilation opening 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 utilityspaces.
   b) The ventilation area must be at least 10 percent of the wall area for each floor, equally distributed on two elevations.
4. Design to prevent damage to occupants, structure, services, and contents from lightning strikes.
   a) Provide protection equivalent to that specified in the most current NFPA standard. 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 10

ft (3 m) of a structure.

5. Design and construct to comply with code and with the requirements stipulated by Yale Environmental Health and Safety.
6. All upper-level windows at Residential Colleges must have opening controls to prevent someone from falling.

Physical Security

In addition to any provisions that may be required by law or code, design and construct both exterior and interior spaces to incorporate accepted principles of crime prevention through environmental design, using natural (as opposed to technological) methods of providing 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 Security.

1. For purposes of physical security, elements at ground level are defined as any elements within 20 feet (6 m) of the ground, grade, or adjacent paving.
2. Security zones are defined asfollows.
   a) Public access zone—an area to which the public has free access, including public corridors, grounds, and parking lots.
   b) Reception zone—an area to which the general public has access but beyond which access is restricted at all times.
   c) Operations zone—an area to which only employees (and visitors with a legitimate reason to be there) have access.
   d) Secure zone—an area to which access is always controlled and which is monitored continuously.
   e) High-security zone—an area indicated in project program, and an area named "vault", "secure file room," or "cashroom."
3. Design and construct to provide physical security in accordance with the following requirements.
4. 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 F 1233 Class I and ASTM F 476 (R96) Grade 10 forced entry resistance requirements, adapted to suit the element.
5. Minimize the size of ground-level glazed elements, and locate them in areas under surveillance by Yale University staff at their normal workstations.

6. Ground-level glazing must have a UL 972 burglary resistant rating.
7. Doors must meet ASTM F 476 (R96) or ASTM F 842 requirements, Grade 10, as appropriate.
8. Windows at grade level may require security screens or intrusion detection systems, as directed by Yale Security.

Accessibility and Convenience

To the maximum extent possible, design all exterior and interior pathways, spaces, building components, fixtures, equipment and furnishings to allow full, comfortable and convenient access and use by all persons. Provide hardware and fixtures that disabled persons can use easily without outside assistance. Projects are to align with Yale Resource Office on Disabilities recommendations. Provide fixtures with fittings and controls that are manageable without special instruction or the need for excessive force.

Roof Worker Access and Safety

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

Access for Maintenance

1. Dunnage on Roofs

   If structural steel dunnage is installed to support equipment above roofs a minimum 30” clear 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 Yale University PM approval.

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 due consideration for easy routine servicing and feasibility of major servicing, including removal and replacement of equipment.
   a) Elevator access to mechanical spaces on the lower and upper floors and 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 6- 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 equipment and pull spaces and 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, anddoorways.
g) Locate thermometers and gauges, as well as thermometer wells and gauge taps, for easy 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 serving 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 2' of any switchboard, motor, or controller. Drain pans must be 20 oz, copper pans at least 4" 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 rolled over stiff brass wire on each side. Seams must be soldered and watertight. Provide 1" diameter drip pipe from the pan down to thenearest drain.
m) Locate equipment to allow the necessary clearance for removing coils and other sub-assemblies.
n) Provide conveniently-located access doors to all enclosed areas housing mechanical equipment.
o) Provide lighting and power for servicing equipment.

4. Access to PipingRisers

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 Lamicore name plates on access doors to identify the services available in pipe chases.

Historic Preservation

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

Generally, Yale University seeks to minimize the impact of updates made to historic buildings. Follow guidance provided by the National Park Service, the Association for Preservation Technology and other preservation organizations reflecting current best architectural and material preservation practices, when specifying work to alter, repair or protect historic materials and building elements.

Durability

Designs must conform to the following durability standards.

Service Life Span

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

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

Weather Resistance

Design and select materials to minimize deterioration due to precipitation, sunlight, ozone, 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 appliedcoatings.

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 tested in accordance with ASTM B 117 for a 1000-hour exposure with 5% 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. There must be less than a 1% change in haze, light transmission, and color over two years of exposure when tested after natural exposure conditions or when tested 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. 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 the 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.

Ultraviolet Resistance

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

Impact Resistance

Design and select materials to resist impact damage in accordance with code and the following additional 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 1/2 inch (12 mm).

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.

Wear Resistance

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

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

Water and Corrosion Resistance

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

1. 3" (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 thesecriteria).
   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.

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.

Ease of Use

Ease of Relocation

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

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 01810: Commissioning and Section 01820: Demonstration and Training.

1. All text on identifying devices must be 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.

Ease of Maintenance & 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'sstandard cleaning supplies and techniques and 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 harshchemical cleaning, without damage.

Ease of Repair

Provide interior fixtures at all locations that are designed to permit repair or replacement of individual components without removing thefixture.

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 life span 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 them

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 life span equal to that specified for the project.

Attic Stock

Provision for attic stock shall be at the discretion of the Yale Planner/Project Manager. Consultant to identify attic stock materials for review by Yale. The Consultant will also identify a temporary storage room to be available for storage of attic stock for a one-year period. Left over supplies of acoustic ceiling tile and vinyl composition tile are to be turned over to Yale at the end of the project at the project manager's discretion.

Expansion Control

Provide for 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 within a range from the most extreme low temperature to 70°F (39°C) greater than the most extreme high temperature, in any year, without causing detrimental effects to components and anchorage.

Diversity and Accommodation

Yale is an extraordinarily diverse and inclusive community, often requiring design sensitivity and architectural accommodations such as:

- Shared and inclusive restrooms
- Sabbath gates and doorways
- Prayer rooms
- Foot washing basins
- Mother's rooms

Adjacent Operations

Many 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, and needs 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 adjacent occupants when complete or to relocate adjacent occupants.

Vibration Control

Assess local vibration requirements that may be present with adjacent facilities, such as of extremely sensitive laboratory devices in the building, particularly the Medical School, Science Hill, and Engineering School areas. Give special attention to the need for pipe and conduit isolation from vibration sources.

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 in 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, to achieve the following minimum airborne sound isolation class values between adjacent spaces, when tested in accordance with ASTM standards.

See Table 1 for room background noise guidelines. Selection criteria depend 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 to achieve specified sound levels, and use sound attenuation, as necessary. See Table 1 for maximum ambient soundguidelines.

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 & receiving spaces	45–55		
Breakout rooms		30–40	
Multi-purpose rooms		40–50	
Laboratories		40–45	
Laboratory work spaces		40–45	
Laboratory support spaces		40–50	
Laboratory equipment rooms		45–55	
Private offices		30	
Open-plan offices		30–40	
Corridors		40–45	
Conference & seminar rooms		25–35	
Instrumentation rooms		30–40	
Classrooms		25–30	
Large lecture rooms		25–30	
Gymnasiums & 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, substructure spaces within the noise criteria ranges indicated in Tables 2 and 3.

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

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.

Departmental Standards and Guidelines

Office of Facilities

Refer to the standards below at https://facilities.yale.edu/documents-resources/design-standards for detailed requirements in these subject areas.

- Landscape Management Standards
- Grounds Maintenance Design Standards
- Sustainability Design Standards

Information and Technology Services

Yale ITS should be consulted with to determine the need and design requirements for telecommunication, audio/visual and other information technologies. ITS has prepared the following standards for reference.

- ITS Telecommunications Design Guidelines
- Section 27 11 00 Telecom Equipment Rooms
- Section 27 15 00 Communications Horizontal Cabling

Architect's Role

IT/DATA/Telecommunications/WIFI

Coordinate all end of line device locations based upon program. Reflect in ID drawings for coordination with FFE and Programmatic Use. Interview/survey Yale IT for standards feedback and connections to infrastructure Demarcation point.

1. 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 back box.
2. Coordinate point of connection to university network, or MDF location in project with specific coordination needs that define limit of project scope and connections to university infrastructure.
3. Generate unique design package for low voltage RFP by Contractor (separate and apart from Electrical sub-contractor).

Audio Visual/Technology

Utilize AV sub consultant as required by program narrative to define full audio-visual system needs that are in addition to IT/DATA/Telecommunications/WIFI requirements above.

1. At SD/ESD level, provide space specific design narrative that confirms use of space and objectives of Audio/Visual program benefit to end user group.
2. At DD level confirm budgetary guidance and Yale AV system coordination with projected university guidelines.
3. As CD level, full system design includes all conduits, back boxes, point to point wire pathways with preferred conduit structure. Include all detailed power connections and heat load calculations for use by EOR in HVAC design. As needed post CD during CA phase update design specifications to accommodate evolution of specified equipment. All specified equipment shall include provision for approved alternate by contractor.
4. CA phase shall include full system commissioning and training of end user group as part of this phase.

Cell Phone/DAS - If specifically required by program, this scope is reflective of the same tasks and detailing as the IT/DATA/Telecom/WIFI scope.

Environmental Health & Safety

For every project, the office of Environmental Health and Safety (EH&S) will survey and test existing building materials and soils to identify hazardous materials, and will develop a remediation plan to remove, encapsulate or manage the contact and disturbance of such materials, delineating the responsibilities of the contractor, the owner and the licensed environmental professional (LEP) hired by the owner. Include the remediation plan in the bid and construction document sets. EH&S has prepared the Contractor's Health and Safety Guidelines, which are applicable to every construction contract. Review these guidelines, and avoid creating conflicting requirements in the contract documents.

Review the information on the EH&S website https://ehs.yale.edu/building-construction-renovation, including the section "Design Issues and Review".

EH&S provides consultation services through its several sections for specific questions or problems dealing with health and safety issues. These consultations, considered essential for the design of any construction project, should be requested and completed at the schematic design stage of the project. Based on the nature of the project, request consultation with the following E&HS sections:

1. Biological Safety
    - Medical School
    - Kline Biology Tower
    - Any other area where work with infectious agents is conducted
    - Any area where animal experiments are conducted

2. Environmental Health
    - Food service, storage and/or processing facilities
    - Swimming pools
    - Potable water systems
    - Solid waste handling (garbage and rubbish)
    - Dormitory facilities
    - Sewage disposal at off-campus sites

3. Occupational Safety
    - All laboratory facilities
    - Walking and working surfaces
    - Ventilation systems
    - Fume hood systems
    - Stairways
    - Shop facilities
    - Storage facilities
    - Electrical services
    - Plumbing services
    - Mechanical rooms
    - Confined Spaces
    - Accessible roofs, ladders, safety railings and fall restraint systems

4. Radiation Safety
    - Research laboratories
    - Clinical laboratories
    - Patient care facilities (including radiation services)
    - X-ray facilities
    - Accelerator laboratories
    - Laser facilities
    - Microwave facilities
    - Ventilation systems
    - Drainage systems
    - Shielding & Shielded facilities

Security Department

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

- Access control systems
- Emergency “blue phones”
- Security cameras
- Intrusion alarm systems
- Window security screens

Central Security/CCTV/Blue Lights/Access Control

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

1. In the ESD/SD phase, interview Yale Security for locations of devices and for detailed access control expectations of user groups.
2. DD phase includes full infrastructure design including End Of Line device locations for coordination with all finish elements. Reflect all devices on Interior design details.
3. CD phase includes all equipment selection and wire pathway coordination with university infrastructure to connection point at university demarcation point. Some systems may sole source equipment as directed by Yale Security.
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. CA phase shall include full system commissioning and end user training by sub consultant.

Yale Animal Resource Center (YARC)

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

Resource Office on Disabilities (ROD)

In addition to applicable codes, the Consultant should review the Facilities Accessibility Guidelines on the Office of Facilities website for requirements 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 Resources for Students and Employees with Disabilities, Facilities Sub-Committee at design milestones.

Facilities Services

The Consultant should reference the Buildings and Grounds Landscape Management Standards, Grounds Maintenance Design Standards and Custodial Accessories in use, all available of the Office of Facilities website. Custodial Accessories for janitorial & supply closets, toilet rooms, trash and recycling areas are provided.

Yale Hospitality

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

School of Medicine Guidelines

Laboratories

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.

Lab Group Definition

At the 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 carrying out research within a thematically related area. At the Central Campus departments include areas such as chemistry, biology or 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).

Laboratory Accessibility Standards – Yale School of Medicine

Yale School of Medicine received a Handicap Waiver for Laboratory Stations. This waiver was approved by the State of Connecticut Office of Protection and Advocacy for Persons with Disabilities and the Department of Public Safety, Division of Fire, Emergency & Building Services, 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 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.***

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 both the current and former code is the provision of required accessibility per LabGroup.

1. To provide accessibility at the *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 an area of countertop. 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.

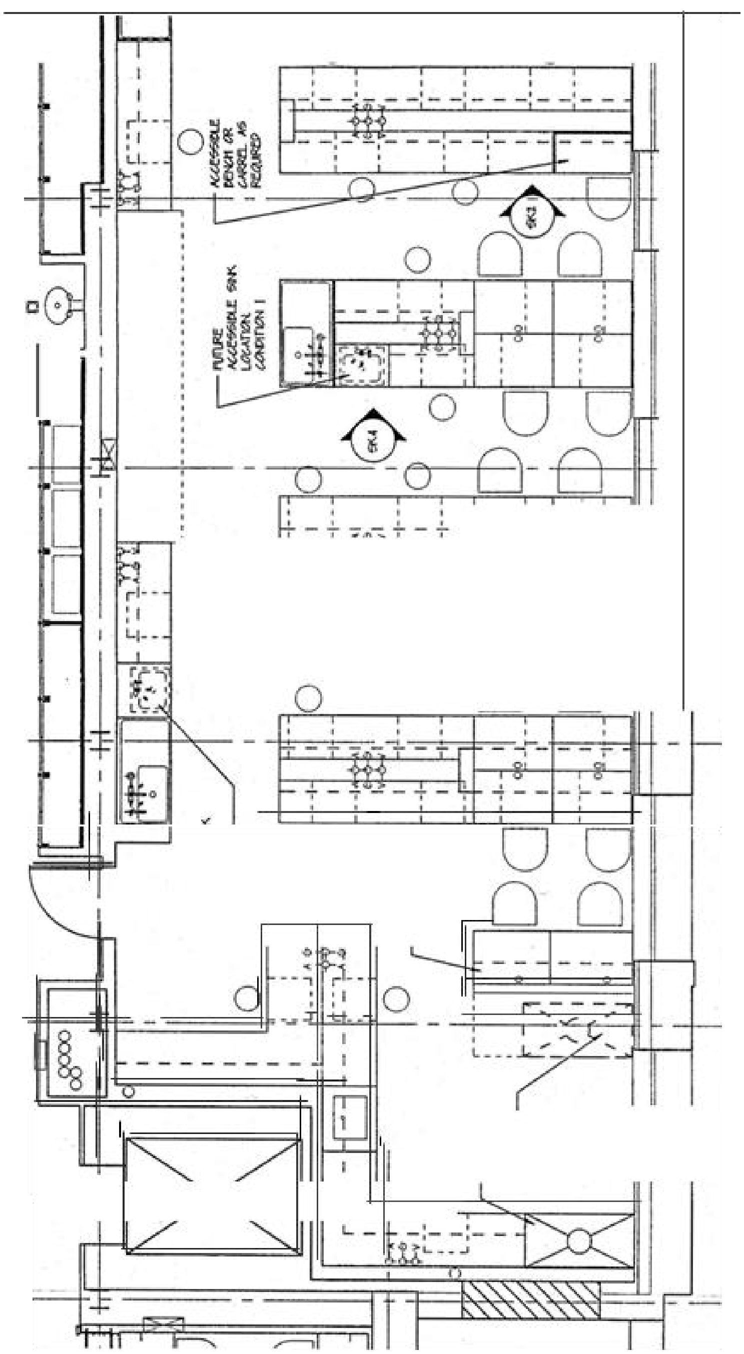
2. To provide accessibility at the carrel an additional *carrel* would be assigned to a person with a physical disability. Alternatively, when a carrel is not available an area of bench countertop with a seam will be provided to allow for easy removal of an area of countertop. An alternate height can 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 we propose 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 we 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 the 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 SK-1)

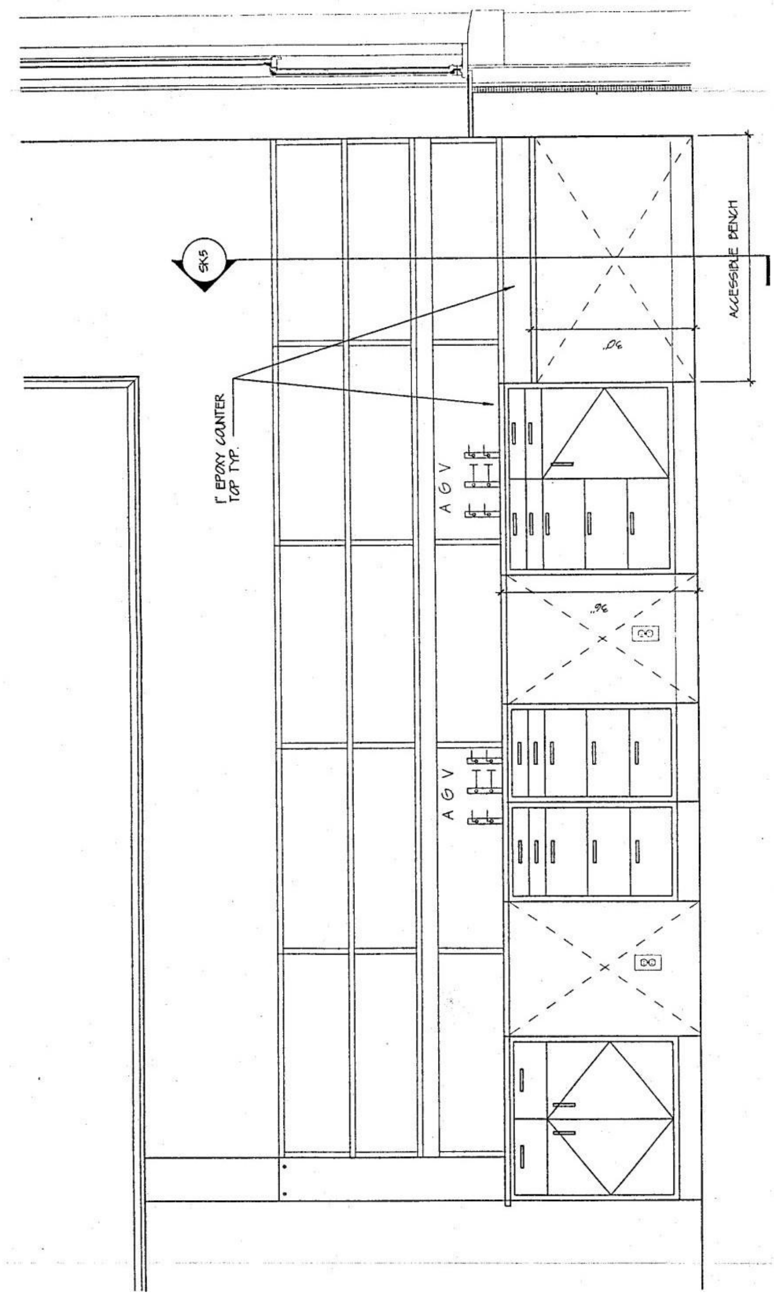
4. To provide accessibility at the fume hood we propose that an area be designated within the laboratories of a particular Lab Group for the location of a future accessible fume hood to be installed in the event that a person with a physical disability is employed in the laboratory. Alternatively, if 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. See the following sketches of samplelayouts

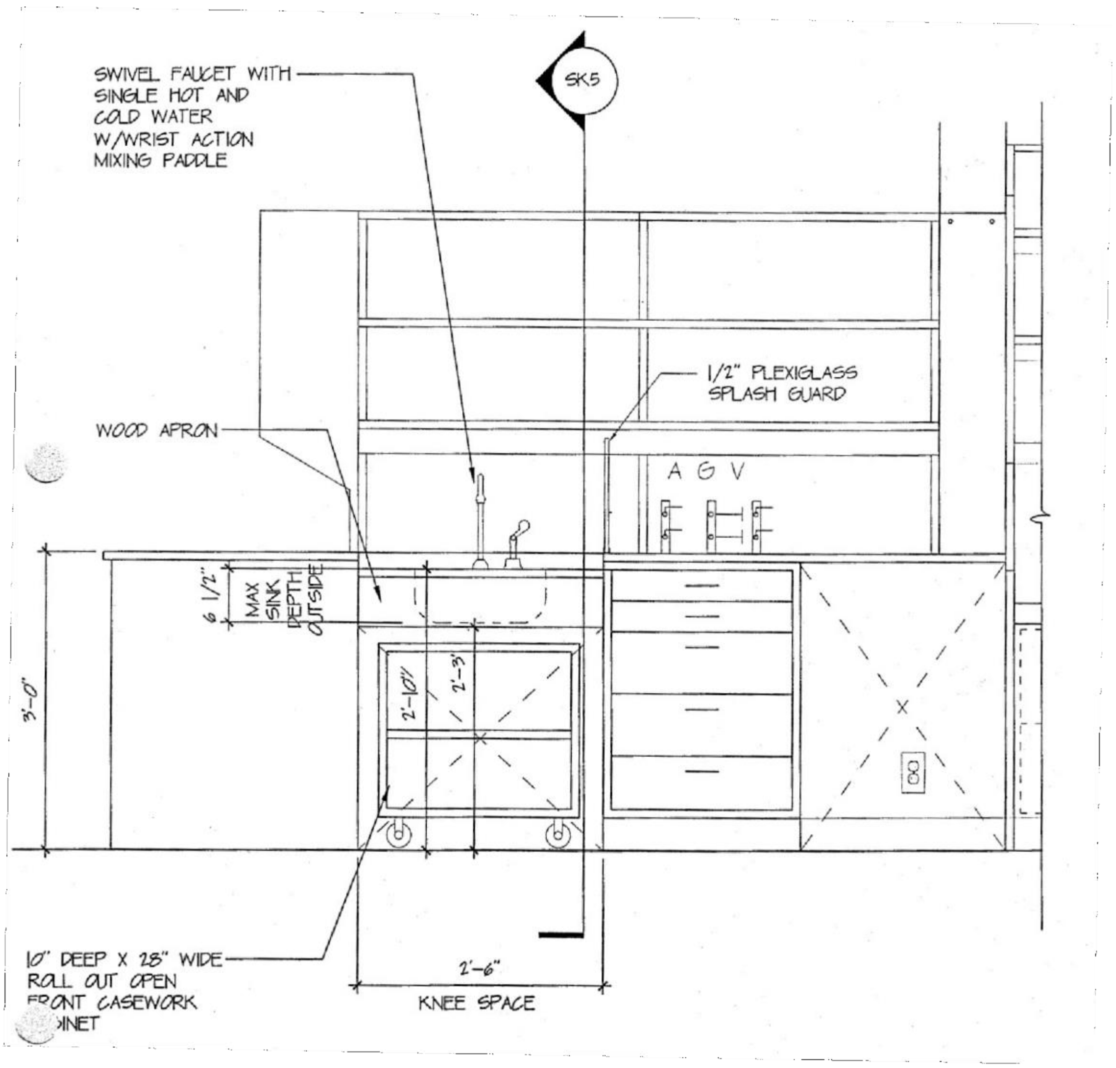
   SK 1 School of Medicine Sample Laboratory Plan
   SK-2 School of Medicine Accessible Bench/Carrel Elevation
   SK-3 School of Medicine Accessible Sink Elevation
   SK-4 School of Medicine Section at Typical Accessible Drop Bench



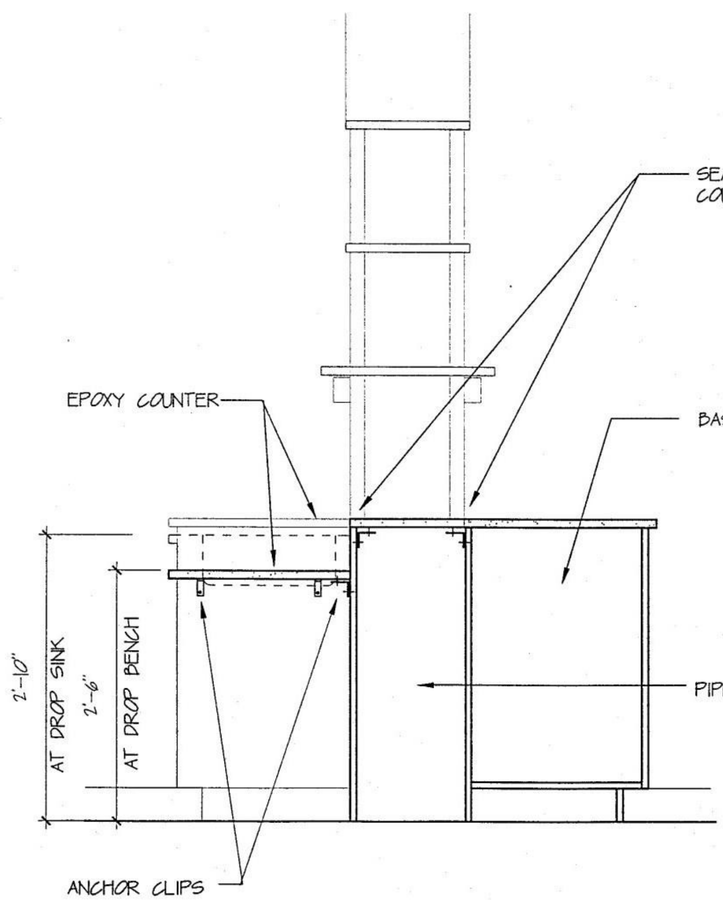
SK-1 School of Medicine SampleLaboratory Plan Not To Scale



SK-2 School of Medicine AccessibleBench/Carrel Elevation Not To Scale



SK-3 School of Medicine AccessibleSink Elevation Not To Scale



SK-4 School of Medicine Section at Typical Accessible Drop Bench Not To Scale

Laboratory Room Layout

1. Island benches shall be perpendicular to exterior wall with carrels at exterior wall.
2. The aisle between laboratory benches shall be 5’-0” wide minimum.
3. Sinks shall be located on exterior/corridor wall, not on the bench, to allow for flexibility. Provide one sink per 8-10 workstations.
4. Separate rooms shall be provided if required for "hot" (i.e., radioactive) work. Provide one “hot sink” and one hand washing sink.
5. Utility drop located at carrel/bench intersection.
6. Fume hoods shall be located away from exit door of lab and shall not be directly opposite carrels.
7. Light level of 70 foot candles minimum maintained at bench.
8. LED lights parallel to lab benches, centered on edge of benches.
9. No incandescent lighting.
10. New windows and existing refurbished windows shall be fixed.
11. Radiant ceiling panels at exteriorwalls.
12. Labs of greater than 1000 SF require two exit doors.
13. All corridor doors shall have magnetic hold opens if open doors are desired.
14. Corridor wall inside lab is the equipment wall.
15. Emergency gas shut-offs are to be provided within the lab, by the entry door, within the corridor demising wall.
16. Labs will be open in design. No subdivisions within laboratories by researcher.

De-Ionized Water at Laboratories

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

Smoke Detectors at Laboratories

1. At Laboratories provide 1 central station smoke detector at egress door.
2. At Lab Support spaces provide 1 central station smoke detector in room.
3. Do not install heat detectors unless occupancy in normal use might produce vapors that would trigger smoke detectors.

Bench and Carrel

1. Lab benches: Wood or metal casework acceptable.
2. Lab benches shall be 5’-0” wide.
3. No Unistrut shelving.
4. Grey epoxy counters and wood reagent shelving shall be provided.
5. No cupsinks.
6. Knee spaces are provided for waste containers and refrigerators.

7. No task lighting at the benches. Task lighting provided at carrels.
8. Two phone/data drops per office and one per carrel, plus one wall phone per lab, in star pattern to data and telephone closet.
9. Sinks to be stainless steel, notepoxy.
10. Carrel shall be 3'-6" wideminimum.
11. Bench plus carrel should equal 10' linearfeet.
12. One hand-held, deck mounted, eyewash/shower at all non-radioactive sinks.

Finishes & Services to Laboratories

1. Air, gas, vacuum provided at all benches as required. Gas and airoutlets shall be minimized- dependent on particular needs.
2. AGV turrets are the double height type (i.e. two outlets per service, per location).
3. Duplex outlets spacing – 18" OC at lab bench, 24" OC at equipment wall.
4. Ceiling tiles are to be 2 x 2 or 2 x 4 lay-in tile, Yale University standard tiles.
5. No exposed ceilings due to maintenance cost premium.
6. VCT flooring in laboratories and corridors. (Standard colors required in corridors.)
7. Please note: for future flexibility (bench reconfiguration/removal), VCT 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 shall be continuous under allcasework.

Material Management

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

Laboratory Corridor Finish Treatments

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

WALLS: Gypsum wallboard, painted with stainless steel corner guards

WALL FINISHES: linoleum Sheet Wainscotting in accordance with Division 9, Section 9670 – extend to floor behind rubber base.

WOOD "CHAIR RAIL': to be mounted directly above sheet wainscoting.

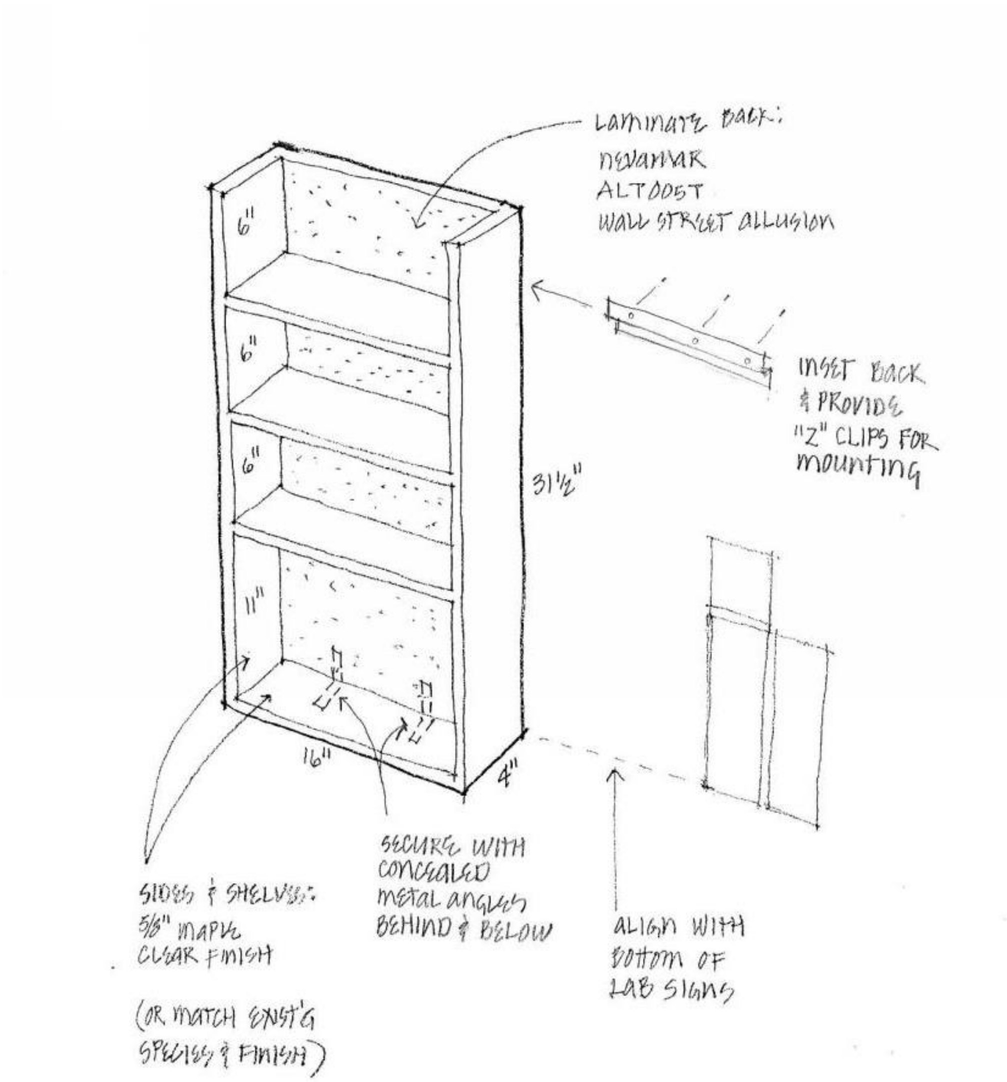
BASE: 4 inch rubber base.

RECYCLING CENTER: One per corridor

HAZARDOUS WASTE CLOSETS: A minimum of two four-foot 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 bio-waste boxes.

ACOUSTIC CEILING TILE: No concealed spline systems are to be used.

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 above criteria.



Glass Pipe Removal Policy

1. In general, 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)

Laboratory Air Flow Rate

Air changes per hour for laboratories is to be approved by Yale Engineering and the Yale Office of Environmental Health & Safety.

Autoclave Room Requirements

1. Floor must be either a monolithic troweled on epoxy resin floor (see Section 09800) or, a continuous welded seam vinyl sheet floor, such as Armstrong "Medin-Tec", with integral core base.

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

XOMAT Film Processor Equipment Policy

This policy is established to reduce the number of flooding incidents caused directly or indirectly by XOMAT film processor equipment. Drains clogged from XOMATS cause substantial flooding damage to occupants on the floor below. All new and existing installations will have the following:

1. Ventilation:
   Prior to installation of a processor, BS&O will retain 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.

2. Floors and Drains:

Floors will be sealed with the Medinteck welded seam solid vinyl flashcove system or equal and pitched from the door, walls and cabinets to the drain. A four inch drain will be installed and be located close to, but not obstructed by, the film processor.

3. Locks:
   The locksets used for the rooms with film processing equipment will allow both the user and BS&O access. This is to enable BS&O to secure the area if there is a flood.

4. Equipment Connections:
   a. All Flexible hoses used to connect utilities to the film processor will be of a non-burst reinforced material.
   b. A stainless steel or aluminum drain pan will be installed under the processor. The drain from this pan will be piped into the floor drain.

5. Drain Service:
   a. The services of a commercial firm (Parker X-Ray or approved equal) will be contracted to assure that all the drains from the processor are regularly cleaned. This contract will be held by the department and will include as a minimum:
   b. Cleaning the drain that is located after the developer on a monthly basis (or more often if needed).
   c. Cleaning process should include: application of granular "fotex" powder for 15 to 20 minutes and then flushing with water through the drain to dissolve the developer hardening clogs in the drain trap.
   d. A method of documentation for the monthly services contracted is required.

The costs to comply with this policy are the responsibility of the department using the Xomat film processing equipment

Biological Safety Cabinet Installation

The minimum clearance required from the top of the biological safety cabinet (BSC) to the ceiling is ten inches. This will allow for proper exhaust airflow and repair of the BSC when necessary. A minimum three-inch clearance on the side and 1.5 inch clearance in the back are recommended.

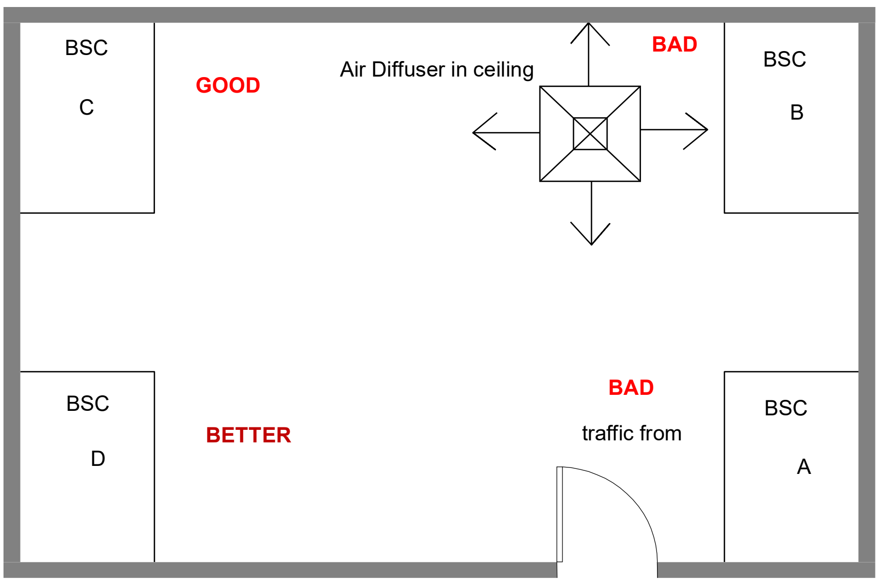
BSCs must be placed away from doors as well as ventilation supply and exhaust vents to reduce air currents around the BSC.

The electrical outlet for a BSC must be a 20 amp dedicated circuit that is readily accessible for service and electrical safety testing.

If a BSC is to be connected to a gas supply a flexible connector will be used. The connector must comply with the Standard for Connectors for Moveable Appliances, ANSI Z21.69. A quick-disconnect device is not recommended. An accessible manual shutoff valve must be installed at the outlet of the gas supply piping system upstream of the connector, as required by ANSI Z21.69.

If a BSC is to be connected to vacuum, an appropriate flexible connection should be used.

Evaluation of Proposed Biological Safety Cabinet Locations



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

For further information or assistance, contact the Yale Office of Environmental Health and Safety (7-2125).

Building Services Rooms & Spaces

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

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

Provide areas for the storage and pickup of trash and recyclable materials. Provide outside storage areas for roll-out trash dumpsters and recycling bins.

Mechanical & Support Spaces

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 more 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:

- Inadequate dimensions, entries, andexits
- Toxic atmosphere or oxygendeficiency
- Moving parts
- Electrical shock hazard
- Heat and chemical hazards
- Structural hazards that can cause injury
- Combustible dust
- Irritant or corrosive agents
- Moisture or water
- Noise and vibration
- Surface residues making the floor unsafe for walking

Design Guidelines

1. 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 ofbuildings.
2. Design mechanical rooms large enough for the intended equipment, with:
   a. sufficient distances and clearances for each piece of equipment,
   b. sufficient work area around the equipment,
   c. sufficient space for removal of equipment components for repair and replacement, and
   d. sufficient space for removal of the entire unit for replacement.
3. 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.

4. Design entries, exits, ventilation, and other mechanical room components with consideration for the conditions inside the room, as well as conditions inside adjacent spaces.
5. Design mechanical rooms with the proper penetrations and seals for cable and piping entries to prevent the penetration of such things as water, moisture, fumes, gases, and heat.
6. Design appropriate doors, rather than hatches, for mechanical rooms and support spaces.
7. 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.
8. 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 operatingconditions.
9. 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.
10. Locate utilities distribution systems equipment that require periodic inspection and service within the building rather than outside of the building in a confined space.
11. Provide adequate spacing of equipment, piping, and cables and 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.

Confined Spaces

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 more easily and safely accessed. Also, follow 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:
   - Large enough and so configured that it can be entered to perform work
   - Has a limited or restricted means of entry or exit
   - Is not designed for continuous employee occupancy

3. Some common examples of confined spaces include below ground electrical vaults that are accessed by ladder, various tanks and pits, boiler interiors, and crawlspaces. For more information, refer to applicable OSHA publications and the OSHA web site: http://www.osha-slc.gov/SLTC/confinedspaces/.

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 (for example, welding, cleaning, painting) or reducing oxygen levels below safe levels. Such hazards are possible within any confined space, as is the nearly 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 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 is enclosed in conduits), their physical location below-grade carries the risk of oxygen deficiency, 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 (for example, welding, cleaning, painting) or by reducing the oxygen level below a safe level

   c. Basic safety design options include:
      i. Incorporating new vaults as part of a building basement, providing a full-size door to eliminate the confined space (preferred).
      ii. Ensuring an access or hatchway diameter of no less than 30" (36" or larger is

preferred for equipment and materials transfer).

iii. Providing an OSHA-compliant fixed stairway or ladder with an extendable grab bar orrail.

iv. Grading the floor and including a small sump pit to collect any water seepage that accumulates within the space and permit 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 very 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:
      i. A minimum clearance of 36" from all breakers, switches, and other components
      ii. Passive ventilation of space to avoid accumulations of ozone or an oxygen-deficient atmosphere
      iii. Providing vaults with frequent need for access with permanent, moisture-protected lighting
      iv. Placing transformers and switch gear away from access doors or hatches

3. Steam Distribution Systems

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

   b. The hazards associated with these steam distribution system components include all those for telecommunications or electrical distribution vaults, plus exposure to very high levels of heat and humidity and the potential for exposure to steam leaks and possible steam explosions.

   c. Basic safety design options include all those for telecommunications or electrical distribution vaults,plus:
      i. Maximizing clearances from all steam pipes and other obstructions, both to provide greater distance from hot surfaces and to reduce head and face injuries.
      ii. 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 intervals to enhance natural airflows through individual tunnelsections.

iii. Ensuring that all pipes that must be stepped over in order to reach a confined area have metal guards around the insulation, and/or steps and platforms.

4. Power Plants

a. Power plants contain a large number and wide variety of confined spaces due to their complex and interconnected operational systems. Some examples of confined spaces in the power plantsinclude:
    i. Boilers
    ii. Turbines or generators
    iii. Liquid storage and other types of tanks
    iv. Water and coolingtowers
    v. Numerous pits and recessed floor or grade channel ways
    vi. Large ventilation system components (for example, ductwork, filter houses, plenums)

b. The hazards in specific power plant confined spaces vary by system. However, access in many 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:
    i. Elevator shaft: access hazards, physical hazards from moving cables and counterweights, fall hazards.
    ii. 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.
    iii. Pit: access hazards, oxygen deficiency, falling objects, and possible drowning from engulfment in accumulated water.

c. Basic safety design options include:
    i. The installation of a lockable door, rather than a hatch to both the shaft & pit
    ii. Fall protection attachment points for shaft work
    iii. Passive or active ventilation of the motor or service room
    iv. Fixed permanent lighting for the motor or service room
    v. Machine and equipment guarding where possible on exposed moving motor and gear or winding parts

6. Sump Pump and Sewage EjectorPits

   a. Although the liquid materials to 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. Some 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 possible drowning from engulfment in liquid.

   c. Basic safety design options include:
      i. 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)
      ii. The installation of permanent fixed ladders
      iii. A means of valving-off and locking-out water or wastewater inputs into the pit during entry
      iv. Lockable access to prevent unauthorized entry

7. HVAC Systems

   a. Many larger HVAC systems 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 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:
      i. Providing fall protection for elevated walkways (preferably railings)
      ii. Guarding exposed mechanical elements (for example, belts and drive shafts)
      iii. Installing adequately-sized drains for condensate collection pans and basins
      iv. Providing adequate clearance around all moving parts, electrical transformers, high voltage switches, and other similarly hazardous systems
      v. Providing adequate access space and clearance space for repairs and

movement of new or replacement equipment
vi. Providing fixed ladders or stairs (preferred) for air supply intake plenums and related building"moats"
vii. Providing filter rooms and mechanical rooms with permanent, moisture-protected lighting
viii. Installing true doors rather than hatches, where possible
ix. 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. The majority of 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 (for example, some 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:
   i. Eliminating crawlspaces wherever possible. Where crawlspaces are necessary, maximize their cross-sectional area and minimize obstructions.
   ii. Installing floor gratings in large vertical pipe chases at each entry point or grade.
   iii. Installing permanent, fixed ladders in large building-wide pipe chases.
   iv. Providing designated access hatches for above-ceiling MEP system components that will likely require regular service (for example, VAV 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 (for example, liquid nitrogen bulk storage and the van de Graff accelerator at WNSL). The confined nature of these kinds of spaces is generally well understood by service and maintenance staff. Those tanks that are located below-ground (for example, many fuel tanks) have limited or no direct means of entry, except after 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:
   i. Boltable or lockable access to prevent unauthorized entry
   ii. A means of removing the contents prior to entry
   iii. Fixed ladder and railing access systems for elevated tanks requiring regular entry or inspection
   iv. A means for remote assessment of contents level
   v. A means for valving-off and locking-out inputs into the tank or vessel during entry

10. Miscellaneous Areas

   a. Several other areas and locations present access problems that can create confined space and related hazards, including tunnels, platforms, and some attic areas where fall hazards can exist because of inadequate or non-existent railings, the absence of a fixed ladder or stairway, or very low clearance within the space. These kinds of issues are best addressed by providing standard means of access (preferably stairs), incorporating hand and toe rail protections, and installing larger entry ways or doors instead of hatches.

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 good design practices that can significantly reduce the hazards associated with most confined spaces.
3. Provide as-built drawings of all confined spaces, showing all penetrations and systems contained within them.
4. Ensure space is sufficiently large to provide adequate clearances.
5. Design the space to be linear in configuration, with a clear line of sight.
6. Minimize obstructions and penetrations to provide clear and safe paths of travel.
7. Adopt a standardized hinged and counterweighted cover in lieu of ordinary manhole covers or large grates.
8. Ensure that access ways are sufficiently large to accommodate anticipated supplies and

equipment transfers into and out of the space.
9. Provide a means of fall protection, preferably through the use of railings and gratings.
10. Provide a safe and easy means for collecting and removing accumulated water in below-grade vaults, using sloped flooring and small sump pits away from the ladder landing.
11. Where possible, provide quality fixed ladders. Follow OSHA guidelines.
12. Install moisture- or weather-protected fixed lighting in frequently-accessed spaces.
13. Provide a means for passive or active ventilation for especially hot or humid locations and all other locations with anticipated atmospheric hazards.
14. Provide an easily accessible means for locking or tagging out power supplies and liquid inputs to the space to prevent accidental engulfment, electrocution, or physical injury during entry.

Design Document review and Approval for Confined Spaces

1. Yale University departments assigned to project reviews review all phases of the design 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 of the design from the managers of the departments servicing the confined space —Yale University Facilities, Telecommunications or other.
3. Submit the final design documentation to Yale University's Office of Environmental Health and Safety for review and approval to ensure the design of safe mechanical, support, and confinedspaces.

Athletic Space Standards

Indoor

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

- Basketball—USA Basketballrules
- Fencing—U.S. Fencing Associationrules
- Gymnastics—USA Gymnasticsrules
- Handball—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 Volleyballrules
- Track and Field—IAAF Rules (International Association of Athletic Federations)

Outdoor

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

- Baseball: turf surface—USA Baseballrules
- 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'srules
- 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 Associationrules
- Track and Field—IAAF Rules (International Association of Athletic Federations)

Swimming Pools and Water Sports Facilities

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

2. The design and construction of swimming pools and water sports facilities must conform to the following rules for the listed sports:
   a. Diving—United States Diving, Inc. rules
   b. Swimming—USA Swimming, Inc. rules
   c. Synchronized Swimming—U.S. Synchronized Swimming, Inc. rules
   d. Underwater Swimming—Underwater Society of America rules
   e. Water Polo—U.S. Water Polorules

Documentation Standards

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.

Space Inventory and Room Numbering Standards

All drawings must follow the designation and numbering guidelines for floors and rooms established in the Yale Space Inventory Standards. See the Office of Facilities website at https://facilities.yale.edu/documents-resources/design-standards

Specifications

Comply with the following specification requirements. Deviation from these requirements is not permitted without formal notice and Yale University's writtenapproval.

Format

Arrange project specifications per the Construction Specifications Institute (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.

Practice

Unless policy is dictated by a funding agency, Yale University favors the following practices. Submit performance specifications, or specify acceptable manufacturers (usually a minimum of three) and omit the term “or equal.” Insert specific product approval standards under General Requirements, covering the following items: “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 theproject.”

Shop Drawings and Samples

Each specification section to state if shop drawings are required. If samples are required state quantities required.

Testing

When the specifications require testing (excluding structural tests identified in the Statement of Special Inspections), such tests shall be included in a master list of required tests, with the responsible party and relevant specification section(s) identified.

Drawings

1. Size and Scale
   Sheets should not be larger than 30" H x 42" L. The preferred scale for all overall plans and sections, except where very limited work is shown, is 1/4" - l'-0". 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, show plans for sub-basement, basement, lst, 2nd, 3rd, 4th, and 5th floors. 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, as well as room number, per Yale University Standards and Guidelines, Central Campus Room Numbering Standards. Room numbers are important. 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.
   Example:

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

6. Standard Abbreviations List
   The face sheet should include a list of all standard abbreviations.

Project Document Inclusions

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

   a. All control boxes, valves, control valves (of every type, shape, and function), and DDC control boxes must be installed in such a manner as 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 other components of the work.

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

c. "Fully and reasonably accessible" shall be defined as: capable of being accessed for service, repair, or replacement by an average sized individual (on a ladder if necessary) and capable of being serviced or removed without removing, modifying, or distorting other components of the work.

d. 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.

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

   Mechanical and electrical drawings show pipe, duct, and conduit runs, and 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.

   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.

   Provide written operating and maintenance instructions for all equipment and systems, in approved form, to the architect before final acceptance of thework.

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

Exhibit X: Format for Meeting Minutes

PROJECT REPORT NO. XX

12345 Melody Lane
Harmony, TM 98765
t: 123456-7890
f: 098765-4321

DATE:

PLACE:

PROJECT:

DISTRIBUTION:	Name	Company	Attending
	Paul Bartlett	Yale University	
	John Bollier	Yale University	
	Mike Ferland	Yale University	
	Douglas Golden	Yale University	
	Rob Klein	Yale University	
	Wilf Lamb	Yale University	X
	Jeff Euben	Yale University	
	H. Rosenberg	Yale University	
	Walt Perry	Yale University	
	Joe DeSimone	Architect XYZ	X
AUTHOR:	John Doe	Architect XYZ	FAX: (xxx) xxx-xxxx

XYZ ARCHITECTS

PURPOSE OF MEETING: PROJECT DESIGN

REVIEW DISCUSSION:

BY WHOM -
DEADLINE
DATE/NO. DESCRIPTION/STATUS

12/5 DISCUSSION

RECORD	12/5-1	SCHEDULE: 01/04 Richard M. presented YXY's project schedule. Critical Dates: 1/12 CD issue to YSM for review. 1/17 YSM sign off of CD's. 1/23 Issue CD's for Bid. 1/23 Completed
12/19 DISCUSSION		
XYZ	12/19-1	Area 2 comments: 1. XYZ to clarify the equipment identified in the northwest corner of room 8201. 01/23 Complete.
01/04 DISCUSSION		
YALE UNIVERSITY	01/04-1	Wilf L. to provide additional spec. information on sterilizing equipment in glass wash room. 01/09 In progress 01/16 In progress 01/23 Wilf working with manufacture to determine requirements for the steam generator. 01/23 Richard M. 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	Barbara D. and G+E to identify future hood locations. 01/09 In progress 01/16 In progress 01/23 Tom R. has met with B. Dodd and is working on the users of Dept X future hood requirements.
RECORD	01/04-4	Wilf L. distributed plan with Mike Ferland comments to XXX.
G+E, ABC, XYZ	01/04-5	John B. 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.
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 5 days, these minutes will be considered an acceptable transcription of the meeting.
Arch's Job No.
here
Date: 1/09/01

Exhibit XX - Mandatory Design Standards

Use the current editions of the following.

American Institute of Architects, Guidelines for Construction and Equipment for Hospital and Medical Facilities. Washington, D.C.: AIA Press,

American Society of Heating, Refrigerating and Air Conditioning Engineers. "Laboratories". In ASHRAE Handbook. New York: ASHRAE

Centers for Disease Control. Biosafety in Microbiological and Biomedical Laboratories. DHHS Publication No. (CDC) 84-8395. Department of Health and Human Services, CDC

General Services Administration. Uniformed Federal Accessibility Standards. 49 FR 31528-31617

National Fire Protection Association. Life Safety Code. NFPA Publication No. 101. Quincy, MA: NFPA.

National Fire Protection Association. Standard on Fire Protection for Laboratories Using Chemicals. NFPA Publication No. 45. Boston: NFPA

National Institute of Health. NIH Guidelines for the Laboratory Use of Chemical Carcinogens. DHHS Publication No. (NIH) 81-2385. Department of Health and Human Services, NIH

National Institute of Health. Recombinant DNA Research. Revised Guidelines. 51 FR 16958-16985

National Research Council. Prudent Practices for Handling Hazardous Chemicals in Laboratories. Washington, D.C.: National Academy Press

National Sanitation Foundation. National Sanitation Foundation Standard No. 49 for Class II (Laminar Flow) Biohazard Cabinetry, rev. ed. Ann Arbor, MI:NSF

Occupational Safety and Health Administration. Occupational Exposures to Hazardous Chemicals in Laboratories. (29 CFR Part 1910). Department of Labor, OSHA

Occupational Safety and Health Administration. Safety and Health Standards. (29 CFR 1900-1910, 1910-end). Department of Labor, OSHA

National Research Council. Guide for the Care and Use of Laboratory Animals. DHHS Publication No. (NIH) 85-23 (Rev.). Department of Health and Human Services, NRC, Committee on Care and Use of Laboratory Animals of the Institute of Laboratory Animal Resources

American Conference of Governmental Industrial Hygienists. Industrial Ventilation, A Manual of Recommended Practices.

National Fire Protection Association. Health Care Facilities Handbook, 2nd ed. Boston [now Quincy, MA]: NFPA

National Fire Protection Association. National Electrical Code. NFPA Publication No. 70. Boston [now Quincy, MA]: NFPA

National Fire Protection Association. Standard for Non-Flammable Medical Gas Systems. NFPA Publication No. 99. Quincy, MA: NFPA

American Society of Sanitary Engineering. Cross-Connection Prevention Devices. Bay Village, Ohio: ASSE

U. S. Environmental Protection Agency. Cross-Connection Control Manual. USEPA 570/9-89-007. USGPO

Building Officials and Code Administrators International, Inc. The BOCA National Building Code. Country Club Hills, IL, eleventh edition (1990)

State of Connecticut, Life Safety Code.

SMACNA Seismic Restraint Manual