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GENERAL PROJECT REQUIREMENTS
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DIVISION A
GENERAL PROJECT REQUIREMENTS

A.1 INTRODUCTION

A. This Instruction to the Professional Design Manual is for the Professionals to use as a guide in the development and preparation of Contract Documents for construction and renovation projects assigned by the University's Division of Facilities Management. Deviations from these standards will be discussed with the University's Project Manager and prior approval will be required before making such deviations. The term "Professional" used throughout this manual refers to the registered Architects and Engineers performing design work for the University.

The practices and procedures that are incorporated herein follow closely the American Institute of Architects (AIA), "Architect's Handbook of Professional Practice" and the Construction Specifications Institute's standards for the preparation of documents.

Unless specifically stated otherwise, reference to specific products and manufacturers is included only to establish a standard of quality. Products of other manufacturers which are of equal quality and perform identical functions will be considered for use. The University does not represent or endorse any specific manufacturer or product referred to in these documents.

From time to time these standards will require revisions and additions. Professionals will verify that their copies contain the latest revisions and requirement changes prior to proceeding with the project design.

The provisions of this Manual are applicable to University of Pittsburgh facilities whether owned or leased. Provisions of the Manual apply to both new and existing construction. Facilities covered by this document include all types of buildings and their contents, structures (whether considered temporary or permanent), mobile and stationary equipment, and outside storage.

The term "Project Manager" refers to the Facilities Management staff person assigned to a particular project. The term "User" refers to the University Department, School, person or persons that will use the spaces or facility designed under a specific project.

B. Duties of the Project Manager:

The University's Project Manager acts as a liaison between the Professional and the User and/or other University entities involved in the project. The University's Project Manager provides a one-person contact for the Professional so as to promote program and budget control. The Professional is thereby discouraged from contacting the User and/or any other University entities for the purpose of discussing the project, without the knowledge of the University's Project Manager.

It is the Professional's responsibility to insure that all requirements discussed in this Manual are incorporated in the Contract Documents, unless specifically waived by the University's Project Manager. The Professional must therefore familiarize himself/herself with the contents of this Manual, and insure that his/her Consultants are also familiar with its requirements.

Professionals performing work under contract with the Pennsylvania Department of General Services (DGS): Whenever a conflict arises between the DGS requirements and requirements of this manual, the DGS requirements prevail.

C. Policy for selection of Design Professionals for University of Pittsburgh Facility Projects:

1. Purpose:

a. To select firms with the best potential to achieve a high-quality design on schedule and within budget.

b. To assure an equitable distribution of work to qualified Pennsylvania firms.

2. Procedures:

a. The procedures to be used to select Professionals will vary, depending on the fund source and estimated construction cost or design fee. The amount of contracts for professional services will be on a maximum, not-to-exceed basis. Professionals must attach time rates to their proposals. Proposals will not be processed as contracts by Facilities Management Administration, unless the fee is structured as stated above.

b. State-funded Projects:

Professionals for State-funded projects are selected by the State Selections Committee of the Department of General Services (DGS) under the regulations of Act 45.

c. University-funded Projects:

Professionals will be selected from a Professional Selections List that contains the names, experience and qualifications of those firms that have expressed interest in working for the University Office of Facilities Management. Qualified design firms that have not had recent contracts with the University and qualified minority or women-owned firms are strongly encouraged to express interest.

d. Construction Cost Under $1 million (Design Fee under $75,000):

These projects usually involve building renovations, additions, utilities replacement or extension, interiors and furnishings, feasibility, environmental and planning studies, or similar work. The Office of Facilities Management will review the qualifications of at least three (3) firms and recommend the final selection. Depending on the nature of the project, the procedures for larger projects may be used if appropriate.

e. Construction Cost Over $1 million (Design fee over $75,000):

These projects usually involve new buildings, large additions or renovations to existing facilities, major upgrading of utility systems and master planning. Facilities Management will assemble a multi-disciplinary Selection Advisory Committee comprised of University architects, engineers, and representatives appointed by the facility User.

A short list of firms with previous experience in the type of project under consideration will be developed from the Professional Selection List. If other qualified firms are available, firms currently under contract may be omitted from the short list in order to achieve a more equitable work distribution.

A scope of work and evaluation criteria for the project will also be developed in conjunction with the User. (The criteria in Appendix One may be used as a general guide.) Short-listed firms will be given the scope of work and evaluation criteria and will be invited to submit qualifications statements that address the specific design skills and experience required for the project.

The Selection Advisory Committee will evaluate these qualification statements according to the established criteria, normally using a numerical method of scoring. The relative weight or importance of each criterion will be set before scoring begins to make the process more objective. The scores of Committee members will then be averaged to determine which firms should be invited for interviews.

After interviewing the firms, the Selection Advisory Committee will develop a priority ranking. This ranking and the Committee comments, if any, will be the criteria Facilities Management will use to select the Professional.

If the Scope of the Project is well defined, Facilities Management may solicit fee proposals from the firms to be interviewed. The Professional selection will not be based on fees alone, but will consider both professional qualifications and previous experience in relation to proposed fees. Facilities Management may further negotiate the Professional fees before a contract is awarded.

D. Policy for Selection of Design Professionals Sample Evaluation Criteria:

1. Planning and Feasibility Studies:

   Ability to define User needs and to establish functional relationships, to recommend funding priorities and project phasing, to estimate costs early in the design process, and to communicate design alternatives with schematic sketches.

2. Site Planning:

   Ability to analyze site conditions and develop creative design solutions, considering topography and drainage, soils, tree preservation and landscaping, wetlands and environmental issues, historic or archeological features, utility sources and capacities, parking, pedestrian circulation, open spaces, density, scale, views, and spatial relationships.

3. Architectural and Interior Design:

   Ability to understand program requirements and functional relationships and to develop functional designs of high aesthetic quality that reflect program requirements and site conditions.

4. Energy and Life Cycle Costs:

   Ability to analyze energy and product alternatives and to design facilities with low energy, maintenance, and operating costs, without significantly increasing initial costs.

5. Schedule and Cost Consciousness:

   Ability to develop economical design solutions, to design projects on schedule and within budget, to make accurate cost estimates, and to avoid costly change orders caused by errors and omissions in design documents.

6. Project Management Concept:

   Ability to manage design of projects of similar complexity and scale, to coordinate the work of all required disciplines, and to communicate design alternatives to building users.

7. Specialized Experience:

   Prior experience with planning studies or the design of sites, buildings, interior spaces, utility systems, environmental and code related studies, with functions similar to those proposed for the project under consideration.

A.2 CODES COMPLIANCE

A. The Professional will be responsible for incorporating the most restrictive requirements of the applicable local, state, and federal standards and codes into each project design. The Professional will include a statement outlining the basic code requirements applicable to the project and will include a listing of codes enforced by the local authority having jurisdiction.

B. It is the intent of the University to establish uniform criteria for all campuses. Toward this effort, the University applies the latest editions of the BOCA National Codes, as adopted by the City of Pittsburgh, to all project designs. The Professional will identify any conflicts between University requirements and local requirements during the preliminary phase of the project. Conflicts should be resolved prior to preparation of construction documents.

C. Contract Documents will state that electrical installations will comply with requirements of the National Electrical Code, latest edition.

D. Concept and final design analyses will address provisions pertaining to fire protection and life safety as required by this manual. Fire protection provisions will be summarized and submitted as a separate analysis. Where applicable, the following fire protection provisions must be delineated:

   1. Type of construction (including interior finish materials).

   2. Classification of occupancy.

   3. Building separation or exposure protection.

   4. Fire protection criteria (this manual and pertinent standards and codes).

   5. Location of fire-rated walls including fire-rated doors and dampers with identification as applicable (fire walls, fire partitions, and smoke partitions, with their fire-resistive ratings).

   6. Life safety provisions (exit travel distances, exit widths based on the capacity and occupant load, number, type, exit signs and lighting).

7. Automatic extinguishing systems (identification of sprinkler areas and areas protected by other automatic suppression systems).

8. Water supplies.

9. Smoke control system: Smoke compartments and the requirements for smoke dampers, smoke detectors, and smoke partitions will be provided. The smoke control system will be delineated by schematic diagram, when applicable, indicating the operations of the normal HVAC mode and the smoke removal mode.

10. Fire alarm system (the type of alarm system and location of the fire alarm equipment, and fire zones).

11. Fire detection system (the type of detection system and location of detectors, and fire zones).

12. Location of fire extinguisher cabinets and fire hose standpipes.

13. Interior finish ratings.

E. The University is required by its property insurance carrier to comply with the provisions of the National Fire Codes as published by the National Fire Protection Association. Further, the insurer provides specific design criteria which may exceed the minimum standards established by the applicable codes utilized by the Authority having Jurisdiction. The Professional will determine the requirements of the insurance carrier during preliminary design. Where there are conflicts between the applicable codes, the Project Manager will secure the interpretations and approvals of appropriate University personnel.

F. University projects will be designed to comply with the Americans with Disabilities Guidelines and local accessibility criteria.

A.3 SPECIAL SUBSURFACE AND LAND CONDITIONS

A. The University's campuses present a variety of subsurface conditions that must be taken into consideration when designing new buildings and/or utility systems. The Professional is urged to request from the University the conduct of subsurface investigations during the schematic stages of design in order to identify conditions, such as:

1. Oakland Campus: The Upper Campus area contains a larger number of abandoned coal mines. The Professional will obtain from the City, records of the locations of these mines and design the buildings accordingly.

   Some areas of the Campus may also have high water tables due to underground streams.

2. Greensburg Campus: The Greensburg Campus is bisected by a creek that floods heavily in the spring. Buildings in this Campus will be located above the 100 year flood plain.

   On the lower parts of this Campus, the water table is very high. Professionals are discouraged from designing basements in these areas.

3. Bradford Campus: The Bradford Campus is located adjacent to a creek that presents heavy floods. Buildings in this Campus will be located above the 100 year flood plain.

   The water table is very high in most areas of the Campus. Professionals are discouraged from designing buildings with basements.

   A large part of this Campus property may be identified as being "wetlands" by the Corps of Engineers. Professionals will be responsible to insure that new buildings do not disturb the wetlands areas.

4. Johnstown Campus: Soils with expansive characteristics have been found in some areas of this Campus.

A.4 SUBSURFACE INVESTIGATIONS

A. The Professional will request proposals from at least two (2) soils consultants for the provision of services related to subsurface investigations. The Professional will be required to prepare the scope of work and drawings showing the location and proposed depth of test borings.

B. Upon University approval of the Soils Consultant proposal, the Professional will enter into a contract with the Consultant for the soils investigation services.

C. At the completion of the soils investigation work, the Professional will invoice the University for the Soils Consultant services plus 10% for administration of the Contract. For more detailed information on this subject, refer to Division E of this Manual: Instructions to Professionals Regarding Subsurface and Related Site Investigations.

A.5 TRAFFIC CONSULTANTS

Should the University or the Department of City Planning require the services of a Traffic Consultant, the University will provide these services at no cost to the Professional.

A.6 PROJECT APPROVALS

A. City Planning and Community approvals:

1. New University buildings and additions to existing buildings on the Oakland Campus must be approved by the City Planning Commission and Department of City Planning.

2. When appropriate, the University Office of Facilities Management will schedule meetings with community groups and the Department of City Planning. The Professional is discouraged from arranging any meetings without University participation. Regional Campus projects will be reviewed with the appropriate community groups and governing bodies for approvals.

3. The Professional's time and presentation materials (except as listed below) required for these presentations, are considered part of the Basic Services of his/her Contract. Should special presentation materials (such as models and renderings) be required, the Professional will submit to the University and obtain approval of a proposal for these additional services before performing the work.

B. University Approvals:

1. From time to time, the Professional may be required to make a presentation of the project to the Board of Trustees, the Chancellor and/or other University Committees as required to obtain approvals. The Professional's time and materials required for these presentations are considered part of the Basic Service of this Contract.

A.7 RELEASE OF PROJECT INFORMATION TO THE NEWS MEDIA

A. Release of information relative to the project to the News Media, will be coordinated by the Office of University Relations in cooperation with the Professional and the University's Project Manager. The Office of the University Relations will produce and update press releases, in order to insure the accuracy of the information. The Professional, without prior approval of the University's Project Manager, will not release project information during design and construction of the building.

B. The Professionals are not authorized to use the name "University of Pittsburgh" in brochures, press releases, or advertising without prior written approval from the Office of University Relations.

A.8 PROJECT PUBLICATION

The Professional may be asked by the University to write a piece of approximately 600 words containing a description of the project and design philosophy and process. This piece will serve as the basis for articles about the project, to be published in the University Journals, together with photographs, renderings, plans, etc.

A.9 ROOM NUMBERS

The Professional, during the **DESIGN DEVELOPMENT PHASE** of the project, will submit to the University, building floor plans showing rooms to be provided in the project. The University will assign room numbers to areas of the building in accordance with established procedures. The Professionals will incorporate the final room numbering system information into the project documents. (See "Drawing Standards" page F.7.)

A.10 MINUTES OF THE MEETING

A. As part of the Contract's Basic Services, it is the Professional's responsibility to write minutes of meetings conducted during the planning and design stages of the project. Three (3) copies of the meeting minutes will be provided to the Project Manager.

1. The Minutes will contain the following information:

a. Date of the Meeting and Date of issue of the Minutes.

b. Project Name and Number.

c. Purpose of the Meeting.

d. Persons in attendance.

e. Issues discussed at the Meeting and resolution of these items.

f. At the end of the Meeting Minutes, the Professional will list the necessary Follow-up Tasks as a consequence of the meetings discussions. Each "task" will state the person responsible, the nature of the "task" and the date by which it needs to be completed, in order not to delay the project.

Follow-up Tasks: (Example)

1. The University's Project Manager will provide to the Professional a clarification of the Security Standards by 7/15/02.

2. The Professional will provide to the University's Project Manager for approval, a set of the latest electrical drawings by 7/20/02.

3. The User will review the latest plans and return to the University's Project Manager with comments by 8/02/02.

A.11 BOND INSPECTION

A. The Professional will be required to specify a one (1) year Bond Inspection. If doing site observation, the Professional will be asked to attend the inspection meeting.

B. The Bond Inspection will be arranged through the University's Project Manager. The bond inspection will be scheduled prior to the end of the tenth (10^{th}) month, and the review competed before the end of the eleventh (11^{th}) month.

C. The Contractor will be given written notice of defective material and/or workmanship and be required to correct all deficiencies within ten (10) calendar days.

A.12 PROJECT SUBMISSION REQUIREMENTS

A. The following project submission requirements will be required for major renovations, additions, and new structures:

1. Schematic Phase/Professional's Requirements:

Up to three (3) distinctly different concepts may be presented to the University before proceeding with final schematic documents. These concepts are to communicate site, functional, and massing relationships. The concepts may be presented in diagrammatic form. There should also be included with each concept, the approximate net assignable to gross area efficiency factors.

The University will select from the above three (3) schematics the one (1) considered most appropriate, with changes as required. After introducing the required changes, the Professional will submit to the University the following information, as applicable:

a. Site Plan

b. Site Survey

c. Soil boring data and Consultant's foundation recommendation (as detailed in the Professional Design Manual)

d. Structural plan showing proposed bay arrangement

e. Schematic floor plans:

1) New work, all floor levels
2) Remodeled areas of existing structures, including demolition

f. Exterior elevations. At least one (1) of them will be color rendered

g. Diagrammatic building sections

h. Typical wall section to show materials, relationships, construction intent

i. Preliminary one-line HVAC duct layouts and/or preliminary mechanical piping diagram

j. Preliminary Mechanical Equipment Room layout (major equipment only)

k. Preliminary one-line electrical distribution diagrams

l. Preliminary design and construction schedule in bar-chart form

m. Program Phase report (description attached)

n. Comparison chart showing Space Program space allocation and actual assignable

B. Program Phase Report: As the schematic design progresses and based on in-depth discussions with the User and the University's Project Manager, the Professional will expand on the Space Program to fully explain and document the following:

1. Limits of the property and site condition (survey and test borings may be required).

2. Traffic/circulation requirements within and without the building. Building services required.

3. Investigation into available utilities.

4. Required relationships of spaces to other spaces.

5. Required use, occupancy, utility services, etc. for all spaces. This information to be recorded in the Facilities Management Room Data Sheet.

6. Code analysis.

All of the above will be submitted to the University's Project Manager in a written PROGRAM PHASE REPORT that will accompany the Schematic Phase Submission.

C. Design Development Submission/Professional's Requirements: The Professional will submit the following information to the University in the Design Development Submission:

1. Site Survey

2. Site Plan:

a. Final contours/grading

b. Paving, sidewalks, curb, fences, parking, and other site improvements (showing location and overall dimensions)

3. Foundation Plans:

   a. Footing and foundation sizes, reinforcing, elevations

   b. Below grade concrete wall thickness

   c. Waterproofing, damproofing, drainage-standard details

4. Structural Framing Plans, including:

   a. Horizontal and vertical member size, sample reinforcing

   b. Typical floor and roof

   c. Typical exterior wall

   d. Lateral bracing methods

   e. Fireproofing of the structure-NFPA designation

   f. Design live and dead loads tabulated for all floors, areas, and roofs

5. Exterior walls elevations, all planes

6. Typical wall sections

7. Typical roofing detail

8. Floor plans, all levels and roofs

   a. Partition type identification

   b. Smoke and fire compartmentation

   c. Built-ins and fixed equipment

9. Room finish and door schedule for typical areas/spaces

10. Plumbing work:

    a. Plans

    b. Fixture schedule, locations

    c. Waste and vent riser diagram with types locations and key sizes

    d. Water piping, locations

11. Roof drainage system, locations

12. Fire Protection Systems

13. Mechanical Systems:

    a. Equipment schedule, locations, sizes, types

    b. Chilled, condenser, hot water steam and condensate piping systems.

    c. Equipment connections and supports

14. Power distribution:

    a. Power distribution equipment schedule, locations

    b. Feeder sizes

    c. Emergency generator size, location

    d. Uninterruptible power supply equipment size and location (if required)

    e. Grounding-Standard detail

15. Interior Lighting and Power plans and details:

    a. Fixture and switch locations with identification

    b. Typical receptacle and power outlet locations

    c. Special requirements noted

16. Motor control schedule with starter and circuit sizing

17. Communications and alarm systems

18. Outline specifications -- all trades

19. Construction cost estimate

20. Description of proposed Alternates and Cost Estimates for each

21. Area comparisons between Space Program and actual plans and net/gross area ratio

D. 1. Interior Design/Furniture and Equipment: As part of the basic contract for design services, the Design Professional is responsible for selecting and specifying interior and exterior finishes and materials. He/she is also responsible for color and texture selection for these materials and for preparing color boards for University's approval. Refer to Section C.2.

2. As part of the basic services, the Design Professional is also responsible for providing layout of furniture and/or equipment within rooms, ONLY FOR THE PURPOSE OF ASSURING THAT THE SPACE DESIGNED WILL ACCOMMODATE THE REQUIRED FURNITURE/EQUIPMENT NEEDS.

3. The Design Professional is NOT responsible under his/her basic design contract, for detailed layout of furniture plans, selection of furniture fabrics and colors or specifying the furniture and equipment. Should the above functions be required

and depending on the size and complexity of the project, an Interiors Professional may be hired to perform these tasks.

E. Interior Design/Furniture and Equipment:

1. Preliminary Evaluation of Furniture and Equipment Needs: As soon as a project is assigned to him/her, the University's Project Manager will meet with the User in order to make a cursory evaluation of the furniture needs. Depending on the size and scope of the project, this evaluation could involve meeting with all the persons who will be moving and compiling a general list of the existing furniture they plan to reuse and the pieces they need. The University's Project Manager will also evaluate the general condition of the exiting furniture for budgetary purposes.

2. Estimating furniture and furnishing allocation: The following costs must be considered when estimating the furniture/furnishing allocation for a project.

   a. Cost of new furniture
   b. Painting/refinishing of existing furniture
   c. Re-upholstering of existing furniture
   d. Assembly/disassembly of desks, landscape partitions and other furniture
   e. Furniture cleaning
   f. Cleaning of existing drapes
   g. Provision of new drapes and blinds
   h. Professional fee for Interiors Professional (usually 10% of furniture budget)
   i. Unusual needs, such as special filing systems, etc.
   j. Contingency of at least 10%

3. Equipment: In general, equipment such as computers, printers, typewriters, copiers, coffee makers, microwave ovens, Audio-visual equipment, etc. are to be purchased by the department. Equipment such as fumehoods, refrigerators, chalkboards, tackboards, fixed projection screens, etc. is purchased with project funds.

A.13 CONSTRUCTION REQUIREMENTS

A. During construction, the Design Professionals are responsible for the following services:

1. Administration of job meetings: this will include recording and distribution of Minutes of the Meeting.

2. Review, approve, and keep logs of the shop drawings, including warranties required at the end of a job. Inspect materials, equipment, workmanship for conformance to drawings, specifications, addendums, schedules, regulations, codes and applicable standards.

3. Review and approve of Request for Payments and preparation for Change Orders. Change Orders will be handled as required. All changes, whether there is a cost involved or not, must have a Change Proposal Request (CPR) form

prepared and approved (sample will be given), keep log of CPR's for Change Orders approved or denied.

4. Provide complete Record drawings to the University based on the information provided by individual contractor's As-Built drawings. Type to be determined: Plotted vellum or mylar (not diazo mylar) and disk if available.

5. Issue punch list of items that require completion before contract can be finalized.

6. Provide the University with gross and net square footage of renovated or new space.

7. The Professional must attend a meeting ten (10) months after the final completion date for a one year bond/warranty inspection. The Professional must issue a punch list if required after this inspection.

8. The Professional must be available throughout the entire project for consultation.

A.14 RESPONSIBILITIES OF THE PROJECT MANAGER AND THE PROFESSIONAL

A. At the beginning of the project, the University will assign a Project Manager who will work with the Professional during the design stage of the project. The function of the Project Manager is to act as a liaison between the Professional and other University personnel, including the Users, Telecommunications, Health and Safety, Engineering, and any other University Offices that need to be involved in the project.

B. THE PROFESSIONAL, AS WELL AS HIS/HER CONSULTANTS, ARE STRONGLY DISCOURAGED FROM CONTACTING ANY OTHER UNIVERSITY REPRESENTATIVES, UNLESS SPECIFICALLY AUTHORIZED BY THE PROJECT MANAGER.

C. It is the Project Manager's responsibility to INFORM the Professional of the University's needs, standards, and requirements. This information will be reflected in Minutes of the Meetings, the Professional Standards Manual, the Room Data Sheets, etc. HOWEVER, IT IS THE PROFESSIONAL'S RESPONSIBILITY TO INSURE THAT THESE NEEDS, STANDARDS, AND REQUIREMENTS ARE INCORPORATED IN THE CONTRACT DOCUMENTS.

D. The Project Manager will review the project documents as required to keep the Users informed of the general status of the project. THE PROJECT MANAGER IS NEITHER RESPONSIBLE FOR COMPLIANCE WITH CODES, NOR FOR DOCUMENTS COORDINATION. IF, UPON SUBMISSION OF DOCUMENTS TO THE PROJECT MANAGER, IT COMES TO HIS/HER ATTENTION THAT THE CONTRACT DOCUMENTS ARE POORLY COORDINATED OR INCOMPLETE, THE PROJECT MANAGER WILL RETURN THE DOCUMENTS TO THE PROFESSIONAL AND WILL DECLARE THE SUBMISSION INVALID FOR THE PURPOSE OF PAYMENT AND/OR COMPLIANCE WITH THE ESTABLISHED PROJECT SCHEDULES.

A.15 PROJECT ALLOCATION

It is the Professional's responsibility to design the project within the established Project Construction Allocation. It is also the Professional's responsibility to inform the Project Manager IMMEDIATELY, when the project is no longer within the allocation. At this point, it will be the Project Manager's responsibility to work with the Users in identifying cuts in the program and/or additional funding for the project. The Professional will not proceed

until he/she is informed by the Project Manager of the available options to bring the project within budget.

A.16 SCHEDULE

It is the Professional's responsibility to inform the Project Manager IMMEDIATELY if the established Project Schedule cannot be met.

A.17 BASE BIDS AND ALTERNATES

A. As a general rule, the Professional will NOT include Alternates on his/her contract documents, unless specifically authorized by the Project Manager. Projects will include a minimum of at least two (2) Base Bids and a maximum of six (6) Base Bids.

B. Base Bid No. 1 will include all work specified in the Contract Documents. This Base Bid should be estimated at about 10% over the estimated Construction Allocation.

C. Base Bid No. 2 should include most of the items in Base Bid No. 1, except that some items may be deleted. All other Base Bids will follow the same format, deleting items from the previous Base Bid. The last Base Bid should be estimated at approximately 10% BELOW the Construction Allocation.

END OF DIVISION

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SPECIAL REQUIREMENTS FOR UNIVERSITY PROJECTS
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DIVISION B
SPECIAL REQUIREMENTS FOR UNIVERSITY PROJECTS

B.1 GENERAL

A. Professional must develop a Special Requirements Section for all projects. This section shall be included as part of the Contract Specifications or, in projects of reduced scope, incorporated on the Contract Drawings.

B. Professional shall use these Special Requirements as a guideline for selecting and incorporating into the Contract Documents those items that directly relate to the project's Scope of Work.

C. Professional shall review these requirements with the University's Project Manager, in order to insure a proper conduct of the work on the part of the Contractors working for the University.

D. When the term "Contractor" is used in this document, it refers to either the single Contractor in charge of the job, or each of the Prime Contractors involved. In some cases, the specific Prime Contractor has been identified when the responsibility has to be singled out. The Professional is to tailor the language of this document according to the manner in which the project will be bid.

B.2 ASBESTOS/LEAD PROCEDURES

A. Summary:

The intent of this procedure is to identify hazardous materials when designing and renovating spaces within the University buildings. Hazardous materials should be accounted for in the design, budget, and schedule of the project in order to minimize the disruption to the User of the space. Even though not all materials that will be disturbed during construction can be tested prior to starting the work, a plan must be developed to deal with those areas that will be disturbed prior to bidding the work.

B. Design Procedure:

1. The Design Professional is to review the University's ACM database on the asbestos materials within and adjacent to the space that is to be renovated.

2. Once the project scope is defined, the Design Professional is to determine what materials will be affected by the work and visit the site to verify existing conditions.

3. The University's Design Project Manager will arrange for an analysis of the materials if necessary, (i.e.: plaster walls, ceilings, acoustical treatments, flooring material, flooring adhesive, floor tile under carpeting, wall tile adhesive, etc.) to determine the exact content of asbestos in the material and to verify the existing conditions. This analysis is to be performed by a licensed technician who can certify the results. The University has a service contract with a testing firm.

4. During the review of the Design, the University's Design Project Manager will review the space for lead containing material that might be affected by the demolition. Example: cutting structural steel with lead paint on it.

5. Construction documents are to include the abatement of asbestos and lead, and are to be part of the general construction trades contract. This may not always be the case; for

example, on large building demolition projects the abatement may be a separate contract. Therefore, who will perform the abatement should be discussed during the early stages of the design process.

6. Construction bid documents for asbestos and lead abatement shall specify that all work is to be performed in accordance with Federal, State, and local regulations.

C. Testing Procedure:

1. The following building components should be suspect for containing hazardous materials:

Walls: Plaster, Tile, brick (fire brick), Transite.

Ceilings: Plaster, suspended acoustical, glued acoustical (including the mastic) and spray-on acoustical treatments.

Flooring: Tile and mastic, sheet flooring and mastic, carpeting adhesives, and in areas that are carpeted, the surface below the carpet should be exposed and tested.

Insulation: Pipe insulation, pipe fittings, covering on pipe insulation, ductwork insulation, spray-on insulations and fire proofing.

Transite: This was used for: ductwork, fume hood linings, fire rated partitions, heat shields behind steam radiators and counter tops in labs.

Doors: Fire doors and cores of older doors.

Mastic: Chalkboard adhesive, glass and mirror adhesives.

Boilers: Chamber linings, doors and breachings.

Paint: Test for lead paint in any areas that has a substantial amount of demolition. This is especially critical with the demolition of steel and the work done with a cutting torch or cutting blade.

2. All layers of building finishes should be tested. For example, vinyl asbestos tile may be found under carpeting, asbestos plaster under a layer of drywall and asbestos ceiling plaster above an acoustical tile ceiling. Insulation on piping above ceilings and in mechanical areas should be suspect of ACM.

D. Testing Results:

1. The Architect or the person responsible for the design should forward a complete set of demolition drawings to the University's Design Project Manager. The University's Design Project Manager shall have the area that is to be disturbed or removed tested for asbestos, lead, and other hazardous materials. This should include a written scope identifying surfaces to be tested. The testing company will then provide a full report of areas tested and show the areas on a drawing where the sampling was taken.

2. Acceptable types of tests are bulk samples, point counts, and T.E.M.

B.3 OFFICE FOR THE CONTRACTOR

A. *Professional Note -- (The following paragraphs are to be used for the construction of new buildings):*

General Contractor shall provide and maintain, at his/her own cost and expense, a suitable office on the premises, at a location directed by the University. The office will contain provisions for email, telephone, fax machine, a table or shelf desk and suitable provision for storage of drawings and contract documents. Contractor shall provide and maintain heating facilities and supply fuel for same in cold weather and shall remove the office from the premises at completion of work. A mobile type office is acceptable.

Other Prime Contractors may, at their option and expense, be located in an area approved by the University, erect and maintain office space on the premises for their own use, and remove same upon completion of their contracts.

B. *Professional Note -- (The following may be used for the remodeling of existing buildings.):*

Contractors shall establish an area at the work site as may be feasible for conducting their operations, as agreed upon by the University.

B.4 OFFICE OF THE UNIVERSITY REPRESENTATIVE

A. *Professional Note -- (This paragraph to be used for the construction of new buildings or large renovations.* ***Verify with the University's Project Manager.)***:

General Contractor, at his/her own cost and expense, shall provide and maintain suitable office space for a University representative at the site, at a location directed by the University. The office shall be large enough to house a desk, drafting table, drawing reference table, file cabinets and a small conference table. Contractor shall pay for and install telephone, E-mail, and fax services, water, heat, sanitary and electrical services to the office space. Costs for telephone calls are to be at the expense of the University.

B.5 TELEPHONE SERVICE

A. *Professional Note -- (This paragraph is to be used for the construction of new buildings, or large renovations):*

General Contractor, at his/her own cost and expense, shall immediately upon award of the contract install and maintain in his/her temporary office, a telephone with local and long distance connections provided with a large gong in an approved location. Long distance calls shall be paid by the person making the calls. Other Prime Contractors shall arrange for telephone services either with the General Contractor or independently with the phone company.

B. *(This paragraph is to be used for small renovations.):*

Contractors will be required to use pay phones or cell phones at their own cost and expense. Contractors shall refrain from soliciting the use of University telephones.

B.6 STORAGE SHED

A. Each Prime Contractor shall, at his/her own cost and expense, provide upon the premises, at a location directed by the University and maintain and remove when directed, suitable substantial watertight storage sheds in which he/she shall store all materials which might be damaged by the weather. Storage sheds shall be of sufficient size to hold all the materials required on the site at one time and shall have floors raised at least six (6) inches above the ground on heavy joists or sleepers. Contractors shall not store materials in any existing building or beyond the contract limits as defined by the drawings. Storage sheds shall have sufficient ventilation to preclude condensation. Roofing materials shall be stored under roofs and not under protective wrapping or covering alone.

B. Contractors shall take precautions as may be necessary for the security of these stored materials. The University shall not be held responsible for any stored items at the sites. This shall be the sole responsibility and liability of the Contractors.

C. *Professional Note -- (The following paragraph is to be used in renovation work):*

Contractors shall not use other than approved designated work areas for storage of materials. Storage of combustibles will not be permitted within University buildings. Corridors, hallways, stairwells, loading docks and egress ways shall not be used for storage of materials.

B.7 SCAFFOLDING

A. Prime Contractors are referred to and agree to comply with the terms, regulations and conditions contained in the latest editions of the BOCA National Building Code and where applies the Department of Labor and Industry "Regulations for Constructions and Repairs", and "Regulations for Railings, Toe Boards, Open Side Floors, Platforms and Runways", “Regulations for Protection from Fire and Panic" and OSHA requirements.

B. Each Contractor shall furnish at his/her own cost and expense scaffolding, trestles, ladders and platforms and other equipment that is required for the execution of the work under his/her own contract.

C. Contractors shall be required to receive permission from the University for the display of signs, banners or emblems prior to erecting same on Contractor owned equipment.

B.8 EXCAVATIONS (UNCLASSIFIED)

Excavation under this Contract is unclassified and includes every kind of subsurface condition and material encountered in the Contract area. No extra or additional compensation for excavation will be paid under this Contract because of unknown subsurface conditions or materials.

B.9 SUBSURFACE INFORMATION

A. Any available data concerning subsurface materials or conditions based on soundings, test pits or test borings, has been obtained by the retained Professional for his/her use in designing this project. Its accuracy or completeness is not guaranteed by the University or the Professional and in no event is it to be considered as part of the contract plans or specifications. Contractors must assume all risks in excavating for this project and shall not be entitled to rely on any subsurface information obtained from the retained Professional. Bidders shall make their own investigation of existing subsurface conditions, and if they do not do so, the University will not be responsible in any way for the consequences.

B. Said subsurface information is available at the office of the retained Professional, and prospective

bidders may obtain this information by applying to the retained Professional. Bidders will be required to sign a standard form of receipt for this subsurface information in accordance with the provisions of this section.

B.10 TEMPORARY SERVICES DURING CONSTRUCTION

A. *Professional Note -- (The Professional is to discuss with the University's Project Manager temporary service requirements. Verify available services for Regional Campuses as they may vary and be restrictive for these temporary services.):*

New buildings or renovations to existing buildings through State Agencies require the contractors to meter and pay for these services until final acceptance of the project work.

B. Designated Contractor shall, at his/her own cost and expense, install, operate, protect and maintain the respective temporary services as hereinafter specified, during the construction period of this project. These temporary services shall include water supply, electric light and power, material hoists, fire protection, sanitary facilities, access roads, and any other services as may be stipulated in the General Conditions, Special Requirements, and/or Specifications.

C. General Contractor shall pay the costs for electric power, and fuel required for the operation of temporary services except where it is stipulated herein that these items will be furnished free of charge to the Contractors by the University or will be furnished by other Contractors. However, the General Contractor will not be required to pay the cost of water, electric power and fuel where these items are used for the specified testing of equipment furnished and installed by other Contractors. Each Contractor shall pay for the cost of these items which are used in testing of equipment furnished and installed under his/her respective contract.

D. Temporary connections to new and/or existing permanent service lines shall be made at locations as directed by the University and when the temporary service lines are no longer required, they shall be removed by the Contractor installing same. Any part or parts of the permanent service lines, grounds, and buildings disturbed or damaged by the installation and/or removal of the temporary service lines shall be restored to their original condition by the Contractor responsible for the temporary installation, at no cost to the University.

E. Any Contractor who fails to carry out his/her responsibility in supplying temporary services as set forth in his/her contract shall be held responsible for such failure and the University shall have the right to take such actions as it deems proper for the protection and conduct of the work and shall deduct the cost involved from the amount due of the Contractor at fault.

B.11 TEMPORARY WATER SUPPLY

A. Plumbing Contractor shall, at his/her own cost and expense, install, operate, protect and maintain an adequate water supply for use by the Contractors on the project during the period of construction either by means of the permanent water supply line or by the installation of a temporary water supply line. This water supply line shall be made available within fifteen (15) days after being so directed by the University. Contractors shall notify the University twenty (20) days prior to the time they will require the temporary water supply.

B. Plumbing Contractor will be required to bring the temporary water supply to a point approximately ten (10) feet from the building and to provide a meter; the actual location of the point to which the water is brought shall be in close proximity to the point of entrance of the permanent water supply. From this point, each Contractor shall install, valve, maintain and protect such temporary water lines as he/she will require to perform the work under his/her contract.

C. *Professional Note -- (The following paragraph must be verified by Addendum during bidding with the University's Project Manager.):*

The University will provide water for construction purposes at no cost to the Contractor.

B.12 TEMPORARY HEAT

A. *Professional Note -- (The following is to be used for new buildings):*

The temporary heat requirements are divided into two categories i.e., (1) temporary heat required prior to the enclosure of the structure, structures, or portions thereof; (2) temporary heat subsequent to the enclosure of the structures.

A structure shall be considered to be enclosed when (a) the roof is on tight; (b) the exterior walls have been complete; and (c) when openings, doors and windows are closed with permanent closures, or with substantial temporary closures which will affect the retention of heat within the structure.

Where projects are multi-story which are more than three (3) levels or stories above grade, buildings shall be defined as "enclosed" when the requirements of the preceding paragraph have been met, except that the stipulation that the roof shall have been completed shall not apply as long as the floor construction of the level above the proposed working area is complete, and as long as all stairs or other openings which penetrate or project through the ceiling or the floor above the proposed working area have been protected. This provision shall apply only after the first three (3) floors are fully enclosed.

Prior to the enclosure of structure, structures, or portions thereof, and when official weather predictions forecast below freezing temperatures, each Prime Contractor shall provide, maintain, operate and pay all costs, including fuel, to supply temporary heat to protect his/her own portion of the work of the project.

Self-contained oil fired portable heaters, if used, shall be vented to the outside of the structure; these types of heaters shall be used only in areas where finished work has been started.

Temporary heat in the enclosed structures will be required on a 24-hour basis when the ambient temperature is officially predicted or is actually at 35°F or lower. Heating Contractors shall advise the University of each 24-hour period that heat will be furnished prior to furnishing same, in order to coordinate accurate field records. The University may authorize temporary heat at times other than above required in order to affect job progress.

After the structure is enclosed and temporary heat is required as determined by the University, the Heating Contractor, at his/her own cost and expense, shall provide the equipment and heating personnel for the temporary heat. The Heating Contractor may install gas or oil fire portable heating units provided the byproducts of combustion are totally vented outside the building. The Heating Contractor may utilize the permanent system or portions thereof or may install temporary steam or hot water radiation or convection or a combination of both. The Heating Contractor may install, operate, protect and maintain a temporary steam heating system through connections to existing University steam lines. The University will provide steam for temporary heating after the structure is enclosed at no cost to the Contractors. (*Coordinate with the University for tie-ins to operating systems.)*
Temporary heating systems shall be of sufficient capacity to heat the interior of the structure to 50°F when the outside temperature is 0°F. Temperature at all times must be 50°F or above. This service shall be continued until the entire project is completed.

Where electricians or plumbers are required to install, operate, supervise or maintain equipment used in the provision of temporary heat, the payment for the services of such personnel shall be the responsibility of the Electrical or Plumbing Contractor respectively. It will be the responsibility of the Electrical and/or Plumbing Contractor to coordinate with the Heating Contractor to meet the temporary heat requirements.

General Contractor shall pay for fuel, including steam for the temporary heat and for electricity in conjunction with the operation of temporary heating facilities after enclosure when not provided by the University. Metering shall be provided by the General Contractor for temporary heat.

General Contractor, at his/her own cost and expense, shall remove soot, smudge and other deposits, from walls, ceilings and exposed surfaces which are the result of the use of any temporary heating equipment, including the use of permanent heating system for the temporary heating purposes. He/she shall not do any finish work until all surfaces are properly cleaned.

Permanent heating equipment used to supply temporary heat shall be completely cleaned and reconditioned by the Heating Contractor prior to final acceptance in the presence of the University personnel. Pertinent heating equipment such as radiator trap seats and diaphragms, valve seats and discs, strainer internals, or any other equipment found to be damaged due to being used for temporary heat shall be replaced. Replacements must be checked and approved by the University personnel.

The use of either temporary or permanent electric resistance heating will not be permitted for temporary heat.

The responsibility of the several Contractors herein mentioned for the provision of temporary heat subsequent to the enclosure of the building, buildings, or portions thereof within their contract price, is limited to the ***Professional to specify*** calendar days, the total cost of which must be included and made a part of the lump sum bid submitted by each bidder. This is also to be shown as the last item on the Contract Breakdown Sheet, Contractors are to include the number of calendar days, cost per twenty-four (24) hour day and extended price. The cost per twenty-four (24) hour day will be used as an add or deduct should the number of days of temporary heat furnished exceed or be less than the number of calendar days stated previously in this paragraph. This price is subject to acceptance or rejection by the University. If accepted, it is to be used in the form of an addition to or deduction from the contract price for furnishing temporary heat for a longer or lesser period than the number of days hereinbefore stipulated. If rejected, a unit price of this purpose shall be agreed to by the parties prior to the approval of the contract breakdown.

Contractor must fully document the cost involved for supplying temporary heat with substantiating data.

B.13 CONSTRUCTION LIGHT AND POWER

A. Electrical Contractor shall, at his/her own cost and expense, install, operate, protect and maintain the temporary service for construction of light and power.

B. This service shall be taken from the closest available primary or secondary source. Electrical Contractor shall extend the temporary wiring throughout the building, properly insulated and installed in a safe manner. The University will not provide electric power used as a source of heat for the temporary heating hereinbefore specified.

C. Electrical Contractor shall furnish this service within fifteen (15) days after receipt of notice from the University. Contractors shall notify the University twenty (20) days before the date they will require the service. The service will be not less than 200 ampere, 1 phase, 4-wire, 120/208 volts with service

and branch circuit protection as required. The Electrical Contractor shall confer with the University and all other Prime Contractors as to the type and location of the temporary services before installation.

D. Electrical Contractor shall furnish and install weatherproof sockets complete with 100 watt lamps for temporary lighting on 20 foot centers, in corridor areas and on stairway landings. Temporary lighting shall proceed with construction and be maintained for the duration of construction. Where the distance perpendicular to the corridor is more than 20 feet, additional lighting should be provided parallel to the corridors and on 30 foot centers.

E. Electrical Contractor shall also provide a 120 volt single phase grounding type outlets with ground fault protection on 30-feet centers in corridor areas. If multi-phase power service is required by other Contractors, these services shall always be the responsibility of the Contractor requiring same.

F. Electrical Contractor shall provide fence lighting in accordance with the City of Pittsburgh's requirements.

G. Complete installation of temporary lighting and power should be in strict accordance with the latest edition of the National Electric Code and OSHA requirements.

H. Where a service of a type other than that as herein mentioned is required, each Contractor requiring same shall provide such service and necessary equipment at his/her own expense. Each Contractor shall provide his/her own extension cords with lamps.

B.13A CONSTRUCTION LIGHT AND POWER *(Existing Occupied Buildings)*

A. Electrical Contractor shall, at his/her own cost and expense, extend temporary lighting and power from existing service presently existing in the buildings. Electrical contractor shall fully coordinate loads required to perform the work and to maintain existing lighting and power circuits in use.

B. *Professional Note -- (The following paragraph must be verified by Addendum during bidding with the University's Project Manager):*

The University, within its facilities, will furnish electricity for construction purposes free of charge to the Contractors.

B.14 FIRE PREVENTION PLANNING FOR CONSTRUCTION, RENOVATIONS OR DEMOLITION PROJECTS

A. Potentially applicable Codes include International Fire Code Chapter 14 and International Building Code Chapter 33, NFPA 241, NFPA 70, and NFPA 3: Recommended Practice For Commissioning and Integrated Testing Of Fire Protection And Life Safety Systems, 2012 Edition

Designers and contractors working on new construction, renovation or demolition projects at the University of Pittsburgh must familiarize themselves with the above Codes enforced by the City of Pittsburgh and/or State of Pennsylvania. A Fire Prevention Plan shall be included as part of construction documents. The project-specific Plan is to be developed by the contractor/construction manager and must be submitted to the University of Pittsburgh Facilities Management Division. Facilities Management shall submit each Fire Prevention Plan to Environmental Health and Safety for review.

During construction, renovation or demolition, especially within buildings that will remain occupied during any portion of the project, the Fire Prevention Plan should address the potential fire and life safety hazards created by the project, and the maintenance of conditions and control measures

that allow for continued building occupancy. It is not acceptable for any project to have a condition that lacks the required fire notification, fire protection, or safe egress features.

A thorough review of the existing fire alarm and fire protection systems along with review of any proposed modifications to these systems should be performed by the design professionals for the project. This review shall determine how modifications or removal of devices in the work zone may impact adjacent areas or the entire building. Maintaining existing systems (in full or in part), installing temporary systems or devices; or a combination of these approaches must be included.

B. Fire Alarm Systems

1. For as long as possible or practical, the existing fire alarm system consisting of but not limited to smoke detectors, heat detectors, waterflow switches for the sprinkler system, valve tamper switches, pull stations, and notification devices (horns/strobes/speakers) shall remain operational.

2. For projects where the scope of work does not allow all system devices to remain in operation (especially during demolition), the following is needed:

   A "minimal level" of detection must be maintained at all times. This is defined as active pull stations at both the primary and secondary egress points and notification devices in the work zone. Smoke detectors in and adjacent to the work zone should be temporarily bagged during construction to help reduce false alarms and keep dust from entering the devices. The bags must be removed at the end of each shift. Accepted bagging techniques involve paper bags or plastic (less than 3 mil in thickness) temporarily fastened to the detector in a manner that covers the sensing device. Tape covering the sensing device is not an acceptable method for bagging detectors. Specific detection devices (e.g. .beam type detectors or duct detectors) may be temporarily disabled upon approval of EH&S. Every effort must be made to minimize the time that the devices are inactive.

   a. The Project's Fire Prevention Plan must address the removal of any devices on the fire alarm system, including the anticipated impact to adjacent areas on the fire alarm system (or loop). Adjacent areas or zones shall remain properly protected and the operation of the fire alarm system should remain unaffected. If programming changes may be needed to the fire alarm panel, these should be documented in the Plan and coordinated with the fire alarm panel manufacturer's approved technicians.

   b. If it is determined that there is no practical way to maintain fire alarm system components during any portion of the project, a fire watch will need to be established. The fire watch and the impacts to the fire alarm system must be detailed in the Plan.

3 All new system installations should comply with applicable standards as listed in the IFC, IBC and/or NFPA.

C. Fire Protection Systems

1. For as long as possible or practical, existing fire protection systems including but not limited to sprinkler systems, fire hose standpipe systems, and fire pumps (including the controller and back-up emergency generators) should remain operational.

2. Consideration must always be given to maintaining portions of the sprinkler system within

the work zone. When sprinklers are removed from service, temporary smoke detection shall be installed. The temporary smoke detectors should be programmed into the fire alarm panel and should remain in service until sprinkler protection is resumed. The temporary smoke detectors in and adjacent to the work zone should be bagged during construction to help reduce false alarms and keep dust from entering the devices. The bags must be removed at the end of each work day.

3. If it is determined that there is no practical way to maintain fire protection systems during any portion of the project, a fire watch will need to be established. The fire watch and the impacts to the fire protection systems must be detailed in the Plan.

4. All new system installations should comply with applicable standards as listed in the IFC, IBC and/or NFPA.

D. Other Responsibilities

1. The General Contractor must establish a designee or Program Superintendent to implement and supervise the following:

   a. Verify that the fire alarm and fire protection systems are arranged and operational as discussed in the Plan.

   b. Verify that the installation of any new equipment, suspended ceilings, walls, cabinets, shelving, signs/displays or other items do not interfere or obstruct any sprinkler heads (existing or new), any fire alarm initiating and/or notification devices, hose cabinets, fire extinguishers, fire alarm control panels, annunciators, or EXIT signs until relocation or new components are provided.

   c. Coordinate with the Project Manager all scheduled or emergency outages to the fire alarm and fire protection systems.

   d. Manage procedures established in the Plan for the control of the following precautions against fire:

      1) The University's Hot Work Permit System must be followed for all cutting, welding or other forms of hot work. Hot Work Permits can be obtained from the Project Manager or EH&S.

      2) Smoking is prohibited in all University buildings and signs shall be posted.

      3) Open burning is prohibited unless a Permit is obtained from the City.

      4) Materials susceptible to spontaneous ignition such as oily rags should be stored in a listed/approved disposal container.

      5) The storage, use and handling of flammable and combustible liquids should be in accordance with IFC Section 1405 and applicable sections of Chapter 34.

      6) The storage, use and handling of flammable gas should be in accordance with Chapter 35 of the IFC.

7) Combustible debris should not accumulate within buildings. Combustible debris, rubbish and waste material should be removed from buildings at the end of each work shift, and should be properly disposed.

8) Temporary wiring for electrical power and lighting installations used in connection with the construction, alteration or demolition of buildings, structures, equipment or similar activities should comply with NFPA 70.

9) The use, type and arrangement of temporary heating equipment should be in accordance with Section 1403 of the IFC.

10) Internal combustion powered construction equipment must not be refueled while in operation and should be located so that exhaust does not discharge against combustible material. Such exhaust must be piped outside of the building, must be directed away from and located at a 10ft minimum from air intakes and operable windows. All fuel should be stored in an approved area outside the building. A Permit must be obtained from the City.

11) For roofing operations, use of heat producing systems or other ignition sources should be in accordance with IFC Section 1417 and Chapter 26.

12) The contractor should provide and maintain fire extinguishers which have current service inspection tags. There should be at least one approved portable fire extinguisher in the work site in accordance with IFC Section 906, and at each stairway on all floor levels where combustible materials have accumulated and in every storage and construction shed. Additional portable fire extinguishers should be provided where special hazards exist including, but not limited to, the storage and use of flammable or combustible liquids.

2. The Project Manager should initiate University outage notification procedures, and coordinate activities with the contractors and designated Facilities Trades staff responsible for the fire protection and fire alarm systems.

3. For all areas under renovation, the University's "Fire Alarm and Fire Protection Outage Procedures" must be reference in the Plan and implemented at all times.

4. The Plan must address impairment procedures with a focus on reducing accidental fire alarm activation associated with demolition, renovation and new construction to include bagging all smoke detectors both inside and adjacent to the work zone; properly planning for the removal or addition of fire alarm initiating and detection devices and fire protection components; and precautions to eliminate damage to existing sprinkler heads and piping.

5. Pitt EH&S must be notified in advance of all planned or emergency impairments/outages, so that these activities are documented with the University's property insurance carrier.

E. Fire Department Access

1. Exterior access for Fire Department apparatus and vehicles must be maintained for the duration of the project. Any alterations to Fire Department access must be incorporated in the Plan.

2. All fire hydrants and all building Fire Department connections must remain accessible. Any

alterations or restrictions in access to hydrants or Fire Department connections must be incorporated in the Plan.

3. An unobstructed path from the exterior through the interior of the building to the work zone must be maintained for fire fighter access. Provisions may be necessary for any areas where secured access is required. If applicable, this must be addressed in the Plan.

F. Means of Egress

1. Whenever practical, at least two means of egress should be maintained from the work zone.

2. For the occupied areas of the building, the minimum number of required egress paths must be maintained and kept free of any obstructions.

3. Directional signs or revisions to existing EXIT signage may be needed to direct occupants around the work zone to the new or existing egress path. Alterations to directional signage and egress paths for building occupants must be addressed in the Plan. Existing Evacuation Maps may need to be altered to reflect these changes in projects of longer duration.

G. Fire Protection System Testing

1. Fire protection and fire alarm system testing subsequent to any modifications and prior to acceptance shall be performed in accordance with applicable NFPA standards. The tests should be documented using appropriate acceptance forms, as completed by the installing contractor and witnessed by both University and AHJ personnel.

2. Pitt EH&S should be notified when acceptance testing will be performed by the AHJ (or FM Global). Pitt EH&S must be provided with copies of all test forms and all test reports.

3. Applicable trades staff should be involved with any outages associated with the acceptance testing and should also be present to witness the testing, especially when it involves specialized fire protection systems, components or devices.

H. New Building Construction or Demolition

The following items also require AHJ approval and should be included in the project's Fire Prevention Plan:

1. The type and arrangement of any required standpipe systems.
2. Provision of a temporary or permanent water supply.
3. Protection of pedestrians.
4. Protection of adjoining property.
5. Temporary use or closing of public streets.

B.15 SITE FENCE

General Contractor shall maintain a temporary site fence on the perimeter of the site as shown on drawings, to meet requirements of the local authorities having jurisdiction. Fences shall be composed of 4'-0" high "snow fence", composed of a slat-and-wire fabric, or polyethylene netting attached to prefabricated metal posts spaced no more than 6'-0" on centers. If required, provide at least one (1) opening of 12'-0" wide for vehicular access.

B.16 SHUT-DOWN OF UTILITIES

A. Contractors shall obtain approval from the University, at least ten (10) working days in advance, for the shut-down of utilities. Utility shut downs must be scheduled so they do not interfere with the University's daily functions.

B. *Professional Note -- (The Professional will be responsible for identifying major shut downs that will occur during night time or weekend hours. These shut downs are to be specifically described in this Division.)*

B.17 ENVIRONMENTAL QUALITY CONTROL

A. Prime Contractors and their sub-contractors shall perform their work in a manner which shall minimize the possibility of air, water, land and noise pollution, and in accordance with governing public authority. Each Prime Contractor shall comply with statutes and regulations of the Commonwealth of Pennsylvania concerning environmental quality control administered by the Department of Environmental Protection, including the Clean Streams Law, Pennsylvania Sewage Facilities Act, Air Pollution Control Act, Surface Mining Conservation and Reclamation Act, Bituminous Coal Open Pit Mining Conservation Act, Dams and Encroachments Act, Water Well Driller's Act, Water Works Act and Atomic Energy Act all as amended to-date. Each Contractor will be solely responsible for any violations and shall be responsible for securing required permits.

B. Erosion control measures are shown on drawings, specifications and/or Section B 18 of these Special Requirements. Erosion control permits, if required, will be obtained by the Professional.

C. Burning of materials from clearing and grubbing operations, periodic clean-up, and related construction shall be governed by local codes and ordinances and/or the Regulations of the Department of Environmental Protection. For each day that the Contractor may contemplate open burning, he/she shall secure written approval from the Department of Environmental Protection. Failure to secure permission for open burning will require Prime Contractors to remove material from the project site and dispose of same in a manner acceptable to the Air Pollution Control Engineer and the Solid Waste Coordinator.

D. Storage, collection, transportation, processing and final disposal of solid waste shall be in accordance with regulations and standards of the Solid Waste Management Act of the Department of Environmental Protection. Immediately upon notice of award of contract, that Contractor shall apply for necessary permits from Department of Environmental Protection and conduct waste disposal on sites approved under this permit. A copy of this permit must be submitted to the University before commencing waste disposal. Name, address and telephone number of the Regional Solid Waste Coordinator of the Department of Environmental Protection is furnished below. This coordinator shall be contacted for the permits and for information concerning sites already approved for conducting waste disposal.

B.18 SOIL EROSION AND SEDIMENTATION CONTROL DURING CONSTRUCTION PERIOD

A. No water which transports sediment resulting from earth moving, demolition or other construction activities shall be permitted to discharge into the waters of the Commonwealth or beyond the contract limits of the project.

B. Natural surface water shall be diverted away from the work area. A permanent diversion drainage system shall be constructed up-grade of work areas required to convey tributary run-off around and

beyond the outer limits of the area subject to earth moving, demolition, or other construction activities. Interception channels shall be constructed within the project area as required to control the discharge of sediment due to construction activities.

C. Surface runoff from a project area and discharge resulting from the de-watering of excavations shall be collected and diverted to facilities for removal of sediment. Water collected by interceptor channels shall be conveyed to sedimentation basins or to vegetated areas but not directly to streams or storm drains.

D. Earthmoving activities shall be planned to minimize the extent and the duration of exposure of disturbed land.

E. Surfaces of cut and embankment slopes, ditches, shales, earth stockpiles, and areas denuded of top soil shall be stabilized to minimize surface erosion as soon as possible after exposure. Whether temporary or permanent, such surfaces shall be stabilized immediately to control erosion.

F. Temporary stabilization shall generally be accomplished by vegetative measures, seeding with rapidly growing plants, such as annual rye grass, small grain, Sudan grass, or field brome grass. This planting should be supplemented by mulches and protective netting as required or directed.

G. Temporary erosion control facilities shall be maintained for the duration of construction and shall be removed only after the permanent drainage and erosion control features of the project have been completed and established in operation.

B.19 NOTIFICATION TO PUBLIC UTILITIES PRIOR TO EXCAVATION OR DEMOLITION WORK WHEN USING POWERED EQUIPMENT OR BLASTING

MAJOR PROVISIONS OF House Bill No. 2543 3772

RE: NOTIFICATION TO PUBLIC UTILITIES PRIOR TO EXCAVATING OR DEMOLITION WORK WHEN USING POWERED EQUIPMENT OR BLASTING.

A. Definitions Section

B. Duties of Utility Company

1. Advise in writing county Recorder of Deeds where utility's lines are located.

   (i) Utility company's name.

   (ii) Political subdivisions where lines are located.

   (iii) Utility's address and telephone number where inquiries may be made as to location of utility lines.

2. Advise in writing any changes in 1(i) through (iii).

3. Pay a $5 filing fee to county Recorder of Deeds.

4. Advise a Designer in two (2) working days as to approximate location and type of utility lines at site for which designer is preparing a drawing.

5. Advise a Contractor who identifies job site in two (2) working days as to:

(i) Location of lines at the site.

(ii) Steps utility may take to avoid line damage.

(iii) Suggestions to avoid damage.

6. Advise Designers and Contractors of a "serial number" assigned by the utility when a telephone call is made and maintain a "register" of pertinent information.

C. Duties of Recorder of Deeds

1. Maintain a list, by political subdivision, of utility lines information provided in B above.

2. Make such lists available for inspection at no charge or provide a copy for $1.00.

D. Duties of Designer Preparing a Drawing, Requiring Excavation or Demolition Work

1. Inspect or obtain a copy of list of utility companies from county Recorder of Deeds. (See C 1).

2. Request from utility companies on the list provided or inspected information as to approximate location and type utility line at the site (See B 4).

3. Show on the drawing the approximate location of line, type of line, name of utility company, utility company's office address and telephone number.

4. Notify the Pennsylvania "One Call" (1-800-242-1776) system within ten (10) days before the design has started on the project.

E. Duties of Contractor Performing Excavation or Demolition Work

1. Ascertain location and type of utility line at the site by inspecting drawing (See D 3), or by inspecting or obtaining a list from the county Recorder of Deeds and then contacting the utility companies on that site.

2. Three (3) days before excavation or demolition, request from the utility companies the steps utility may take to avoid damage [See B 5(ii)], and suggestions to avoid damage [See B 5(c)].

3. Inform each equipment operator or blaster, information obtained in 1 and 2 above, (E 1 and 2).

4. Report any damage to utility lines to utility company, made or discovered, in the course of the work.

5. Alert any occupants of premises as to any emergency created or discovered.

6. Provisions of (1), (2) and (3) above do not apply in an emergency. (Defined as any condition constituting a clear and present danger to life or property by escaping gas, exposed wires or other utility line breaks or defects).

7. Notify Pennsylvania "One Call" (1-800-242-2776) system three (3) days prior to start of construction.

F. This Act would not amend or repeal any other law or local ordinance on the same subject matter. This Act does not preclude establishment of "one-call systems" or other such agreements.

G. Penalty of $100.00 to $1,000.00 or prison up to 90 days, or both upon conviction for violation of the Act.

B.20 CONSTRUCTION ACCESS ROAD (WHERE REQUIRED):

A. *Professional Note -- (The following is a requirement for new buildings or large additions in the Regional Campuses.)*

B. Materials and equipment delivered to the construction project shall enter and leave via the "access road" indicated on the Site Plan. The General Contractor shall construct the new gravel access road and shall do required grading and supplying of stone base as will be necessary to make this road passable at all times, under all weather conditions and shall maintain the road during the course of construction.

C. At the termination of the project, the access road shall remain in place (or removed and land restored to original conditions) as determined by the University.

D. Mud, dirt, or debris deposited on any of the Campus roads by construction operations or construction traffic shall be cleaned daily by the General Contractor to the satisfaction of the University.

Oakland Campus:

E. *Professional Note -- (The following paragraph is to be used for projects at the Oakland Campus.)* Contractors shall be responsible for keeping public and private roads clean of mud, dirt, or debris originated by the construction operations. These roads shall be cleaned daily by the Contractor to the satisfaction of the University.

B.21 TEMPORARY ROADS AND PAVING:

A. General Contractor shall provide temporary roads and paving as called for on the drawings. To the fullest extent possible, locate temporary roads and paving for storage areas and temporary parking, in the same locations as permanent facilities for similar uses.

Temporary Road:

1. Coordinate development of temporary roads and paved areas with grading and the compaction of the sub-grade, installation and stabilization of the sub-base and installation of the base and finish courses of permanent paving.

2. Delay installation of the final course of permanent asphalt concrete paving in areas exposed to temporary use until immediately before substantial completion. Coordinate with normal weather conditions to avoid unsatisfactory results.

3. Extend temporary paving in and around the site construction area as necessary to accommodate the following:

Delivery and storage of materials.
Fabrication operations.
Use of equipment.
Testing Operations.
Administration and supervision.

Safety and protection activities.

Paving: Construct and maintain temporary roads and paving to support required loading and to withstand exposure to traffic during the construction period.

1. Provide a reasonably level, graded and well drained sub-grade of satisfactory soil material, as defined in Sub section 2, well compacted to not less than 95% of maximum dry density.

2. Provide gravel paving course of a well graded sub-base material not less than 3" thick, roller compacted to a level, smooth, dense surface.

3. Provide a dust control treatment consisting of a "road-oil" or other petro chemical compound known to be non-polluting and not tracking.

B.22 HAULING EXCAVATION MATERIALS

A. *Professional Note -- (Review the following paragraph with University Project Manager.)*

Excess topsoil and material suitable for backfill shall be disposed off/on Campus property, (at the location shown on drawings.) Other materials shall be removed from the site and disposed of properly by the Contractors or subcontractors responsible for the same.

B.23 PARKING FOR CONSTRUCTION WORKERS

A. *Professional Note -- (The following paragraph is to be used in Oakland projects.)*

The University will not provide parking for Contractors. Workers, at their own expense, may park in the available public parking areas close to the site. Contractors and their workers shall not park along the streets in the residential areas adjacent to the Campus.

No parking of Contractor vehicles is permitted on sidewalks, pedestrian plazas or lawn and green areas.

B. *Professional Note -- (The following paragraph is to be used for projects in the Regional Campuses.)*

The University will designate parking areas for Contractors within the Campus. Workers shall refrain from parking outside the designated areas.

B.24 RESTORATION

Work such as paving, walls, floors, lawns, walkways, construction items, and/or similar related items and other work which is to remain, but which has been damaged by the operations of any of the Prime Contractors on the project, shall be restored to its original condition with equal materials all at each Contractor's expense to the approval of the University. Areas of suspect damage must be photographed prior to start of construction, and copies provided to the University.

B.25 SALVAGED MATERIALS

A. General Contractor shall verify with the University's project manager items of demolition work that shall be salvaged and turned over to the University by the respective Contractors. Contractors shall remove such items to a pickup area of the building to be removed by others.

B. Other demolished materials not scheduled to be salvaged shall be the property of the Contractor and shall be disposed of properly.

B.26 WORKING HOURS

A. Contractor's working hours shall be in accordance with a schedule agreed upon by the Contractor and the University.

Should evening hours or weekend work be required, this work must be fully coordinated with the University in advance of scheduling the off-hours work.

B. *Professional Note - (Check with University's Project Manager for work starting time restrictions that may exist in Campus areas.)*

B.27 TRUCK ROUTE

A. *Professional Note -- (Check with University's Project Manager for restrictions that may exist on all Campuses.)*

B.28 SANITARY FACILITIES

A. General Contractor shall provide and maintain in a clean and sanitary condition, temporary sanitary facilities until all structures are enclosed, where after the Contractor's work forces may use existing toilet facilities only within areas where construction work is being completed. These shall be maintained in a sanitary condition and shall be thoroughly cleaned immediately prior to occupancy by the University.

B. Contractors shall not dispose of flammables or solids such as paint thinners, plaster and concrete scurries in University sanitary facilities. Foreign products shall be properly disposed off the site and University property.

C. Use of University dumpsters for disposal of materials is prohibited.

B.29 SEQUENCE OF OPERATIONS ON ALTERATION WORK

A. *Professional Note -- (Projects that require phasing of the work shall be performed within these guidelines.)*

B. The Phasing Sequence is intended to permit the continued use by the University of portions of the building during construction activities. The Professional shall develop a tentative phasing schedule to serve as a guide to the Contractor. The General Contractor, however, is responsible for the development and implementation of the final Phasing Schedule which shall be submitted to the University and the Professional for approval and shall be in the form of a Critical Path with specific dates for construction phases and occupant moves. The phasing outlined herein is intended as a guide to be used by the Professional in the development of the final phasing schedule.

C. Departments and functions are to remain in operation with the minimum number of disruptions (moves).

D. Existing HVAC, plumbing and electrical systems shall be maintained during construction in areas to be occupied by the University by providing temporary or permanent connections. Mechanical work indicated to be demolished or removed shall be completed without interruption to occupied areas. Each Contractor shall be responsible for maintaining and protecting the systems related to his/her trade.

E. At the conclusion of each phase and at the completion of the project, temporary HVAC, plumbing and electrical systems shall be removed by the respective Contractor.

F. Occupied areas in the building shall be tightly protected against noise and dust resulting from construction. The General Contractor shall be responsible for the erection of dust and other barriers as required to separate areas under construction or demolition from occupied areas. Barricades and construction partitions shall be erected in a manner which shall maintain exit access to fire stairs and exit passages. The Electrical Contractor shall be responsible for maintaining existing exit signage or the installation of temporary exit signage as required by the City of Pittsburgh, Department of Building Inspection. The Plumbing Contractor shall be required to maintain existing fire suppression systems and fire hose cabinets or the installation of temporary fire suppression systems of fire hose cabinets as required by the City of Pittsburgh, Department of Building Inspection.

G. General Contractor shall be responsible for maintaining the existing fire alarm system in operation throughout the project. Where temporary outages are required, alternate means shall be established to alert building occupants of a fire condition.

H. Construction access to work area shall not be routed through a finished or occupied space.

I. The University will designate one (1) elevator for the movement of workers and materials as is permissible within the load limits of the elevator cab and equipment. The General Contractor shall schedule the use of the elevator with the University and Professional prior to construction operations. The General Contractor shall provide protection pads and covering for the walls, ceilings and floors of the elevator cab and shall provide an elevator operator, if required.

J. General Contractor is responsible for the overall coordination of the phasing program. The University will be responsible for the removal of furnishings, equipment or salvaged items not identified for removal and/or storage by the General Contractor. The General Contractor shall review the phasing schedule during the weekly job meeting prior to implementation of phases and notify the respective Contractors and the University of the areas to be affected by the phasing. General Contractor shall be responsible for determining the route that construction traffic shall use to the work areas and insuring that adjacent areas are protected against damage, dust and noise. Each trade is responsible for the rerouting or temporary support and connection of existing utility lines and any temporary construction required for the completion of that trade's particular scope of work.

K. Contractors shall schedule the use of loading dock areas for deliveries of materials and equipment so as not to disrupt University activities.

B.30 BLASTING

A. Blasting will not be permitted on University property.

B.31 VIBRATION CONTROL

A. *Professional Note - (Because of experimental work being done in certain buildings and because laboratory equipment can be damaged or destroyed by unexpected vibrations, the Professional must check with the University's Project Manager, if restrictions on the use of vibration-producing equipment such as jackhammers, etc., are to be regulated.)*

B.32 NOISE CONTROL

A. In most instances, noise control will be a matter of prime concern. It is therefore mandatory that equipment such as compressors, generating equipment, etc. be fitted with mufflers or other noise abatement attachments.

B. It may become necessary to schedule some operations during periods of low occupancy of neighboring buildings.

B.33 JOB SITE SECURITY

Job site security will not be provided by the University.

The University assumes no responsibility for damage or loss to Contractor's property.

B.34 DEWATERING

A. General Contractor shall assume responsibility for continuous removal of water, including surface and rain water, by the use of pumps, drains and other approved methods necessary to keep the excavation and site free from water at all times until completion of the work.

B. Water must be directed away from existing structures in a manner that will cause no erosion, and that will keep foreign material from backing up existing drains or entering into the sewers.

B.35 LAYING OUT THE WORK

A. Contractor shall employ a competent, experienced registered engineer to determine lines and grades and certify same from time to time during the progress of the work.

1. Engineer shall establish benchmarks referenced to the finished grade lines and critical elevations.

2. Each subcontractor shall provide a competent engineering service to lay out his/her work in accordance with lines and grades established by the Contractor.

B.36 PROJECT SIGN

If identified and requested by the University, the Contractor for General Construction, at his/her own cost and expense, shall erect at a prominent location as selected by the University, a six-feet by eight-feet (6' x 8') sign, well braced, and supported by 4" x 4" posts identifying the project under construction. Sign board shall be constructed from weatherproof plywood, hardboard, or other smooth faced material that will weather and remain intact throughout the job. The sign shall be placed with eight-feet (8') dimension horizontal. The base colors shall be white with black lettering for University portion of the sign with the University logo consisting of a gold shield, trimmed in white within a blue circle. Professionals' and contractors' names shall be red on white background. A 2" blue border shall be provided the perimeter of the sign. Information to be provided on the project sign shall be with the University's approval. At the completion of the project, General Contractor shall remove the sign from the site.

B.37 UNIVERSITY OWNED EQUIPMENT

The use of University-owned equipment is prohibited. It shall be the responsibility of Contractors performing work at the University to provide tools, equipment and materials necessary to perform the work.

B.38 TEMPORARY HOUSING

A. *Professional Note -- (Verify with University's Project Manager the use of Facilities at Regional Campuses.)*

B. Contractors shall provide for temporary housing of his/her employees for the duration of the work. The use of University Facilities will not be permitted unless **clearly** provided for in the contract documents.

B.39 "AS BUILT" DRAWINGS

A. During the course of the work, the Contractor is required to record changes in the work on a set of the contract documents to include one (1) set of corrected specifications. The Professional shall revise the original documents and provide the "Record" information to the University. This applies to all trades involved with the work.

B.40 NO-SMOKING POLICY

The University's "No-Smoking" policy applies to University owned and leased facilities including residence halls, off-campus housing, University vehicles, and construction sites. Construction workers must refrain from smoking in these areas.

B.41 SUBSTANTIAL COMPLETION PUNCH LIST PROCEDURE

A. Summary:

The purpose of this procedure is to develop a means to track and expedite the completion of the punch list that is developed when the space is considered substantially complete as defined in the contract between the University and Contractor. The University's Project Manager will be responsible to track the progress of the punch list work and ensure that the work is completed in the time frame as agreed to on the punch list.

B. Procedure:

1. A punch list will be developed by the Professional with the assistance of the Project Manager when the work is considered substantially complete as defined by the agreement between the University and the Contractor. The Project Manager is to include in the preparation of the punch list the Area Coordinator, and a representative from the University's Systems and Energy Management Department when applicable.

2. If a Professional is not used or contractually not required to provide a punch list, then the Project Manager is to develop a punch list when the work is substantially complete.

3. When the Professional completes the punch list, he/she will forward it to the Project Manager, via E-mail, facsimile, or written transmittal.

4. Project Manager will review the punch list when received from the Professional. If acceptable, Project Manager will send it via facsimile to the Contractor(s) for his/her use. If the punch list is not acceptable, the Project Manager will work with the Professional to revise.

5. Professional will provide a space in the right margin next to each punch list item for a completion date. Contractor will fill in the scheduled completion dates for each item, sign

and forward to the Project Manager via email, facsimile, or written transmittal. The punch list will also be given to the User personnel for their information. (*Note*: it is important to document either via E-mail, facsimile, or written transmittal, the dates when the final version of the punch list is the possession of all parties involved with the project.) If there are items of work that cannot be completed within a reasonable period of time (usually 30 calendar days), the Contractor is to indicate the reasons in a space below each punch list item. *Reasons for a completion beyond 30 days can be Change Order or Scope Increase, Manufacturer Delivery Period, Incorrect Item Shipped and Reordered, etc.*

6. Project Manger will review the punch list and the completion dates with the User. **This must take place within one (1) week of the substantial completion date as established by the Professional or Project Manager.**

7. As the work is completed, the Contractor will fill in the actual completion dates which will be verified by the Project Manger.

8. When the punch list is complete and verified by the Project Manager, a final copy will be distributed by the Project Manager to all parties for their records.

B.42 FINAL SUBMISSION CERTIFICATE

A. Professional shall be responsible for the review and coordination of all work related to General Construction, HVAC, Fire Protection, Plumbing, and Electrical Systems as required for the successful execution of the project.

B. Upon final review and coordination, and prior to the release of Contract Documents, the Professional and his/her consultants shall execute and submit the following: Final Submissions Certificate of Drawings and Specifications.

B.43 SECURITY CLEARANCE REQUIREMENTS

A. All Contractors and Sub-Contractors are required to have clearance and background checks listed below for all personnel working in UCDC, Falk School, and all Housing buildings. .

1. Pennsylvania State Police Request for Criminal Record Check. The request can be filed at https://epatch.state.pa.us/.

2. Pennsylvania Child Abuse History Clearance. You can get the form at http://www.dpw.state.pa.us/ucmprd/groups/webcontent/documents/form/s_001762.pdf.

3. Fingerprint-based FBI background check. You can register on-line at https://www.pa.cogentid.com/index_dpw.htm.

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DIVISION C
UNIVERSITY STANDARDS FOR MATERIALS AND PRODUCTS

C.1 GENERAL

The Professional will review the following list of items and will incorporate those that apply to the project into the Contract Documents.

C.2 COLOR SELECTIONS

A. The color selections of materials for use on buildings' interior and exterior surfaces will be approved by the University. During the design stages of the project, the Professional will submit color boards or review and approval. These boards will be reused during construction as may be required. Material samples will be approved by the University before ordering or fabrication.

B. Guidelines:

1. Submissions:

a. It is the Professional's responsibility to prepare and submit for University approval a Color Selection Board showing color, finish and texture of ALL specified interior finish materials to be used in the project, properly labeled for room location. The final Board must be submitted together with the Final Contract Documents and will be kept at the job site during construction. The Selection Board will have space to allow for the approval signature of the FM Project Manager, as well as the User.

b. Colors and materials samples will be submitted to the Facilities Management Project Manager. The Professional will not submit colors or materials samples to the Users. It is the Facilities Management Project Manager's responsibility to submit the colors and materials samples to the Users, after they have been reviewed and approved by the University Architect or his/her appointed representative. The Professional is discouraged from submitting individual color samples for approval at different times during the design or construction process.

c. The Professional is also required to submit catalog cuts, for items shown below, as well as any other items that are considered necessary by the Professional or the University Project Manager for a proper depiction of the project.

The following is a list of cuts and samples to be submitted:

Carpet	Min. 12"x12" sample
VCT	Min. 2"x2" sample
Vinyl or rubber base	Sample
Paint colors	Min. 2"x2" color chip

Ceiling tile and grid	Catalog cut and material sample
Toilet partitions	Catalog cut and sample
Ceramic tile	Sample of colors to be used, as well as drawing showing pattern.
Lighting fixtures	Catalog cut and color of fixtures, except University standard.
Diffusers, electrical boxes, etc.	Color chip, if other than white
Hardware Finish	Catalog cut and finish
Doors and frames	Paint chip and/or veneer finish sample
Blinds and drapes	Fabric sample 6”x6” min.
Countertops and counters	Color and material sample
Furniture	Catalog cuts, fabric and other materials samples (veneers, metal finishes, etc.)
Elevators	Walls, floors and ceiling finishes

d. Once bids are awarded, the Professional will obtain from the Contractor samples and/or catalog cuts of materials not specifically identified in the Contract Documents and will update the Color Selection Board for approval. **The Contractor will not be instructed by the Professional to proceed ordering the interior materials until the University has approved all materials and color samples.**

2. Brief Guide to Colors and Materials Selection:

a. General:

The following Guide has been developed in order to ensure that the colors and materials provided in University interiors are easy to maintain, promote energy conservation and do not become “obsolete” as Users of the spaces change.

1) Use of the University colors and seal: There is no requirement for the Designers to use the University colors (blue and gold) in the building interiors, unless specifically requested by the Users. If the University colors are to be applied in graphic form, the University standard colors must be used. If the University seal is used, modifications or omissions of part of the seal are not acceptable.

2) Wall paint: Wall paint colors will have a minimum reflectance rating of LRV 75, except for accent walls, for which this reflectance rate does not apply. Accent walls will be limited to a maximum of 25% of the total wall surface of the room.

3) Ceiling paint: Ceiling paint color will have a minimum reflectance rating of LRV 85. Use of dark colors on ceilings is not acceptable for energy conservation reasons.

4) Exposed utilities and building systems: The Professional will make a concerted effort to locate new pipes (including sprinkler piping), wires, raceways, outlets, ducts and miscellaneous utilities and systems in existing finished spaces, behind walls or above ceilings, so as not to detract from the architecture of the space. If this is not possible due to economics or building constraints, alternative exposed locations will be agreed upon with the Project Manager. Professional must specify that utilities/systems components that are to remain exposed will be painted the same color as the background wall/ceiling, so as to make them as inconspicuous as possible unless otherwise specified by applicable Codes. (*Note* -- At the present time, the Code does not require sprinkler piping in finished spaces to be painted red.)

5) Vinyl composition Tile and base: Vinyl tile will be variegated, in a medium to medium/dark range. Colors of tile and base will be in the neutral range (gray, beige, brown, cream, etc.)

6) Restrooms: Ceramic tile or mosaic will be specified for restroom floors and base. Floor tile color to be light, neutral color. The use of color accents is optional. Walls will be either tile or epoxy paint. Colors to be also light and neutral, with optional color accents. It is acceptable to use the same colors and materials in both male and female restrooms.

7) Elevators: Flooring will be Heuga carpet tiles or vinyl composite tile. Wall panels will be plastic laminate, cherry wood grain, or material to match existing elevator interiors. Ceiling will be modular louver type plastic diffuser, off-white color.

8) Door frames and doors: Paint color or veneer to match interior color scheme. Doors leading from the renovated area to a public corridor will be painted or finished to match existing corridor doors on the corridor side.

9) Public Corridors: The materials, style and colors to be used in public corridors, will be consistent with the architectural style of the building and also with the existing building colors.

10) Carpet: The Professional will specify the University's standard carpet, in standard colors, unless otherwise authorized in writing by the FM Project Manager. If alternative carpet is specified, the quality (weight, yarn, etc.) will be at least equal to that of the

standard carpet. **Professionals are highly discouraged from using plush pile carpets, colors that are too dark or too light and also single color carpets, as they are extremely difficult to maintain.** The best performing carpets are those that have a loop weave in a combination of at least two (2) colors in a medium range.

11) Hardware: The Professional will match the existing building hardware, in type and finish. Keying will be reviewed with the FM Project Manager.

12) Lighting Fixtures: University standard lighting fixtures will be specified, unless otherwise specifically approved in writing by the Project Manager, for special conditions. When non-standard fixtures are used, the lighting fixtures will have the following characteristics:

Made in the USA
Commercial or institutional quality
Incandescent fixtures are not allowed
Energy-saving
Standard bulbs and other replacement parts such as glass shades will be readily available in the Pittsburgh market
Finishes will be maintenance-free

13) Toilet partitions: Will be floor-mounted type, solid plastic by Santana or equal. Colors to be selected from manufacturers' standards.

14) Window blinds: To match building standard. If the building does not have a standard, blinds will be horizontal slat mini-blinds, ½ inch aluminum slat, in light tone, neutral color (cream, gray, light beige, bone, etc.)

15) Drapes: Use of drapes is discouraged, except when the style of the interior absolutely requires it. If fabric window drapes are specified, the fabric must be inherently flame-resistant, or flame-resistant treated.

16) Interior signage: To be University standard interior signage, unless otherwise authorized by the FM Project Manager in writing.

17) Code Compliance: Interiors will meet applicable local, State and National Codes, including ADA standards. *Note:* When renovating existing restroom facilities, the Professional will check with the Project Manager whether that facility needs to comply with ADA. The decision to comply will be made by Facilities Management, based on the availability of other ADA compliant facilities in the building.

C.3 CONCRETE WALKWAYS

A. New walkways will have 2b crushed stone base. Sidewalks will be a minimum 4" thickness

with woven wire mesh reinforcing.

B. Concrete for exterior use will be minimum 4000 psi, and will have 5% to 6% air-entrained admixture. Depending on the amount of concrete to be provided, Professionals may be required to specify concrete testing.

C.4 BRICK & STONE MASONRY

A. *Professional Note -- (The Professional will show on the contract documents, the locations of expansion and control joints, and their construction details.)*

B. The University has standardized the exterior brick color in the Regional Campuses and in some areas of the Oakland Campus. It is of the utmost importance that the Professional reviews the brick selection for new buildings with the Project Manager in order to insure a proper match.

C. For DGS projects, the Professional will select and obtain University approval of three (3) comparable brick samples from different manufacturers, all of which will match the University brick standard for the particular location.

D. *Professional Note -- (The Professional will specify efflorescence testing of all brick to be used in exterior locations.)*

E. Brick masonry work will be in accordance with the Brick Institute of America and in compliance with ASTM Standards.

F. Masonry units will be provided by a single source supplier and be uniform in texture and color, or a uniform blend within the ranges accepted for these characteristics.

G. During project design, actual samples of the brick masonry units will be submitted to the University for approval and acceptance of the materials for appearance, color and characteristics.

H. For exposed masonry, samples will be submitted for mortar materials, including cement for each aggregate.

I. Prior to installation of masonry work, a 3' wide x 4' high mock-up wall will be erected to further verify selection made for color and textural characteristics with the selected samples of masonry and mortar, and to represent completed masonry work for quality and appearance, materials and construction. Masonry materials will not be ordered by Contractor until the mock-up panel has been approved by the University and the Professional.

J. Admixtures: Setting accelerators or antifreeze compounds will not be permitted.

K. Unless adequate protection against freezing is provided, no masonry work will be performed when the temperature is below 36ºF or predicted to be 36ºF degrees overnight.

L. Thru-wall flashings, weep holes, construction and control joints will be provided as may be required for the work, and properly detailed in the Contract Documents.

M. Johnstown Campus:

A large number of buildings at the Johnstown Campus have a quartzite stone exterior. Should

this material be selected for a new building, the stone must be obtained from Valley Forge Building Stone Company, Morgantown, Pennsylvania 19543. The University has a large amount of stone reserved in this quarry.

C.5 INTERIOR PARTITIONS (GYPSUM BOARD)

Interior partitions will be constructed of metal stud frame work with studding spaced at 16" o.c. as may be required by code. Gypsum board will be minimum thickness or 5/8". Provide "Noise Barrier Batts" in stud cavity at all sound and office walls for compliance with STC established ratings. Corridor walls will be extended to deck above as required by governing codes.

C.6 ACCESS PANELS

Access panels will be provided for accessibility to devices and controls requiring service by the University that will not be readily accessible after completion of the project.

C.7 ROOFING SYSTEMS

A. *Professional Note – (The Professional will incorporate into the Specifications, the requirement for a roofing conference before roof work is to begin. This roofing conference will have all parties involved in attendance.)*

B. *Professional Note – (The Professional must devote particular attention to the design of plazas and other accessible roof areas. These are very expensive areas for the University to maintain, and they must be properly detailed and specified in order to insure a first quality installation.)*

C. The University requires proper design, material selection, and rigid inspection for maximum performance of roofing systems. Roofing systems will be reviewed with the University on a project-by-project basis.

D. Roofing will be provided in strict accordance with the manufacturer's recommendations.

E. Provide proper access to roof levels by means of scuttles and ladders.

F. Provide walking pads leading to rooftop equipment, exit ways and penthouses.

G. Written warranties and guarantees will be provided for roofing installations at the completion of the work.

H. Roofing installations will be reviewed with the University's roofing consultant and Insurance Carrier during the design stages of the Project.

C.8 MOISTURE PROTECTION

Below-grade foundation walls and masonry work must be damp-proofed and/or waterproofed to meet the design requirements and site conditions. Provide for perimeter drainage of footings as required.

Provide waterproofing membrane under suspended interior slabs where restrooms, toilets, showers and similar wet-type facilities are located.

C.9 METAL DOORS AND FRAMES

Metal doors will comply with American National Standards Institute, "Nomenclature for Steel Doors and Steel Door Frames". Doors will be in accordance with ANSI standards, latest edition, for handicap accessibility. Interior doors will be 18 gage and exterior doors will be 16 gage, properly prepared to receive specified hardware. Doors to be minimum 1-3/4" thickness.

C.10 WOOD DOORS

A. *Professional Note – (The University will only accept staved core wood doors to be used in its buildings. Hollow core or mineral core wood doors <u>are not acceptable</u>. Doors requiring more than a 20 minute rating will be metal doors.)*

B. In addition to complying with pertinent codes and regulations, doors will comply with the "Architectural Woodwork Quality Standards and Guide Specifications" published by the Architectural Woodwork Institute. Doors will be provided in accordance with ANSI standards for handicap accessibility.

C. In existing buildings, door finish will match existing. <u>Do not</u> specify pre-finished doors *(unless existing)* since it is difficult to match finishes already existing with factory finishes.

C.11 HARDWARE

A. New hardware being provided for University buildings will be Architectural grade in accordance with governing bodies and Code requirements. In existing buildings, hardware will match existing in quality, manufacture, finish and keying. Hardware on fire doors will be approved and listed for fire door service.

B. The University standard cylinder lock is "BEST". <u>No substitution</u> will be allowed, except in DGS projects in which only hardware that is compatible will be specified.

C. Before delivery of the hardware, the Contractor will discuss with the University and obtain approval of the keying system to be supplied.

D. Hardware suppliers will be required to have in their employ, a member of the AHC (American Hardware Consultants) during the course of construction at no cost to the University for consultation.

E. Hardware schedules and samples will be submitted to and approved by the University before the hardware is delivered to the job site and/or door manufacturer.

C.12 KEYING

A. The purpose of this Procedure is to ensure that the University Police and the Users are properly involved in each stage of the project since they have the responsibility, working together, for determining the keying of all spaces. The University Police also has the responsibility for the issuance of keys to the Users when they move into the completed project. The PM must ensure that the Users properly understand Facilities Management and the University Police's division of responsibilities during design and construction of the project.

B. Procedure:

1. NEW BUILDINGS:

a. Design:

1) At the beginning of the Design Phase, the Project Manager (PM) will schedule a meeting with the Police Department Liaison (PDL) and the Users to inform them of the project scope, budget and schedule and to review security issues, **including their responsibilities in this process**.

2) During the Preliminary Phase of the project, the PM must schedule meeting(s) with the PDL, the Professional and the Users, as required to review and resolve the overall security issues in the building, such as the need for a Security Desk, electric door locks and alarms, grilles to keep people from certain areas of the building, etc. The PM must make sure that the Professional incorporates these security issues into the Contract Documents.

3) Early in the Final Design stage of the project, the PM will forward to the PDL the building floor plans and will notify them to set up meetings with the Users and the lock provider (Best), as required for them to establish the final keying of the building **before** the Construction Documents are finalized.

4) The PM must ensure that the Professional includes the following paragraph in the Contract Specifications: “The Contractor will provide two (2) keys per core with appropriate sub-master and master keys. A key cabinet will be provided and installed in a location as directed by the University. The cabinet will be arranged and marked to accept all keys at the completion of the project”. **Also, the PM must ensure that the Professional specifies Best cores for hardware in the project.**

b. Construction:

1) At the beginning of the Construction Phase, the PM must request from the Contractor that the Construction Schedule for the building specifically include dates for the installation of the cores.

2) The PM must inform PDL when the project is ready to be permanently keyed, so that the PDL can schedule the installation of the permanent cores with the core provider. The contractor will install the cores while being accompanied by the University Police key administrator. This will ensure accuracy of the key control records and turnover the keys to the University Police.

3) The PM will inform the Users that they are required to request keys through the Police Department using Key Requests Form 0059 and mailing/carrying it to the University Police (faxing is not desirable due to verification of signature of requestor).

2. Renovated Spaces

a. Projects built by outside Contractors:

The keying procedure for renovation projects in which outside contractors are involved is similar to that described above for new buildings, except that the PM must give the Professional the manufacturer's name for the building hardware and the keyway, so that the Professional can include this information into the project specifications.

b. Projects built by the Facilities Management Trades:

For projects to be built by our Trades, the Carpenters must provide the cores. The PM must send a Work Order request, for the Carpenters to re-key the cores per the University Police's instructions. The PM will also inform the Users that they must request keys from the University Police Department.

C. *Professional Note* – (*The Professional will be responsible for reviewing existing key way systems and coordinating how lock systems are to match in renovation and addition projects. The following indicate Keyway Systems. These need to be verified with the Project Manager.)*

BUILDING NAME	**KEYWAY SYSTEM**
Alumni Hall (Masonic Temple)	Best "J"
Allegheny OBS	Best "A"
Allen Hall	Corbin Z4-59B2-7 Yale RB8
Athletic Fields	Beat "A"
Bellefield Hall	Yale RB8
Benedum Hall	Lockwood "L-M-N-P-Q-R-S-T"
Bio-Tech Center	Best "E"
Cathedral of Learning	Corbin X1276
Chevron Building	Best "A"
Clapp Hall	Corbin Z459A27
Charles Cost Center	Best "F"
Craig Hall	Sargent "RC"
Crawford Hall	Corbin Z459A27
Eberly Hall	Best "A"
Old Engineering Hall	Corbin 5918R
Eureka Building	Corbin Z1605
Falk School	Corbin Z1606
Field House	Best "A-G-L"
Frick Fine Arts	Sargent "RB"
Gardner Steel Conference	Sargent "S"
Graduate School of Public Health	Sargent "LF"
Heinz Chapel	Corbin X1276

Hillman Library	Sargent “LK”
Langley Hall	Corbin Z459A27
Law School Building	Best “A”
David Lawrence Hall	Sargent “RF”
LRDC Center	Sargent “RA”
LIS Building	Sargent “RJ”
Mervis Hall	Best “G”
MIB	Yale RB8
Music Building	Yale “GA”
Posvar Hall	Best “A”
Primate Center	Peaks
Salk Hall	Best “G”
SRCC Building	Best “D”
Stephen Foster Memorial	Best “F” Corbin X1276
Thackeray Hall	Corbin Z1605 & Z1606
Thaw Hall	Best “A” Yale RB8 Corbin 5981R
Trees Hall	Corbin BL4
UCDC Center	Best “E”
Van DeGraff	Yale “SA”
Victoria Hall	Best “A-F”
William Pitt Union	Best “D”
121 University Place	Arrow
480 Melwood	Best “A”

C.13 COMBINATION LOCKS

A. *Professional Note* – (*The Professional will be required to review the installation policies as established by the University regarding combination locks. Final approval for the use of combination locks for the project will meet with the approval of the Department of Public Safety*.)

B. The University standard for combination locks is as manufactured by Simplex Security Systems, Inc., and is master keyed to "BEST" removable core cylinders, and to specific zones on the Oakland Campus. Only combination locks with key overrides may be specified. Simplex models 1000 and 100 / 200 series DL-M and NL-M are standards.

C.14 TOILET ACCESSORIES

A. *Professional Note -- (The Professional will review with the Project Manager requirements for toilet accessories in existing and new buildings. Toilet accessories will comply with ADA Requirements. The University has established standards for type and style of products being used for new University buildings in toilet room facilities.)*

B. Paper products for towels and tissue will be in the roll form. Soap dispensers will be of the liquid type. Napkin holders will be dual dispensing and be coin operated. Mirrors will be set in metal frames. Grab bars will have non-slip finish.

C. Standard Toilet Accessory Schedule

Designation	**Description**	**Manufacturer**	**Model**

TA-1	Surface-Mounted, Jumbo Single Toilet Roll Dispenser w/ Stainless Steel Body+	ASI GAMCO	0042 TTD-13
TA-2	Surface-Mounted, Single Toilet Roll Dispenser w/ Theft-Resistant, Cast Alum. Body	Bobrick Bradley ASI	B-2730 5071-50 0263-12
TA-3	Recessed-Mount, Single Toilet Roll Dispenser w/ Theft-Resistant Spindle, Stainless Steel Body	Bobrick Bradley ASI	B-667.60 5102-5255 7402
TA-4	Surface-Mounted, Jumbo Single Toilet Roll w/ ABS Plastic Body*+	Bobrick Kimberly-Clark Georgia Pacific	B-52891 KCC09071 GPC58050
TA-5	Sanitary Napkin/Tampon Dispenser**	By Others (University Vendor)	
TA-6	Partition-Mounted, Sanitary Napkin Disposal Unit w/ Stainless Stl. Body (Two Toilet Compartments)	Bobrick Bradley ASI	B-4354 4721-15 472
TA-7	Surface-Mounted, Sanitary Napkin Disposal Unit w/ Stainless Stl. Body	Bobrick Bradley ASI	B-270 4781-15 0852
TA-8	Surface-Mounted Liquid Soap Dispenser (Mtg. Plate)**	Corian Surell Wilsonart SSV	Oceanic Cobalt 9022-MG
TA-9	Recessed-Mount, Roll Towel Dispenser/ Waste Receptacle; Stainless Steel***	Bobrick Bradley ASI	B-39601 227-PS200170 04523
TA-10	Semi-Recessed Mount, Roll Towel Dispenser/ Waste Receptacle; Stainless Steel	Bobrick Bradley ASI	B-396034 2277-10 045224
TA-11	Surface-Mounted, Roll Towel Dispenser; Stainless Steel Body	Bobrick Bradley A & J	B-2860 2483 U169AJ
TA-12	Surface-Mounted, Roll Towel Dispenser;	Bobrick	B-52860

	ABS Plastic Body*	Bradley	2492
		A & J	U199FL
TA-13	Recessed-Mount, Warm Air Hand Dryer w/ Touchless Operation, 208 V*	Bobrick	B-750
		Bradley	2889-28
		World Dryer	NR246
TA-14	Over-Sink Mirror Unit w/ Stainless Steel Frame & Integral Shelf; 24"w x 36"h	Bobrick	B-292 2436
		Bradley	7805 24x36
		ASI	0625 24x36
TA-15	Full-Length Mirror Unit w/ Stainless Steel Frame & Tempered Glass; 24"w x 48"h	Bobrick	B-290 2448
		Bradley	780 24x48
		ASI	0620B 24x48
TA-16	Stainless Steel Shelf, Tamper-Proof; 8" d x length	Bobrick	B-298 Series
		Bradley	758
		ASI	0692
TA-17	Folding Stainless Steel Utility Shelf (ADA toilets only)*	Bobrick	B-287
		Bradley	790
		ASI	0698
TA-18	Reversible ADA-Compliant Shower Seat	Bobrick	B-5181
		Bradley	9563/9564
		ASI	8206
TA-19	Single Robe Hook	Bobrick	B-6717
		Bradley	9114
		ASI	7340
TA-20	2-Prong Robe Hook	Bobrick	B-6727
		Bradley	9124
		ASI	7345
TA-21	Shower Curtain Rod: 20 ga. Stainless Steel, 1" Dia.	Bobrick	B-6107
		Bradley	SR953
		ASI	1214
TA-22	Broom Stow; 18 ga. Stainless Steel w/ Shelf; 3 Grips	Bobrick	B-239 x 34
		Bradley	9933-34
		ASI	1308
TA-23	Grab Bars: 18 ga., 1.5" Dia. Stainless Steel	Bobrick	B-6806

			Series
		Bradley	8120 Series
		ASI	3500 Series
Partitions	Solid Plastic, Floor-Mounted, Overhead Braced w/ Stainless Stl./ Extruded Alum. Mounting Hardware & Stainless Steel or Alum. Slidebolt: Jacknob #5050 or	Santana Products, Inc	Poly-Mar HD
		Hadrian Manufacturing	Solid Plastic
	Approved Equal; ADA Slidebolt: Jacknob # 6049	Columbia Partition Systems, Inc.	PolyLife Plus 20000 Series

C.15 SECURITY SYSTEMS

A. *Professional Note* – (*The Professional will review with the University, security standards presently in use on the Oakland Campus. The University will review with City officials the use of electric locking devices when required for the project, other security devices and systems will be compatible with those in place.)*

B. Special locking arrangements on means of egress doors will be in accordance with Section 812.4.1.2 of the BOCA National Building Code. The University will apply for variances to these provisions on a project-by-project basis. The existing electric locking devices will be reviewed with the Project Manager.

C. The security standards are a guideline for any security system or device that is supplied, installed and/or modified that will be monitored by the University Security Office.

D. Locking devices for Regional Campuses projects will be compatible with present locking and monitoring systems, and will be in accordance with governing codes having jurisdiction. Alarms will be battery or hardwired as may be needed for the project.

E. Alarm locks will be capable of providing an audible or monitored signaling alarm 24 hours a day. Special devices and alarms will be provided only with the approval of the University.

C.16 SECURITY STANDARD

A. Intent: The intent of the University's security standard will be to provide a guideline for any security system or device that is designed, supplied, installed, or modified that will be monitored by the University Security office and/or maintained by the University. The security systems/devices covered in this standard must have the capability of being tied into the University-wide system. The University will be responsible for determining whether an existing security panel is available or if a new security panel is necessary. The University will be responsible for having/making final connections at the security panels and perform software and program modifications to the Tracer system to incorporate the new security devices/systems. Refer to Division K, Section K.42 for specific requirements of the Electric Lock System.

B. *The Professional will discuss with the Project Manager the need to use any of the security*

systems described below in a specific project.

C. General Requirements:

1. Documentation: *During design, the Professional will require suppliers to pre-qualify their product and submit requested information to assure compatibility with present University system.*

   Submit three (3) sets of documentation which includes but is not limited to the following:

   a. Operations manual: Detailed description of how the device or system operates, including how to make programming changes, if applicable, to the particular unit.

   b. Installation drawings: Details showing exact wiring, wiring numbers, junction boxes etc. (if Contractor installs).

   c. Installation manuals: Details describing how to install, listing materials and equipment needed for installation, and a description of any setup, testing or calibration necessary for operation (if Contractor or University installs).

   d. Maintenance manuals: Listing of potential problems and solutions; wiring schematics (board level layouts if electronics are involved) description of preventative maintenance functions and recommended schedules; spare parts and replacement parts listings and prices. This manual will include the information necessary such that the University can maintain all systems and devices without having to rely on the manufacturer for service if the University so desires.

   e. As-built drawings: Drawings used for installation purposes will be marked in red to show the as-built installation and submitted to the Professional for revising originals. (If by Contractor or University, they will provide the as-builts). Only one (1) set of marked-up drawings need be submitted per job to the Project Manager.

2. Training: If necessary (at the University's discretion), provide in the specification a minimum of four (4) hours of operation training and four (4) hours of maintenance training by the Contractor installing the system. It is the University's intention to have the ability to do maintenance required in-house after the warranty period has expired.

3. Testing: Contractor will demonstrate acceptable system performance during actual operation prior to University acceptance of the system.

4. Service and Warranty: Contractor will maintain a local service organization. Service personnel will be factory-trained. Warranty period will be for twelve (12) months after acceptance. Warranty will include material and labor to repair or replace defective devices or systems. A 24-hour response to a service request is required.

5. Installation: Contractor will employ first-class workmen who will work in harmony with other trades and crafts at the site of the work or adjacent thereto.

If the installation is included, the Contractor will furnish and install cable, conduit, wire mold, junction boxes, etc. necessary for a complete system as required. The installation will meet applicable code requirements. The Contractor will also be responsible for obtaining applicable permits. Wiring will be in conduit or wire mold. Wiring will be a minimum of AWG #18 gauge. Wiring will be tagged describing what device is attached to the wiring.

If the installation is performed by the University, the Contractor will supply completed installation supervision by a factory-trained representative as required by the University.

6. Approvals: Before any system or device is purchased for the purpose of providing security, written approval must be obtained from the Project Manager. The Professional is hereby advised that, any department, person or contractor planning an installation, alteration, addition, or deletion to the security system, which affects the University of Pittsburgh, must receive a written approval from the University.

C.17 SUSPENDED ACOUSTIC TILE CEILING

Suspended ceiling tile systems should be the removable and accessible type. Lighting fixtures and devices will have additional support hangers added to the suspension system for proper reinforcement as required by code. Do not suspend ceiling from ductwork or existing piping above ceiling. Provide access areas to serviceable equipment located above ceilings without the need to remove major portions of the ceiling support system.

C.18 RESILIENT FLOOR TILE

Vinyl composition floor tiles and adhesives will be free of asbestos. Tile will be installed per manufacturer's recommendations. Substrate will be properly prepared prior to installation of materials, provide latex leveling for uneven surfaces and depressions. Provide accessories and trims at transitions of materials. Base will be topset rubber cove or vinyl. Installed surfaces will be protected during construction. At the completion of work, surfaces will be cleaned. Major projects will include waxing of flooring surfaces prior to turning over to the University.

C.19 FIRE PROTECTION FEATURES

A. ***Professional Note – (The Professional will submit the fire protection and life safety analysis outlined in Section A.1 of this manual to the Project Manager for preliminary approval of the Documents by the University and the University Insurance Carrier prior to issuance of contract documents. The Contractor will be required to submit three (3) sets of fire protection system shop drawings and calculations to the University for written approval prior to commencing installation. Any work installed by the Contractor that is not in compliance with the University standards will be removed and replaced at his/her expense if written approval was not given.)***

B. Provide protection systems and/or devices that are required by Code and/or as required by the University Insurance carrier. The Professional will meet with the Insurance Carrier representative, the Project Manager and a representative of the Environmental Health and Safety Office during the design stage of the project to review the fire protection and life safety scope of work.

C. When necessary, the Professional will meet with the Project Manager and the local authority

having jurisdiction to resolve conflicts between various codes and standards. The Professional will support the University with technical documentation any time a variance or appeal to a code requirement is pursued.

D. Fire protection features will be in accordance with the applicable standards except as modified herein.

E. The provisions of the City of Pittsburgh BOCA National Building Code applicable to high-rise buildings will apply to buildings having floors for human occupancy located more than 75 feet above the lowest level of fire department vehicle access.

F. The fire protection systems section of the current edition of the BOCA National Building Code will be adopted by the University in lieu of the equivalent section adopted by the City of Pittsburgh.

G. New installations of automatic sprinkler systems will be hydraulically calculated. Systems will be installed in accordance with NFPA Standard 13 except as modified by the University Insurance Carrier. The University Insurance Carrier requirements are advisory in nature, therefore, the Design Professional will advise the Project Manager in writing of any exceptions taken to these requirements.

H. As a minimum, the following sprinkler design densities and areas of application will be observed:

Hazard Category	Density (gpm/sf)	Area (square feet)	Hose Stream (gpm)
Light Hazard	0.10	1,500	100
Ordinary Group 1	0.15	3,000	250
Ordinary Group 2	0.20	3,000	250
Extra Hazard Group 1	0.30	3,000	500
Extra Hazard Group 2	0.40	3,000	500

In high-rise buildings, the sprinkler control valve will be located inside the stairway and will be a floor control assembly including test valve, sight glass, and express drain.

I. Fire pumps will be electric driven unless the power supply to the facility is deemed unreliable as based on NFPA 20, *Standard for Installation of Centrifugal Fire Pumps*. Standby power supply will be provided to operate the fire pump on loss of power, if the power supply is deemed unreliable. New installations of sprinklers with a fire pump will be designed to avoid the use of pressure reducing valves in the system.

J. Standpipes will be provided with 100 feet of hose and fog-type nozzles unless fully sprinklered.

K. Commercial kitchen hood systems will be protected by dry-chemical extinguishing systems designed per NFPA 17A.

L. Fire alarm systems will be in accordance with the applicable codes and Section K.15, Fire Alarm Systems, of this manual.

M. Smoke control systems where required will be designed in accordance with NFPA 92A. *Recommended Practices for Smoke Control Systems* and NFPA 92B, *Guide for Smoke*

Management Systems in Malls, Atria, and Large Areas.

N. Halon will not be used as a suppression agent on any campus. Alternative gases may be used in critical areas subject to the approval of the Project Manager.

O. Fire extinguishers will be provided as part of the project, as may be required by the authorities having jurisdiction. Professionals will also specify required fire extinguisher cabinets. For general use, and unless otherwise required by codes, fire extinguishers will be 10 lb. ABC type extinguishers complete with mounting hardware.

P. Fire protection systems will transmit alarm and trouble signals to the University's approved central station system.

C.20 MOVEABLE PARTITIONS (LANDSCAPE)

The University has established standards for suppliers of landscape partitions and furnishings (Steelcase & Herman Miller). Verify with the Project Manager the availability of panel systems at the start of the project design, depending on the availability from warehouse stock, use of a certain manufacture may be required for project work as a cost-saving measure and compatibility of systems in the work area.

C.21 CUSTODIAL FACILITIES

A. New Buildings: Provisions will be made for custodial services areas in new buildings. Areas to be provided will consist of: a central receiving/storage area at the service entrance to the building, custodial office, custodial closets to be provided on each floor of the building with a floor level mop receptor - shelf - mop holder, and floor space for a cleaning cart and sweeper. Additional storage areas will be provided as may be required to accommodate servicing and cleaning equipment to be housed in the building. Provide for trash and recycling areas at each floor and at loading docks. (Verify with the Project Manager final requirements.)

B. Existing Buildings: Existing custodial areas will not be deleted unless other similar areas are provided as part of the project. Existing sinks will not be used by the contractors to dispose of materials or cleaning of tools and equipment used to perform the construction work, i.e.: plaster, paints, thinners, etc. Contractors will make other provisions for this cleanup since they will be held responsible for any costs as a result of damages to the facilities.

C.22 EXTERIOR METAL PANELS

A. Exterior metal panel systems will comply with applicable provisions of the "Metal Curtain Wall, Window, Store Front and Entrance Guide Specifications Manual" by AAMA.

B. Panel systems will be reviewed with the University's Facilities Management Office for compliance with design, appearance and intent of the work.

C. Color of the panels will be as selected by the Professional and the University.

D. Manufacturers of the panel system will submit to the owner two (2) 24" square samples of the panel system with the selected panel color for approval prior to manufacturing of the panels. During the course of manufacturing of the panels, two (2) additional 24" square samples will be provided to the University by the manufacturer, to assure the color of the panels are as approved for the project.

E. Shop drawings for the exterior metal panels system will be *prepared and stamped by the panel manufacturer.* The Contractor will provide the University with one (1) set of panels, shop drawings for review and approval prior to manufacturing of the panels. Panel manufacturer will submit written warranties in accordance with the Contract Documents requirements.

F. Panel installer will provide written warranty for two (2) years from the date of final completion and acceptance, guaranteeing materials and workmanship for water-tightness and weather-tightness. During the two-year period, the installer will repair all leaks at no cost to the University.

C.23 DELIVERIES AND STORAGE

A. *Professional Note – (These paragraphs to be used for renovations of existing buildings only.)*

B. Equipment and materials delivered to the work site will be stored at locations approved by the University.

C. The Contractor will coordinate with the University for use of the building loading dock for delivery of construction materials. The Contractor will keep the building loading dock unobstructed at all times.

C.24 TELECOMMUNICATIONS

Professional Note – (The following telephone/data wiring requirements will be provided for new and existing building modifications as may be required for the project's requirements and needs. Verify final requirements with the Project Manager during the development of the Project Documents.)

C.25 ELECTRICAL - GENERAL REQUIREMENTS

A. *Professional Note – (The following are Electrical Note statements that are to be considered in the final design. See DIVISION K for further Electrical requirements.)*

B. Insofar as possible, use existing conduits for all wiring. However, do not reuse existing wiring.

C. Fully coordinate electrical switches, outlets, panels, etc. with the General Contractor so that electrical conduits etc. are concealed in walls and above finished ceilings.

D. Unless otherwise specifically approved by the Project Manager, new wiring in existing and new buildings will be concealed. Should surface mounting be approved, wiring will be encased in wire mold.

E. Contractor will coordinate telephone/data equipment locations with the University.

F. New outlets to be 18" A.F.F., switches mounted at 48" ADA unless otherwise noted, verify compliance with codes and handicap requirements.

G. Existing boxes to be used will receive new devices and cover plates except where grounded devices are already installed.

H. Except as noted, materials will be new and U.L. listed.

I. Work will conform to the latest National Electric Code (Latest Edition).

J. Wire will be run in rigid thin wall conduit except where noted. Minimum size 3/4". Use of BX is prohibited. Use compression fittings for E.M.T.

K. Wire will be type THHN insulated stranded copper. Minimum wire size will be #12 AWG.

L. Use of ENT (non-metallic) conduit will not be permitted without the expressed approval of the University Electrical Engineer.

M. Convenience receptacles will be Hubbell #5362, 20 amps, grounding type or equal, NEMA rated. Switches to be Hubbell #1221, 1223, and 1224.

N. Cover plates for switches, outlets, and receptacles will be stainless steel finish, unless otherwise approved by the University. Surfaces specified to receive wall covering, cover plates will be finished to match wall.

O. Electrical contractor will be responsible for the repair of damages to other contractors work and/or existing work area and to repair said damages to original condition to the satisfaction of the University.

P. New buildings will be equipped with electric meters with the ability to be read and monitored for status of feeds on the Campus Wide (Energy Management) System.

Q. Electrical wiring passing through an environmental air plenum space will be approved for such use or will be installed in metal conduit.

END OF DIVISION

DIVISION D
REQUEST FOR SURVEY INFORMATION
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DIVISION D
REQUEST FOR SURVEY INFORMATION

D.1 GENERAL

A. The University of Pittsburgh has on file surveys of several University property areas. The Professional should check with the University's Project Manager for survey information that may already exist.

B. Should additional survey information be required, the Professional will request it in writing from the University. A map will be included with the request, showing the area to be covered by the survey.

D.2 DRAWING REQUIREMENTS

A. Unless otherwise requested by the Professional, the following requirements will be a part of the final survey drawing.

1. Drawings will be completed on plotted velum or Mylar (not diazo Mylar) and be
    1. 24" x 36" or 30" x 42" in size.

2. Show North arrow.

3. Include legend of symbols and abbreviations used on drawings.

4. Spot elevations on paving or other hard surfaces will be to the nearest ½", on other surfaces to the nearest 1".

5. Boundary and topographic information will be on the same drawing unless noted otherwise by the University.

6. State the elevation and the location of bench marks on each drawing. The datum used establishes the bench marks will be stated: USGS, City, and others.

7. Furnish to the University one plotted velum or Mylar (not diazo Mylar) transparency of each drawing. The licensed land surveyor will sign and seal each drawing which certifies that to the best of his/her knowledge, the information shown is true and correct.

D.3 BOUNDARY SURVEY

A. Unless otherwise specifically requested by the University, the following will be provided as part of the boundary survey:

1. Boundary lines, giving length and bearing, including interior angles, radius, point of tangency, and length of curved lines, location of all existing monuments.

2. Provide the area in square feet if less than one (1) acre; areas larger than an acre are to be in thousandths of an acre.

3. Name, width, ownership and type of surface for streets and highways.

4. Locations of any structures within the property and structures outside of the property at a distance of 50 feet. Provide dimensions to property lines.

5. Any encroachments if they apply.

6. Fences and walls with dimensions to property line, height and top elevation.

7. Known easements and rights-of-ways that cross the property, including ownership.

8. Individual lot lines if they apply.

9. Names of ownership and zoning of adjacent properties.

10. Make notification of discrepancies that occur between the recorded deed and the survey.

11. Furnish a legal description which conforms to the recorded title boundaries.

Before performing field work, the Surveyor will obtain information concerning the site such as deeds, maps, and any additional boundary line information as may be required.

D.4 TOPOGRAPHICAL SURVEY

A. Unless otherwise specifically requested by the University, the following information will be provided as part of the topographical survey:

1. Provide a minimum of one (1) permanent bench mark on the site for each 20 acres with the elevation to the nearest .01 ft.

2. Contours at five-feet intervals or two-feet intervals as required.

3. Spot elevations at a 25 feet grid covering the property.

4. Spot elevations at street intersections and at 10 feet on center on curbs, sidewalks and edge of paving.

5. Locations of existing structures and foundation wall. Show floor elevations and elevations at building entrances.

6. Location of underground utility lines, complete with depth and utility name.

7. Fire hydrants available to the property and size of water lines serving each.

8. Power and communication systems above and below ground.

9. Size, depth and direction of flow for sanitary sewers, storm sewers, catchbasins and manholes serving the property. Provide top and invert pipe elevations at manholes and catchbasins.

10. Names and telephone numbers for operating utilities.

11. Water level at any nearby body of water.
12. Note if property is in a flood plain. Show 100 year flood level of streams or adjacent

bodies of water. Show extent of wetland areas if applicable.

13. Note extent of watershed onto property.

14. Locations of test borings if known and elevations at top of holes.

15. Perimeter outline of thickly wooded areas unless otherwise directed.

B. Additional Requirements: The Professional will verify with the University's Project Manager of any additional requirements or special conditions for survey information.

END OF DIVISION

DIVISION E
INSTRUCTIONS TO PROFESSIONALS REGARDING
SUBSURFACE AND RELATED SITE INVESTIGATIONS
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DIVISION E
INSTRUCTIONS TO PROFESSIONALS REGARDING SUBSURFACE AND RELATED SITE INVESTIGATIONS

E.1 SCOPE

A. The Professional will obtain assistance from his/her Civil/Structural Engineer as set forth in these instructions and be responsible for obtaining subsurface and related data that will yield sufficient information for an accurate evaluation of the existing subsurface and related conditions for the following purposes:

1. Analysis, design and construction of foundation and substructure.

2. Analysis, design and construction of site work, including embankments, slopes retaining structures, underground structures, site and subsurface drainage, roads and pavements.

3. Soil erosion and sedimentation control.

4. Cost analysis and estimation of rock excavation.

5. Analysis of excavation and fill problems.

E.2 INITIAL INVESTIGATION AND INSPECTION, PRIOR TO SCHEMATIC DESIGN STAGE

A. Prior to schematic design phase, the Professional's Civil/Structural Consultant will, with the Professional's help, contact the University's Project Manager for this project for data mentioned in items (G) and (H) of the section E.4. The Civil/Structural Engineer will then visit the site of the proposed project and inspect by visual or physical means the topographical and geological conditions that are prevalent. Particular attention will be directed to the following:

1. Evidence of fill material.

2. Outcrops of rock strata.

3. Type of overburden.

4. Features of the terrain.

5. Substructure of adjacent buildings.

6. Water levels (ground and other).

7. Previous boring results and foundation reports on projects in the vicinity of the proposed facility.

8. Preliminary subsurface and related site investigation report if available.

E.3 INITIAL ANALYSIS AND RECOMMENDATIONS - SKETCH SUBMISSION

A. Data obtained from the initial investigation and inspection will be analyzed by the Professional and his/her Civil/Structural Engineer and will constitute the basis for recommending one of the following procedures at the schematic design phase:

1. Proceed with design without further investigation.

2. A limited number of test borings and/or test pits be completed and analyzed under his/her supervision. The Test Boring Plan, Specifications and Contract Documents form a part of the Schematic Design. These documents will be prepared by the Professional in accordance with Paragraphs E.4 and sections A through M below with necessary technical information from his/her Civil/Structural Engineer.

3. Based on the initial investigation and inspection and analysis outlined in Paragraphs E.2 and E.3 above, a brief report bearing the title "INITIAL SUBSURFACE AND RELATED SITE INVESTIGATION REPORT" will be prepared by the Civil/Structural Engineer. Two (2) copies of this report will be included in the documents to be submitted for the Schematic Design to the University.

E.4 PREPARATION OF TEST BORING PLAN, SPECIFICATIONS AND PROPOSALS - SCHEMATIC DESIGN

A. If further investigation is to be made, the Professional will prepare a tracing, showing the location of test borings. The drawing will be the identical size of the other contract drawings, and will be titled and numbered "TEST BORING PLAN, SHEET NO. TB1". Where more than one (1) Test Boring Plan is required, the numbering will be consecutive, such as TB2, TB3, etc.

B. Each test boring will be a suitable number, and the drawing will contain a schedule, showing the boring number, contract depth, and surface elevation. The surface elevation data, however, is not to be filled in by the Professional, until the elevations have been obtained at the time of staking out the holes.

C. The drawing will contain a note to the effect that "all test borings will be carried to the depths listed in the schedule, except where rock is encountered prior thereto, in which case, the coring will extend five (5) feet into the rock, whether or not the final depth is more or less than the depth listed in the schedule, except that holes Nos. --- will be carried to the contract depth regardless of the material encountered." If necessary, the stipulated rock penetration may be increased 10, 15 or 20 feet into rock.

D. In sections of the State where LIMESTONE FORMATIONS are predominant, it will be stipulated on the test boring drawing TB1, that rock coring will be carried to such depths that at least ten (10) feet of continuous bedrock has been intercepted, so as to insure against stopping just above a thin rock shelf. Furthermore, in these limestone regions, it will be stipulated on the test boring drawings, that rock coring will extend at least ten (10) feet below the proposed footing elevation and will meet the above criteria.

E. The Professional, when preparing the drawings, must bear in mind that the test borings are made only for the purpose of obtaining accurate design information, such as bearing value of the soil and rock, cost data, and ground water conditions. Test boring drawings are not included in the contract drawings for the construction contracts.

F. The contract depth of borings will be such as to extend at least ten (10) feet below the bottom of footings and will generally be listed in multiples of five (5) feet, at 10', 15', 20', etc. However, certain holes will be carried to a greater depth (50' to 100') and these holes will be carried to the contract depth regardless of the material encountered. The number and depth of these holes will be dependent on the size and complexity of the situation, but generally at least one (1) hole will be so designated.

G. Auger borings may be stipulated on the Test Boring Plan in lieu of standard test borings, for shallow utility lines, where deemed appropriate by the Professional. Contract depth of auger borings will be at least two (2) feet below the bottom of the utility lines, but will only be carried to such depth as to determine the elevation of rock which may occur above the contract depth.

H. At least one (1) test hole will be designated on the drawings as WATER OBSERVATION HOLE. Specifications will provide that before casings are withdrawn from these holes, a small steel pipe equipped with a well point be installed in these holes to a depth below the basement or lowest floor level. The pipe will be packed in coarse sand or gravel and will extend above grade so that during the period of design work, the ground water level may periodically be observed.

Test boring drawing must therefore indicate the elevation of the basement or lowest floor level, and the borings selected to be developed into ground water observation holes must be of such contract depth, regardless of conditions, so as to accommodate the well point and water pipe to the required depth.

I. The Professional will prepare specifications for test borings. He/she will prepare the proposal and invitation to bidders. The proposal will be a lump sum price based on performing work required by the drawings and specifications and a schedule of contract quantities furnished by the Professional. The contract agreement will be between the Professional and the Contractor.

J. An example of the Schedule of Contract Quantities to be prepared by the Professional and to be included in the Professional's request to Drilling Contractors for proposals is as follows:

SCHEDULE OF CONTRACT QUANTITIES

No. Holes	Earth Drillings	Rock Coring	Total Footage
45 Std. Borings	600 Lin. Ft.	275 Lin. Ft.	875 Lin. Ft.
30 Auger Borings	180 Lin. Ft.	----------	180 Lin. Ft.

NOTE: The Schedule of Contract Quantities will appear on the Test Boring Plan - TB1.

K. In addition to the lump sum price, the Professional will request prospective bidders to furnish the unit prices listed below, which will be used to adjust the lump sum price, for variances between the Schedule of Contract Quantities and the actual work performed.

1. Earth Drill (Standard Test Borings), complete, per lineal foot.

2. Rock coring, complete, per lineal foot.

3. Setting up equipment for drilling standard test borings.

4. Auger borings complete, per lineal foot.

5. Test pits, complete, per test pit.

6. Thirty (30") inch long undisturbed samples, per sample (if required).

L. The Professional, when requesting proposals, must stipulate a date for receipt of proposals, the minimum number of drilling rigs to be used by the Contractor, and a specific date on which work (including submission of result drawings), must be complete. In establishing the completion date, the Professional will use the following guide:

1. Allow one (1) week after bid date for Authorization to Drilling Contractor to proceed.

2. Number Weeks Drilling Time

$$\frac{\text{TOTAL FOOTAGE}}{35 \times \text{Number Rigs} \times 5}$$

3. Allow two (2) or three (3) weeks for preparation and submission of result drawings.

M. Test Boring Result Drawings: It is the responsibility of the Professional to specify additional requirements and to prepare all other contract documents. The Drilling Contractor will prepare drawings showing the results of the borings. These drawings will be identical in size to contract drawing TB1. The Drilling Contractor will place his/her title block in the lower left hand corner, leaving the lower right hand corner open for the Professional to insert any necessary information to properly identify the project. In no event will the Professional identify his/her firm with the test boring result drawings.

E.5 AUTHORIZATION OF TEST BORING CONTRACT AWARD, TEST BORING INSPECTION WORK SOILS ENGINEER WORK AND TEST BORING HOLE LOCATION

A. Upon receiving approval of the Test Boring Plan, the Professional will solicit proposals from as many responsible and experienced Drilling Contractors as may be deemed reasonable (preferably not less than 3) by submitting to each of them one (1) set of contract documents. Proposals will be completed and signed by the Contractor and returned to the Professional with a transmittal letter on letterhead of the Contractor.

B. At the same time, the Professional will draw the attention of his/her Civil/Structural Consultant to his/her responsibilities towards the performance of test boring work, observation of ground water levels and soils engineering work as required by Paragraphs E.6, E.7, E .11 and E.12 of these instructions and have him/her contact the University's Project Manager with recommendations for appropriate inspection work and soils engineering work and obtain his verbal concurrence.

C. Upon receipt of bids, the Professional will prepare bid analysis consisting of a comparative statement, bid evaluation and recommendations for contract award. The Professional will submit proposals for test boring contract award, test boring inspection work and soils engineering work to the University's Office of Facilities Management for written confirmation to proceed with the contract.

D. Unless otherwise advised, the test boring locations will be staked out by the Drilling Contractor.

E.6 PERFORMANCE OF TEST BORING WORK: DIRECTION, INSPECTION, SOILS ENGINEERING WORK AND CHANGES

A. The test boring work will be properly directed by the Professional's Civil/Structural Engineer who will provide part-time inspections and also ensure reasonably correct identification of subsurface materials and ensure conformance of the work to contract documents. The Professional will have his/her Civil/Structural Engineer contact the University's Project Manager and discuss the program for test boring inspections and soils engineering work. Cost of this inspection and soil engineering work by the Civil/Structural Engineer is reimbursable (see Paragraph E.13). Obtaining ground water elevations is a part of the test boring inspection (see Paragraph E.7).

B. If it is considered necessary to drill additional test borings or to make significant changes in the test boring program, the Civil/Structural Engineer of the Professional should promptly make this recommendation, to the University's Project Manager prior to completion of the previously approved test boring program.

C. The Contractor's test boring logs are the basic records of subsurface data collected and are important. The primary purpose of inspection is to ensure correctness of this document and the Test Boring Result Drawings which are based on the logs. The Professional and his/her Civil/Structural Engineer are responsible for achieving the proposal of this inspection.

E.7 GROUND WATER LEVELS

It will be the responsibility of the Professional and his Civil/Structural Engineer to observe ground water levels at suitable intervals during the entire design stage and to tabulate and include this information in the Soils Report. Addendum should be prepared for observations made after preparation of Soils Report.

E.8 RELEASING TEST BORING INFORMATION

The Professional will furnish a copy of this Geotechnical Engineering report to Contractors upon receiving a letter of request. The Geotechnical Engineering reports are available for review at the University's Facilities Management Department. The University will not provide copies to Contractors.

E.9 TIME OF COMPLETION OF INVESTIGATION

The subsurface investigation will be completed prior to, and the results will be part of, the Design Development Phase.

E.10 SUBMISSION OF DOCUMENTS TO THE UNIVERSITY

References should be made to University Project Requirements and Contractual Agreements regarding documents to be submitted for various reviews.

E.11 SERVICES OF FOUNDATION CONSULTANT

A. When deemed necessary by the Professional's Civil/Structural Engineer and the Professional and approved by the University, a qualified Foundation Consultant with a minimum of five (5) years experience will be retained for the purpose of furnishing any or all of the following services:

1. Providing technical assistance in programming the subsurface investigation. Please note that contract documents for test boring, auger boring and test pit work will be prepared by the Professional. The Professional will solicit bids and provide contract administration.

2. Furnishing adequate qualified resident inspection during the execution of the subsurface investigation.

3. Laboratory testing of soils and of rock core specimen.

4. Checking Drilling Contractor's boring result drawings.

5. Furnishing the subsurface and related site investigation report.

B. Principals will be Registered Professional Engineers. Final reports will be prepared, signed, and sealed by a Registered Professional Engineer.

C. The Professional will submit for approval, a detailed estimate of cost for field, laboratory, and office work.

D. In addition, the Foundation Consultant, or a qualified Registered Professional Engineer from the Foundation Consultant's firm, familiar with the project, should be available for any job conferences or consultations during the design and/or construction phases of the project. The Professional will submit the name of the Registered Professional Engineer for approval and experience brochure to the University for approval.

E. Upon completion of the boring contract, the Foundation Consultant will submit to the Professional four (4) copies of a complete report covering the field work and laboratory testing, with complete analysis of each and every boring and with recommendations for soil and rock bearing capacities The Professional will retain one (1) copy, submit one (1) copy to the University's Project Manager and the remaining two (2) copies to the University with Preliminary Submission documents. The Table of Contents for subsurface and related investigation report is furnished in Paragraph E.12.

F. As payment for the above professional foundation services, the Professional will be reimbursed for all costs incurred directly by the foundation engineering firm. These costs will be determined on the following basis:

1. For all work, excluding laboratory testing, the total cost will be salary cost (**AGREED MULTIPLIER**) (Principals' salaries not subject to multiplier) plus travel (**AGREED MILEAGE**)/mile, subsistence, and long distance telephone expenses. Invoices must be supported by payroll summaries showing names, classifications, hourly rates, and hours and dates worked.

2. Costs for laboratory testing will be in accordance with firm's established unit prices for the various necessary tests.

E.12 SUBSURFACE AND RELATED INVESTIGATION REPORT

Subsurface and Related Investigation Report will be prepared by the Civil/Structural Engineer or by the Soils Consultant, in accordance with Paragraph E.11. The Table of Contents is as follows:

1. Project location map.
2. Boring location plan.
3. Scope of Report.
4. Description of Site.
5. Field investigation.
6. Laboratory testing program (when required).
7. Brief Description of subsurface conditions.
8. Ground and surface water conditions and data.
9. Soil Profiles (if necessary).
10. Recommend soil and rock bearing capacity and elevations of corresponding bearing stratum at each bore hole.
11. Soil erosion and sedimentation control recommendations.
12. APPENDIX:
    (a) Core boring logs.
    (b) Laboratory test results (where applicable).
    (c) Other data.

E.13 PAYMENT

A. Upon prior approval of the University's Project Manager, the Professional will be entitled to reimbursement as follows:

1. Actual cost of drilling (or test pit) work per Contractor's invoice.

2. Actual cost of soil engineering work performed by the Civil/Structural Engineer in compliance with Paragraphs E 2, E 3, E 6, and E 7. This "actual cost" will consist of cost per technical payroll X (AGREED **MULTIPLIER**) plus cost of travel at (**AGREED MILEAGE**)/mile, subsistence, and long distance telephone expenses. Principal's salaries are not subject to multiplier.

3. Actual cost of soil engineering work performed by the Civil/Structural Engineer in compliance with Paragraph E 12 .

4. 10% markup of a + b + c.

5. 10% markup on Items (b) and is not applicable if the Civil/Structural Engineer is an employee of the Professional.

6. 10% markup of Items (a), (b) and (c) allows for preparation of test boring contract documents and related work by the Professional and coordination of soil engineering work by the Civil/Structural Engineer.

E.14 INVOICING

A. The Professional should present billings to the Facilities Management Office on his/her own invoice. One invoice should be submitted for test boring/test pit work and another one for inspection and soil engineering work. Originals and one (1) copy of invoices/bills and one (1) copy of back-up information.

B. The Professional will obtain necessary assistance from the Civil/Structural Engineer and certify in his/her invoice for test boring/test pit work that the drilling/test pit contractor has performed the work satisfactorily in accordance with contract documents, that all quantities were verified by him and that it is in order to make payment for the amount claimed by the Contractor. The Professional will also certify that the reimbursement

claimed in his/her invoice has not been previously claimed by him/her in part or in full. One (1) copy of driller's invoice and one (1) copy of our letter authorizing the contract award must accompany this invoice.

C. Invoice for soil engineering work rendered by the Soil Engineer or Civil/Structural Engineer must be accompanied by one (1) copy of our authorization letter.

D. Rates in excess of the University's agreement requirements will not be used.

E. Invoices must be signed by the Professional or his/her on-duty authorized representative.

F. Back-up information must be signed by authorized personnel of the Soil Engineer or Civil/Structural Engineer.

G. Invoices which are not in accordance with these instructions will not be processed. Invoices exceeding authorization will not be processed.

H. Any questions should be directed to the University's Project Manager for this project.

E.15 INSURANCE

The soils consultant will be required to carry insurance with a minimum coverage of $1,000,000 as outlined below:

During the course of the work, the Engineer will maintain:

1. Workman's Compensations Insurance as required by the Commonwealth of Pennsylvania for all employees working at the job site.

2. Comprehensive General Liability Insurance
   Bodily Injury: $1,000,000/1,000,000 limits
   Property Damage: $100,000/300,000 limits

3. Automobile Liability Insurance
   Bodily Injury: $1,000,000/1,000,000
   Property Damage: $100,000 limits

4. Professional Liability Insurance covering claims resulting from errors, omissions, or negligent acts of the Professional or his/her consultants with a maximum allowable deductible of $25,000. Professionals will indicate in their proposal the level of coverage maintained.

END OF DIVISION

APPENDIX-A

STANDARD FORM, RECEIPT FOR

TEST BORING RESULT DRAWINGS

University Project No._____

_____

_____

_____

RECEIVED of _____,

retained Professionals for the above numbered project, unofficial test boring data, which is accepted by the undersigned under the following terms and conditions:

Any available data concerning subsurface materials or conditions which is based upon soundings, test pits or test borings, has been obtained by the retained Architects or Engineers for their own use in designing this project. Its accuracy or completeness is not guaranteed by The University of Pittsburgh or the Architects or Engineers, and in no event is it to be considered as part of the contract plans or specifications. Contractors must assume all risks in excavating for this project and will not be entitled to rely on any subsurface information obtained from the retained Architects or Engineers, or indirectly from The University of Pittsburgh. Bidders will therefore make their own investigation of existing subsurface conditions, and if they do not do so, The University of Pittsburgh will not be responsible in any way for the consequences.

_____
(Bidder)

Dated_____ 20___.

DIVISION F
DRAWING STANDARDS
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DIVISION F
DRAWING STANDARDS

F.1 GENERAL

A. 1. The Office of Facilities Management has the responsibility for the care, use, storage and retrieval of all architectural and engineering drawings done by and for the University of Pittsburgh. This applies to drawings generated by projects contracted to outside Professionals as well as in-house design.

2. Facilities Management has developed these standards for continuity and to ensure that certain drawing standards and instructions are applied to drawings produced by and for the University.

B. Drawings shall contain:

1. Adequate information to include schedules, details and pertinent information to perform the work.

2. Uniformity of methodology.

3. Uniformity of drawing size.

4. University assigned Job Numbers, Drawing Numbers, and Room Numbers.

5. Professional stamp and signature on drawings.

6. The cover sheet on new construction projects shall include the building construction type and fire resistance ratings for building elements.

C. 1. Construction drawings must be submitted to Facilities Management in **AutoCAD versions up to ver. r2006.**

2. Each CAD construction drawing, floor plan, elevation, etc., must have its own separate CAD file. CAD floor plans must stack properly above on another with an insertion point of (0,0,0).

3. Drawings shall be drawn at full scale, 1 inch = 1 inch.

4. X-refs shall not be used. If unavoidable, X-ref's shall be converted to blocks using the X-ref bind (insert) command.

5. Unless the drawing is specifically intended to be 3D, great care should be taken to ensure that lines, blocks, etc., are drawn at and have a Z value of 0 (zero).

6. Two (2) sets of electronic files shall be submitted on CD in **AutoCAD** and **Adobe PDF**, accompanied by an index file. The index file should be an Excel file describing the contents of each sheet.

7. A CD containing University of Pittsburgh border sheets, graphic symbols, and layers is available for Professionals. A copy should be requested from the University's Project Manager.

D. Facilities Management's Technical Services Support Group will provide assistance in the development of documents, and provide key plans, reference prints, archival information, drawing numbers and is also responsible for assigning appropriate room numbers to new configurations.

F.2. DRAWING STANDARDS

A. Standard drawing sizes shall be 24" X 36" or 30" X 42", with current University Title Block. (*See Sample Attached)*

B. Exceptions to the above drawing sizes must be approved **BEFORE** drawings are made.

C. A minimum 3/32" size lettering will be permitted when space is limited, but larger point sizes are preferred.

D. Projects with five (5) or more drawings shall have a Cover Sheet with an Index listing of drawings, showing the reference number of each drawing and a Descriptive Title of the Drawing.

E. The cover sheet shall show the Name of the Project, the Job number, a Key Plan, Legend and a Complete List of Drawings with their Drawing Numbers.

F. A Legend showing reference symbols and abbreviations used in the preparation of the drawings, with a clear explanation of each must appear on appropriate drawings.

G. Each set of drawings shall include General, HVAC, Plumbing and Electrical notes where applicable. Notes shall indicate areas of Owner/Contractor responsibilities and any special conditions or instructions relating to the work to be performed.

H. Drawings shall include Structural Notes describing Live Loads used in the structural design and highlight any Structural Design Characteristics such as post-tensioning, etc. which may have to be taken into consideration in future renovations of the structure.

I. Each drawing shall show a reference to the drawings having the Notes and Legends. Lettering must be 3/32", or larger.

J. Drawings that show a floor plan or partial plan, shall show a Campus North Arrow and a Key Plan indicating Area of Renovation or Alteration, Nearest Street, and Best access for the Contractors (*See Campus Plan attached).*

K. Plan drawings shall show Column and Row identification as shown on the original building construction drawings, where applicable.

L. Room Numbers shall be assigned by Facilities Management's Technical Services Office via the Project Manager. Room Numbers must be assigned as soon as the new design configuration has been approved. Architectural design shall be coordinated with Mechanical, Plumbing and Electrical Design regarding new or changed room numbers.

M. Fire Walls and Smoke Barriers shall be defined and identified on the drawings; openings or penetrations shall be fully coordinated with all disciplines.

N. Specifications shall be a part of every design project. Drawings and Specifications shall be submitted to the assigned Project Manager for circulation and review.

O. During the construction period, Contractors must provide "As-Built" prints to the Professional of Record. The Professional shall revise the original drawings accordingly and supply Facilities Management with revised AutoCAD files and PDF files. NOTE: Payment of last invoice for Professional services will not be released until these reproducible drawings are provided to the Project Manager.

P. Drawings shall bear a Professional Stamp with Signature.

Q. Standard symbols have been adopted by Facilities Management for the development of drawing documents. Certain primary Architectural, Mechanical, Plumbing and Electrical Reference Symbols shall be used (refer to illustrations provided in this Division).

R. Drawings not conforming to these standards shall be corrected by the Professional at no cost to the University.

F.3 ADDENDUM TO DRAWING STANDARDS

Providing "As Built" Drawings:

1. AutoCAD is the method of preference for drawings done by and for the University of Pittsburgh.

2. Original bid drawings plotted on reproducible media and "as builts" provided on CD's or DVD's in an AutoCAD compatible format will satisfy the requirements of the University.

3. Drawing files using AutoCAD-compatible software i.e., Intergraph, etc., must be formatted and provided as AutoCAD.DWG or DXF, and must be accompanied by hard copy.

4. CD's or DVD'S are acceptable for delivery of electronic files.

5. The Professional must provide original drawings to the University for bid and construction prints, and is responsible for obtaining "as built" information from the Contractor and revising the originals. **Diazo mylars or sepias are unacceptable.**

F.4 TITLE BLOCK

A. Title Block shall be standard University of Pittsburgh as shown in this manual.

B. Title Block shall state Building Name, Area of Renovation, and Clear Description of what is being conveyed on the drawings.

C. A Drawing File Number shall be assigned by the Technical Services Office via the Project Manager. This number shall be shown in the title block along with the University's Project Job Number.

D. A Categorized Sequential Number shall accompany the assigned drawing number, i.e. XXXX A1, XXXX A2 etc.

E. Total Number of Complete Working Drawings in Set, including all disciplines, shall be indicated on the Title Block to the right of Categorized Sequential Number, and also on the cover sheet. For example: (2 of 5), (9 of 15) etc.

F. Drawings shall have the Same Date in the Title Block. Refer to Title Block example provided.

F.5 DRAWING TITLES

A. The following drawing category designations shall pertain to all projects as a standard for the various disciplines of design.

TYPE OF DRAWING	CATEGORY
Cover Sheet	**CS-1**
Architectural	**A-1, A-2,etc.**
Heating, Vent. A/C	**HVAC-1,etc.**
Electrical	**E-1, E-2,etc.**
Plumbing	**P-1, P-2,etc.**
Site Plans	**S-1, S-2,etc.**
Structural	**ST-1, ST-2,etc.**
Steamline	**STM-1, STM-2,etc.**
Furniture	**F-1, F-2,etc.**
Fire Alarm System	**FAS-1, FAS-2,etc.**
Environmental Health & Safety	**EHS-1, EHS-2,etc.**
Fire Protection	**FP-1, FP-2, etc.**

F.6 DRAWING CHECKLIST

A. Obtain Facilities Management Drawing FILE NUMBER.

B. Ascertain that Existing Conditions, Demolition, and New Construction are properly identified.

C. Include Key Plan and Campus North Arrow on drawings having site and floor plans or partial floor plans.

D. Provide Dimensions and Ceiling Heights for areas of renovation or alterations.

E. Use Proper Symbol Identification on Sections, Details and Elevations.

F. Provide applicable Notes, Schedules, and Legends etc. that pertain to the work.

G. Cross Reference work of other trades.

H. Indicate Demolition with Dotted Lines.

I. Provide Column and Row Identification on building plans.

J. Coordinate New Room Numbers and Room Number Changes with Facilities Management.

K. Provide Cover Sheet and Index for projects with five (5) or more drawings.

L. Complete Title Block information.

M. Provide Professionals Stamp and Signature on drawings.

N. Indicate clearly Fire walls and Smoke Barriers where applicable.

O. Include Air Distribution and Air Handling Unit Schedules on mechanical drawings.

P Indicate Supply and Return Ducts, Transitions, Duct Sizes, Thermostats, Registers and Dampers on drawings.

Q. Provide Isometrics, as well as Line Diagrams and Risers on Plumbing drawings.

R. Provide Circuit Numbers, Wiremold, Wire Sizes, Switches, Catalog Numbers, Manufacturer, Wattage, Voltage, and Symbol Legend on lighting plans.

S. Provide Panel Identification, Outlets, Circuit Numbers and Wire Sizes on power plans.

T. Provide Single Line Diagram for new panel feeds.

U. Fire alarm riser diagram, alarm matrix and system operation defined, if applicable; including interface with security and/or building management systems.

V. Provide Security System Schematic with system operation defined if applicable.

W. Provide Electric Lock System Schematic with Panel Diagrams, Interface and Tracer Remote Panel with Junction Boxes included if applicable.

X. Indicate Single Line Diagram, Fuse Sizes and Metering on High Voltage 4160V drawings.

Y. Provide complete Specification for the work.

F.7 CRITERIA FOR ASSIGNING ROOM NUMBERS

A. The University has developed criteria for assigning room numbers to facilitate Space Management's needs to input space data on the University's Space Server. The criteria are as follows and are strictly adhered to in new construction. In older buildings adherence is occasionally precluded when feasibility is questioned.

1. Technical Services is authorized to assign room numbers, and should be contacted via the Project Manager when any renovation involving partition changes is planned.

2. Any new configuration should have room numbers assigned before further design or other disciplines are involved.

3. Numbers can only be used once per building. Duplicate numbers cause major problems with the Insite Database.

4. When a design involved only a partial floor plan, the entire floor must be considered to avoid duplicating room numbers.

5. Numbers are arranged on each floor to follow an ascending order if possible, such as 201 being directly above 101, etc.

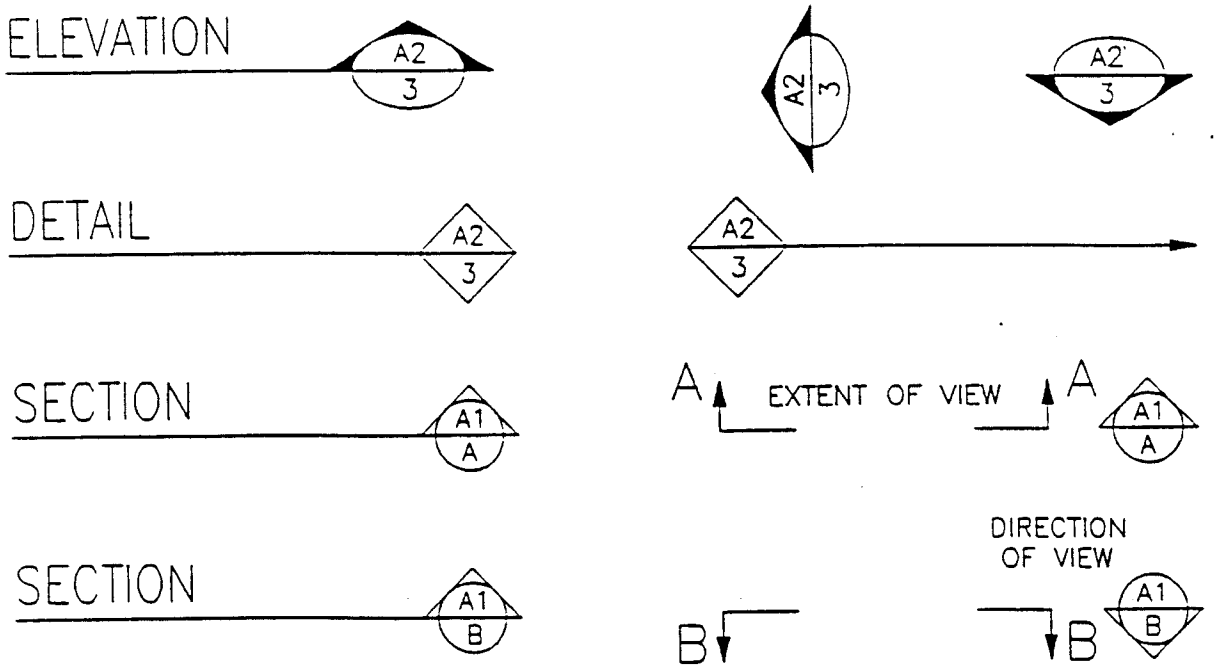
6. Each door with a lock needs to be identified for tumblers to be set, keys cut and control of key distribution. When a space has more than one (1) door, all doors have the same number installed on the side leading into that space, but the space itself has only one number.

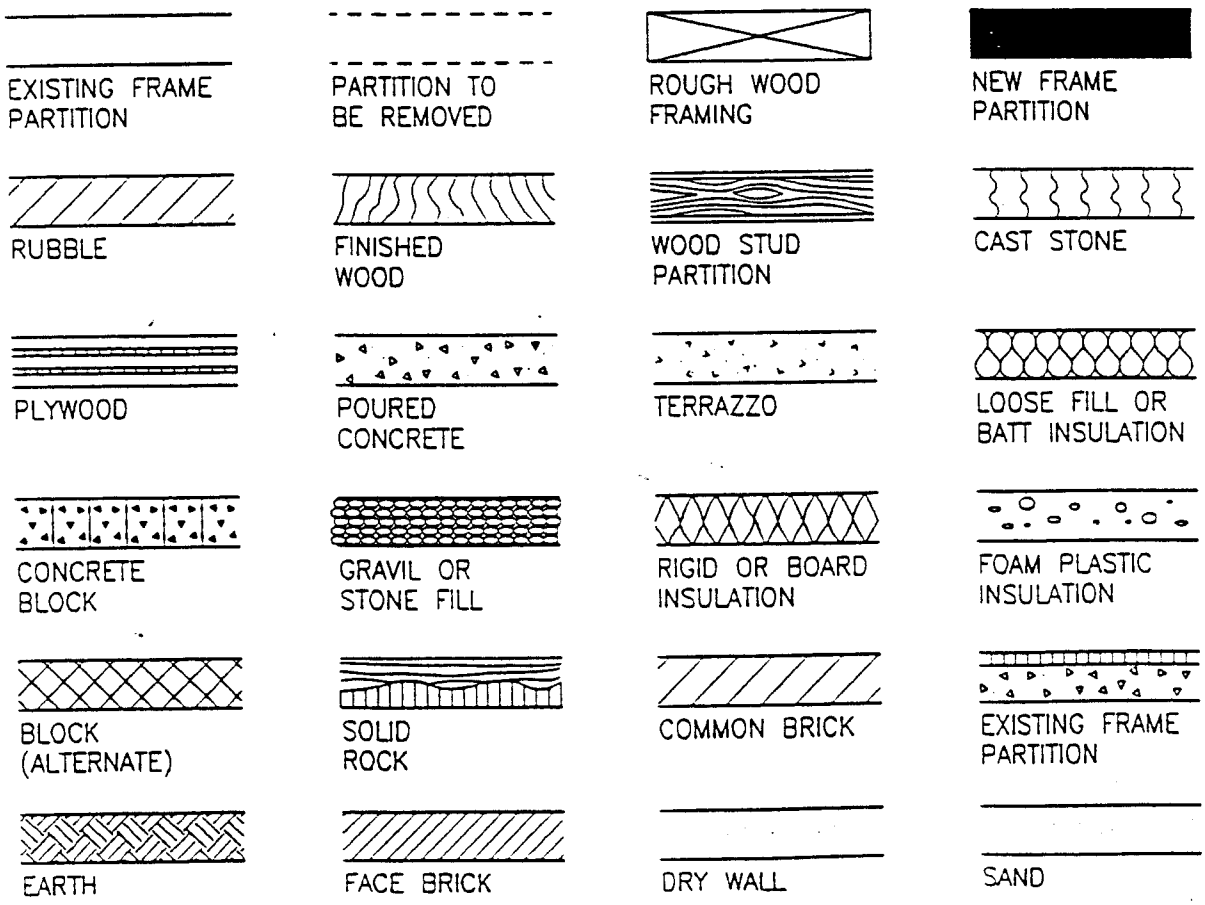
F.8 DRAWING SYMBOLS

The following are Standard Symbols for drawings designed for the University of Pittsburgh. Designers are expected to adhere to these symbols. To symbolize other information for which no standard is illustrated in Division F, Designers may use their discretion about other commonly used symbols.

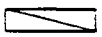
END OF DIVISION

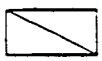
ARCHITECTURAL SYMBOLS

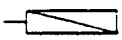


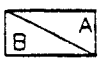


ELECTRICAL SYMBOLS


SURFACE MOUNTED FLUORESCENT LIGHT FIXTURE (2 tube)


RECESSED FLUORESCENT LIGHT FIXTURE (4 tube)


STEM MOUNTED FLUORESCENT LIGHT FIXTURE



SEPARATELY SWITCHED BALLASTS

WALL MOUNTED FLUORESCENT LIGHT FIXTURE

EXISTING LIGHT FIXTURE

FIXTURE TO BE REMOVED


INCANDESCENT LIGHT FIXTURE


WALL MOUNTED INCANDESCENT LIGHT FIXTURE


FIXTURE TO BE REMOVED



HIGH PRESSURE SODIUM LIGHT FIXTURE



HIGH PRESSURE SODIUM LIGHT FIXTURE - LOWER WATTAGE



LOW PRESSURE SODIUM LIGHT FIXTURE



LOW PRESSURE SODIUM LIGHT FIXTURE - LOWER WATTAGE


EXIT SIGN PROGRESS UNIVERSAL

PANEL BOX


FAN

ELECTRICAL SYMBOLS (continued)



JUNCTION BOX



DISCONNECT SWITCH



SWITCH



THREE WAY SWITCH



DUPLEX OUTLET, 2" X 4"



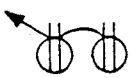
DOUBLE DUPLEX OUTLET, 4" X 4"



GROUND FAULT INTERCEPTOR



220V RECEPTICAL



HOMERUN



WIRES



NEW WIREMOLD



WIREMOLD TO BE REMOVED



FLOOR DUPLEX RECEPTACLE OUTLET



FLOOR TELEPHONE OUTLET (PRIVATE)



PHONE



DATA OUTLET



DOG HOUSE WITH DATA PORT

ELECTRICAL SYMBOLS (continued)



ELECTRIC DOOR LOCK


FIREMAN'S PHONE JACK


SPEAKER



PULL BOX


PULL BOX WITH BELL


HORN WITH FLASHING LIGHT

TSP TWISTED PAIR WIRE



SMOKE DETECTOR



HEAT DETECTOR



MOTION DETECTOR



SPRINKLER



RELAY BOX



PHOTO SENSOR

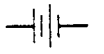

ANNUNCIATOR


LIGHTNING ARRESTER


RESISTOR


CAPACITOR

ELECTRICAL SYMBOLS (continued)


BATTERY


GROUND


SWITCH–SINGLE THROW


FLOW SWITCH–CLOSES ON INCREASE IN FLOW


LIMIT SWITCH–NORMALLY OPEN


PRESSURE SWITCH–CLOSES ON RISING PRESSURE
(ALSO USED FOR VACUUM)


TRANSFORMER


CIRCUIT BREAKER


FUSE

NOTE:

WATTAGE, VOLTAGE, TYPICAL FIXTURES, MANUFACTURER, AND CATALOG NUMBERS MUST BE NOTED WHEN APPROPRIATE.

MECHANICAL SYMBOLS

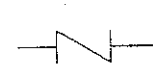

BALL VALVE

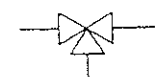
BUTTERFLY VALVE


DIAPHRAGM


GATE VALVE


GLOBE VALVE


CHECK VALVE

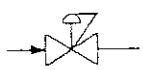

3 – WAY VALVE

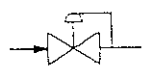

NON – RISING STEM

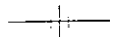

OUTSIDE STEM & YOKE

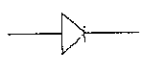

ELECTRIC CONTROL VALVE

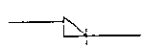

PNEUMATIC CONTROL VALVE

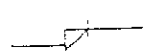

PRESSURE REDUCER – SELF CONTAINED


PRESSURE REDUCER – EXTERNAL


UNION


REDUCER – CONCENTRIC

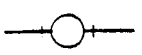

REDUCER – ECCENTRIC; STRAIGHT INVERT

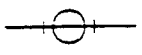

REDUCER – ECCENTRIC; STRAIGHT DOWN

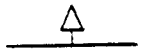
MECHANICAL SYMBOLS (continued)

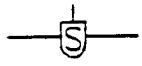
——CP——	CONDENSATE PUMP DISCHARGE
——A——	COMPRESSED AIR
——VAC——	VACUUM (AIR) LINE
——H——	HUMIDIFICATION LINE
——D——	DRAIN
——C——	CONDENSER WATER SUPPLY
——CR——	CONDENSER WATER RETURN
—CHWS—	CHILLED WATER SUPPLY
—CHWR—	CHILLED WATER RETURN
——HPS——	HIGH PRESSURE STEAM
——MPS——	MEDIUM PRESSURE STEAM
——LPS——	LOW PRESSURE STEAM
——HPR——	HIGH PRESSURE RETURN
——MPR——	MEDIUM PRESSURE RETURN
——LPR——	LOW PRESSURE RETURN

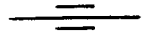
MECHANICAL SYMBOLS (continued)


TEE - OUTLET UP


TEE - OUTLET DOWN


AIR ELIMINATOR

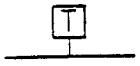

AIR SEPARATOR


ALIGNMENT GUIDE

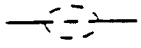

MAIN ANCHOR

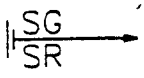

EXPANSION JOINT


PRESSURE GAUGE

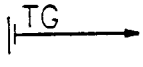

THERMOMETER


PRESSURE REDUCING VALVE

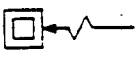

ROUND DUCT VOLUME DAMPER

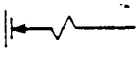


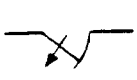
SUPPLY GRILLE OR REGISTER; SIDEWALL



TRANSFER GRILLE


RETURN GRILLE - CEILING


RETURN GRILL OR REGISTER; SIDEWALL


DOOR GRILLE


SUPPLY DIFFUSER - CEILING

MECHANICAL SYMBOLS (continued)



FLANGED JOINT



SCREWED JOINT



BELT & SPIGOT JOINT



WELDED JOINT



SOLDERED JOINT

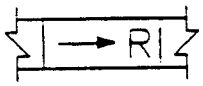


SOLVENT CEMENT JOINT

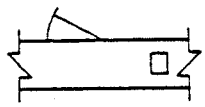
MECHANICAL SYMBOLS (continued)



DUCT SECTION – NEGATIVE PRESSURE



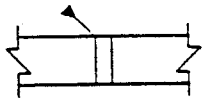
CHANGE IN ELEVATION (R = RISE, D = DROP)



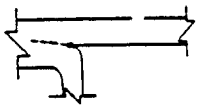
ACCESS DOORS (VERT. & HORIZ.)



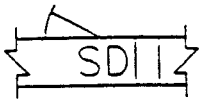
MANUAL VOLUME DAMPER



FIRE DAMPER



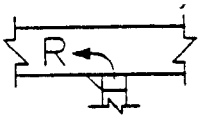
MANUAL SPLITTER



SMOKE DAMPER



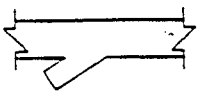
STANDARD SUPPLY BRANCH



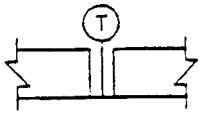
STANDARD RETURN BRANCH



BUTTERFLY DAMPER



BACKFLOW PREVENTER



THERMOWELL WITH TEMP. SENSOR

STANDARD TITLE BLOCK

itle Blocks can be obtained from Technical Services in several formats. Sheets of mylar or vellum with borders in standard size 24" x 36" are in stock, as well as the Title Block itself on stickyback to apply to 30" x 42" size. Floppy disks are also available as AutoCAD.DWG or DFX files in 3 1/2" or 5 1/4". Requests for any of these formats shall be made directly to the Project Manager.

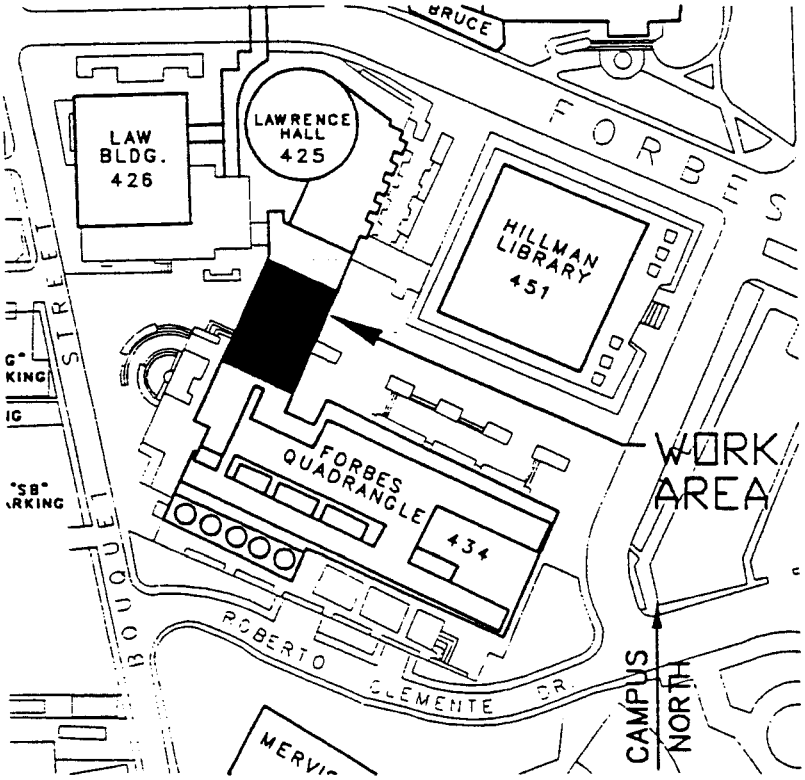
Revisions	
1 REVISED SW 8/94	

University of Pittsburgh
FACILITIES MANAGEMENT

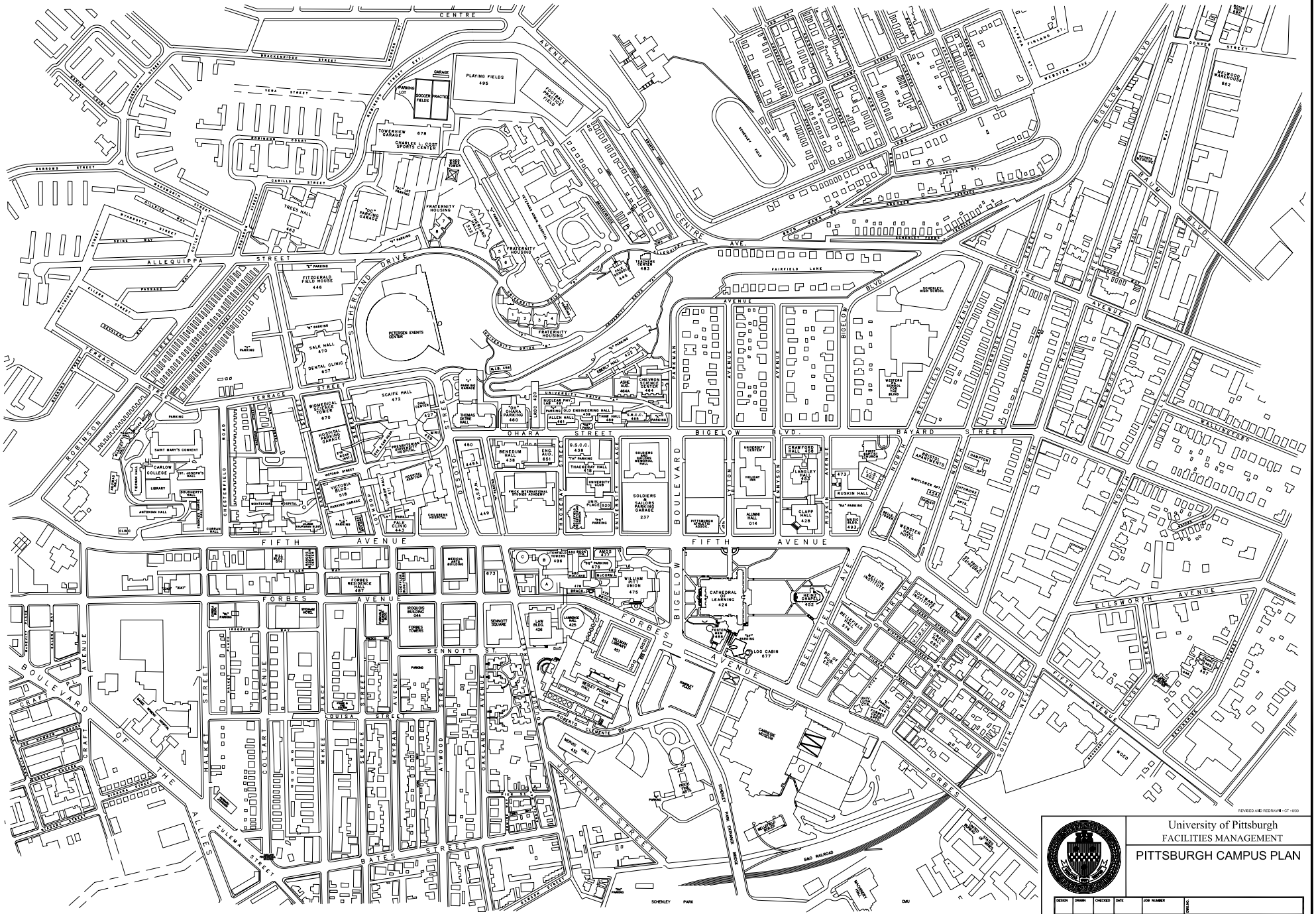
Professional Stamp

Project Name UPT HASKELL LIBRARY PEO LIGHTING PROJECT	Job No. T2832 Issue Date 7/94
Drawing Description GROUND FLOOR PLAN EXISTING CONDITIONS NEW LIGHTING	
CAD File Name UPT-HASK.DWG	Drawn By RF
Drawing Number 8236 E1	Set Order 1 of 2

TYPICAL KEY PLAN



KEY PLAN


CENTRE AVENUE
ALLEQUIPPA STREET
SUTHERLAND DRIVE
TERRACE STREET
O'HARA STREET
BIGELOW BLVD.
BAYARD STREET
FIFTH AVENUE
FORBES AVENUE
BOULEVARD OF THE ALLIES
SENNOTT ST.
LOUISA STREET
BATES STREET
JONCAIRE STREET
ELLSWORTH AVENUE
PETERSEN EVENTS CENTER
CATHEDRAL OF LEARNING 424
HILLMAN LIBRARY 451
POSVAR HALL 421
WILLIAM PITT UNION 675
SOLDIERS & SAILORS MEMORIAL HALL 237
SOLDIERS & SAILORS MEMORIAL GARAGE 920
PETERSEN SPORTS COMPLEX
ALUMNI HALL 014
LOG CABIN 677
HEINZ CHAPEL 452
CARNEGIE MUSEUM
SCHENLEY PARK
SCHENLEY PARK DRIVE
B&O RAILROAD
CMU
REVISED AMC/REDRAWN - CT - 8/00
University of Pittsburgh
FACILITIES MANAGEMENT
PITTSBURGH CAMPUS PLAN
DESIGN
DRAWN
CHECKED
DATE
JOB NUMBER
DWG. NO.

DIVISION G
GUIDELINES FOR OFFICE DESIGN
INDEX

G.1 GENERAL POLICY 2

G.2 OFFICE CATEGORIES 2

G.3 OFFICE SIZE 2

G.4 FLOOR SURFACES 3

G.5 WINDOW TREATMENT 3

G.6 FURNITURE 3

G.7 ACCESSORIES 4

G.8 OFFICE FURNITURE GUIDELINES 4

G.9 TYPICAL FLOOR PLANS 7

DIVISION G
GUIDELINES FOR OFFICE DESIGN

G.1 GENERAL POLICY

This Section provides guidelines for determining standards for office sizes, furniture and accessories for University faculty and staff. Responsibility for adhering to these standards is assigned to the Facilities Management Division and the Office of the Provost. Exceptions to these policies may be granted only by the Associate Vice Chancellor of Facilities Management.

G.2 OFFICE CATEGORIES

For purposes of determining office size and furnishing options, University staff and faculty are categorized as follows:

1. Associate Vice Chancellor, Executive Director, Dean
2. Assistant Vice Chancellor, Associate/Assistant Deans, Distinguished Professors
3. Department Chairperson
4. Faculty and Professional Staff
5. Administrative Staff
6. Part-Time Faculty/Staff, Teaching Fellow, Research Associate, Instructor or Lecturer

G.3 OFFICE SIZE

A. The following office sizes are to be regarded as general guidelines only. Variations to these standards may be approved by the Office of the Provost, Facilities Management Division and University Departments. Variations on size standards would be due to size conditions of existing space in projects with reduced renovation budgets or in spaces in need of special technical or physical requirements. Renovated offices shall be in compliance with ADA guidelines.

B. Office size to be assigned based on the following standard:

1.	Associate Vice Chancellor, Executive Director, Dean:	300 sq. ft.
2.	Assistant Vice Chancellor, Associate/Assistant Deans, Distinguished Professors:	200 sq. ft.
3.	Department Chairperson	150 sq. ft.
4.	Faculty and Professional Staff:	90-120 sq. ft.
5.	Administrative Staff:	60-120 sq. ft.
6.	Part Time Faculty/Staff, Teaching Fellow, Research Associate, Instructor or Lecturer:	60 sq. ft.

G.4 FLOOR SURFACES

A. Floor area in offices should receive a direct glue University Standard broadloom carpet. Current University standards consist of the following solution dyed Shaw Contract styles:

1. Dot Com II, Wisteria, 34812
2. Dot Com II, Desert, 34211
3. Dot Com II, Midnight, 34512**
4. Dot Com II, Prairie, 34312
5. Scholar II, Brainiac, 14435**
6. Scholar II, Wisdom, 14465
7. Scholar II, Textbook, 14820
8. Scholar II, Sage, 14455

Note: These standards are subject to change, and Professionals need to verify current standards.
*** University Standards that are not actively stocked, slightly longer lead times apply to orders.*

B. Carpet tiles may be used in areas where floor utility needs dictate. Facilities Management will review and approve selections.

C. Resilient tile may be used in areas of excessive wear, food preparations, and general classrooms. University Standard is Armstrong Standard Excelon Imperial Texture 12" tile. Exceptions to the 12" tile, (i.e. straight vinyl or rubber) will be considered, reviewed, and approved by Facilities Management.

D. Wall base should generally be 4" top set rubber. Coved base should be used in hard surface floor areas and straight base in carpeted areas. Coordinating base to University standard carpeting is Johnsonite- Moonrock, N29.

G.5 WINDOW TREATMENT

Drapes, Blinds and Shades:

1. Drapes will generally be provided only in the offices of the Associate Vice Chancellor, Executive Director or Dean; or in high profile areas where functional and aesthetic needs dictate.

2. Blinds or shades will be provided as determined by Facilities Management. Blinds or shades must match existing conditions for a uniform appearance. Exceptions will be considered, reviewed and approved by Facilities Management.

G.6 FURNITURE

A. *Professional Note – (Unless otherwise required in the Professional's contract, the specifying and purchasing of furniture for the project will be the responsibility of Facilities Management. This function will be coordinated with the project through the University's Project Manager. However, the Professional is responsible for supplying furniture plans as part of the basic contract, as required to insure proper room capacities, i.e. book stacks in libraries, seating in cafeterias, lounge areas, and any other areas where the*

ability of the designated room to accommodate an established capacity may so require.)

B. Furniture must be of high quality and have a manufacturer's warranty against defect as standard practice. All furnishings must have an ergonomic benefit to the end user.

C. For bidding procedures, the University requires three (3) equal products to be specified in projects over $5,000.00.

D. General guidelines for furnishing offices are specified in Section G.8. Variation to manufacture, furniture lines, quantities, aesthetic/functional styles, fabrics and finishes may be reviewed and approved by Facilities Management.

G.7 ACCESSORIES

Accessories include both aesthetic and functional items and should be considered a subsection to the furnishing of a University space. Accessories will include:

1. Coat Hooks
2. Waste Receptacles
3. Supplemental Lighting, task or ambient
4. Keyboard trays and Mouse pads

G.8 OFFICE FURNITURE GUIDELINES

A. <u>Associate Vice Chancellor, Executive Director, Dean</u>
Office size: 300 sq ft
All wood furniture
Manufacturers: Steelcase, Herman Miller Meridian, InWood, National, Paoli, OFS, arran, Gunlocke, Joffco

1. U-shape desk consist of 36"x72" single pedestal desk,
24"x42" bridge
24"x72" credenza with two drawers lateral files, or two FF pedestals
Pencil drawer, keyboard tray/ mousepad.
Hutch/overhead storage with doors.
Quantity: 1 unit

2. Executive high back desk chair
Quantity: 1

3. Five-shelves 30"wide bookcase
Quantity: 2

4. Four-drawers 30" wide lateral file
Quantity: 1

5. 42" diameter round conference table
Quantity: 1

6. Swivel tilt guest chairs on casters
Quantity: 4

7. Lounge Chair
   Quantity: 1

8. Loveseat
   Quantity: 1

9. End table
   Quantity: 1

10. Coffee table
    Quantity: 1

B. Assistant Vice Chancellor, Associate/Assistant Dean, Associate Director, Distinguished Professor
Office Size: 200 sq ft
Wood top and metal base, or all wood casegoods
Manufacturers: Steelcase, Herman Miller Meridian, InWood, National, Paoli, OFS, Darran, Gunlocke, Joffco, KI, Design Options

1. U-shape desk consist of 36”x66” single pedestal desk,
   24”x42” bridge,
   24”x66” credenza with two drawers lateral files
   or two FF pedestal.
   Pencil drawer, keyboard tray/ mousepad.
   Hutch/overhead storage with doors.
   Quantity: 1 unit

2. Executive mid back desk chair
   Quantity: 1

3. Five-shelves 36” wide bookcase
   Quantity: 2

4. Four-drawers 36” wide lateral file
   Quantity: 1

5. 36” diameter round conference table
   Quantity: 1

6. Swivel tilt guest chairs on casters
   Quantity: 4

7. Loveseat
   Quantity: 1

8. End table
   Quantity: 1

C. Department Chairperson
Office Size: 150 sq ft
All metal casegoods with laminate top
Manufacturers: Steelcase, Herman Miller, Allsteel, KI, Design Options

1. U-shape desk consist of 36”x66” single pedestal desk,

24”x42” bridge, 24”x66” credenza with two drawers lateral files.
Pencil drawer, keyboard tray/ mousepad.
utch/overhead storage with doors.
Quantity: 1 unit

2. Executive mid back desk chair
Quantity: 1

3. Five-shelves 36” wide bookcase
Quantity: 1

4. Four-drawers 36” wide lateral file
Quantity: 1

5. 36” diameter round conference table
Quantity: 1

6. Swivel tilt guest chairs on casters
Quantity: 4

D. Faculty and Professional Staff
Office Size: 90 – 120 sq ft
All metal casegoods with laminate top
Manufacturers: Steelcase, Herman Miller, Allsteel, KI, Design Options, Teknion

1. L-shape desk consist of 36”x66” single pedestal desk,
24”x42” bridge, 24”x66” credenza withone FF pedestal.
Pencil drawer, keyboard tray/ mousepad.
Hutch/overhead storage with doors and task light.
Quantity: 1 unit

2. Mid back task chair with T-arms.
Quantity: 1

3. Five-shelves 36” wide bookcase
Quantity: 1

4. Four-drawers 36” wide lateral file
Quantity: 1

5. Sled base guest chairs
Quantity: 2

E. Administrative Staff
Office Space: 60 – 120 sq ft
Landscape furniture
Manufacturers: Steelcase, Herman Miller, Allsteel, KI, Design Options, Teknion

1. “L” or “U” configuration workstation with panel supported system.
Keyboard tray/mousepad
One BBF and two FF pedestals
Overhead storage with doors and task light.

2. Two drawers 30” wide lateral file

Quantity: 1

3. Task chair with T-arm
   Quantity: 1
4. Sled base guest chair
   Quantity: 1

F. Part-Time Faculty/Staff, Teaching Fellow, Research Associate, Instructor or Lecturer
Office Space: 60 sq ft
Landscape furniture
Manufacturers: Steelcase, Herman Miller, Allsteel, KI, Design Options, Teknion

1. "L" configuration workstation with panel supported system.
   Keyboard tray/mousepad
   One BBF and two FF pedestals
   Overhead storage with doors and task light.

2. Two drawers 30" wide lateral file
   Quantity: 1

3. Task chair with T-arm
   Quantity: 1

4. Sled base guest chair
   Quantity: 1

G.9 TYPICAL FLOOR PLANS

The following pages illustrate typical floor plans for use and assistance to the Professional for the various office and work areas classifications.

END OF DIVISION

DIVISION H
VERTICAL TRANSPORTATION REQUIREMENTS
INDEX

H.1 INTRODUCTION.....2

H.2 GENERAL.....2

H.3. PRODUCTS.....4

H.4 PASSENGER ELEVATORS.....5

H.5 FREIGHT AND COMBINATION PASSENGER/FREIGHT ELEVATORS.....10

H.6 ESCALATORS..... 13

DIVISION H VERTICAL TRANSPORTATION

H.1 INTRODUCTION

Professionals will incorporate the following vertical transportation guidelines as applicable to the project's requirements. Verify with the Project Manager the final Scope of Work.

H.2 GENERAL

A. STANDARDS: Elevator equipment specified will follow the design and manufacturing procedures in accordance with the International Organization for Standardization (ISO 9000 family of standards) to meet product and service requirements for quality assurance for new products.

B. CODES: Designs, unless specifically excepted, will be in accordance with the requirements of the ASME American Safety Code for Elevators and Escalators (ANSI A17.1), also referred to as the ASME Elevator Code A17.1 as adopted by the Commonwealth of Pennsylvania under the UCC code accepting all addendum up to 2002, the Commonwealth of Pennsylvania's L&I Elevator Code, the Federal ADA Regulations and Design Standards, and Codes having legal jurisdiction in effect at the date of design completion.

C. PAINTING: Exposed metal work furnished under this specification will be, except where otherwise specified, properly painted, in accordance with the National Paint and Coatings Association by the Elevator Contractor. Existing metal parts, equipment, and concrete pit and maintenance room floors will be properly prepared and painted in accordance with paint manufacturer's recommendations.

D. TEMPORARY USE: For modernization projects, a minimum of one (1) elevator will be fully operational at all times unless prior approval has been granted by the University.

E. MAINTENANCE: Elevators included in any new installation or major modernization project will receive regular full maintenance on each unit for a period of twelve (12) months in accordance with the University's current service/maintenance agreement/specification from the date of warranty start. For major modernization projects, in addition to these twelve months, the Elevator Contractor will also provide maintenance from the date construction begins. The work to be performed consists of furnishing all material, labor, supervision, tools, and equipment necessary to provide full maintenance services and repairs of every description.

F. WARRANTY: Elevator Contractor will warrant that the work supplied will comply with the specifications and that there will be no defects in materials and workmanship for one year after the elevator inspector turns over all elevators in the project for use by the University. Elevator Contractor assumes complete responsibility under the warranty to provide a full service maintenance contract for all elevators in the project from the date construction begins until the end of the one year warranty period.

G. TESTS:

1. Elevator Contractor will perform tests specified and/or required by laws, rules, and regulations of all Departments having jurisdiction.

2. All parts of the work and associated equipment will be tested and adjusted to work properly and be left in perfect operating condition. Correct defects disclosed by these tests without any additional cost to the University. Repeat tests on repaired or replaced work if deemed necessary by the University.

3. Elevator Contractor will notify the University at least 72 hours in advance of tests. Furnish necessary instruments, gauges, and other equipment required for tests. Do not include expenses of Owner or his/her authorized representatives required to be present at such tests unless tests cannot be completed as scheduled. In the event of delay of tests after 72 hour notice had been given, or when such tests must be repeated, pay additional expenses incurred by Owner or his/her representatives, including cost of traveling, lodging, and meals. To avoid such occurrences, make preliminary tests prior to giving notice of final tests.

H. AS-BUILT DRAWINGS: Three (3) sets of mechanical, electrical, architectural, structural, fire protection, and control as-built drawings will be provided to the University's Facilities Management Division by the Professional. One (1) set of drawings will be provided in electronic format.

I. SHOP DRAWINGS AND O&M MANUALS: Three (3) sets of as-built shop drawings and installation, operations, maintenance, and adjustment (O&M) manuals will be provided to the University's Facilities Management Division by the Elevator Contractor. One (1) set will be provided in an electronic format. As-built shop drawings will show the complete elevator system and components, including project specific details of assembly, erection, anchorage, controls, wiring, and dimensions of hoistway and machine room. O&M manuals will include all project specific control schematics, wiring diagrams, software user manuals, maintenance and error code manuals, equipment user manuals, equipment catalog cuts, and spare part lists.

J. CONSTRUCTION SCHEDULE: For installations in new buildings, Elevator Contractor will supply elevators, escalators, mechanical and electrical equipment, hoistways, pits, and associated equipment or systems in a "punch ready" condition 30 days prior to the scheduled building completion date. Elevator Contractor will schedule a final inspection by the Commonwealth of Pennsylvania's Department of Labor and Industry Elevator Division and the Local Fire Department ten (10) days prior to the scheduled building completion date.

K. CERTIFICATION OF ELEVATOR: During construction, if needed, the Elevator Contractor will certify through the Commonwealth of Pennsylvania a change in designation (e.g., passenger to passenger/freight) of an elevator during that period, and when construction is completed, the Elevator Contractor will recertify the elevator back to its original use.

H.3 PRODUCTS

A. Accepted Materials:

1. Materials and equipment will be new, of makes and kinds specified, or as indicated on the drawings, without exception. Where one brand, make of material, device, or equipment is specified or shown, the products of the manufacturers listed in "Accepted Manufacturers" will be regarded as acceptable when, in the opinion of the University, it is a recognized equal considering quality, workmanship, economy of operation, and suitability for the purpose intended.

2. Should bidders desire to install equipment and materials other than those included under "Accepted Manufacturers," they will submit with their bid a rider listing the deductions or additions to the Contract for these substitutions. Said substitutions must be accepted in writing by the University, otherwise all materials and equipment must be according to plans and specifications.

3. Specifications will be based on the equipment and materials specifically designated. If it is elected to install material and equipment included under "Approved Materials", or it is permitted to substitute other equipment, drawings will be submitted for approval showing changes required by this equipment or material and be responsible for its installation in the allotted space with proper clearances for servicing and repairing said equipment.

4. Where such accepted substitution or deviation requires a different quantity or arrangement of structural supports, wiring, or other equipment or accessories normal to this equipment, Elevator Contractor will furnish said changes and additions and pay all costs for changes to the work and the work of others affected by this substitution or deviation.

B. Accepted Manufacturers:

1. Materials will be in strict accordance with the quality, style, performance, and sizes specified. Manufacturer's name or catalog numbers given in the specifications will be only for the purpose of establishing a standard of quality, style, size, and type and will not be construed to exclude equipment or material of other manufacturers. OEM proprietary equipment will be considered only if it meets or exceeds the quality, style, performance, and sizes specified of listed accepted manufacturers.

2. If OEM proprietary systems are submitted for approval, the OEM must provide all diagnostic tools (including those considered proprietary), software, hardware keys, SIM cards, prints, parts, wiring diagrams, manuals, etc. for the operation and maintenance of the systems to the University FM project manager at the time of shop drawing submission. Final payment will not be made until OEM provides all such items. The University agrees to sign a non-disclosure agreement for any proprietary software tools. The University also reserves

the right to share with all maintenance companies the proprietary software tools and will require them to sign non-disclosure agreements also.

3. When materials and equipment are purchased from the manufacturer specified or listed, Elevator Contractor will submit a complete verification specification with each copy of the shop drawings.

    a. Controllers

        1) Motion Control Engineering, Inc. (MCE, Inc.)

        2) Elevator Controls Corp. (ECC).

    b. Door Operating Equipment

        1) G.A.L. Manufacturing Corporation

        2) Moline Accessories Company (MAC).

    c. Door Detectors

        1) Janus Elevator Products, Inc. – Panaforty Plus

        2) Adams Elevator Equipment Company – ICU Gatekeeper Plus.

    d. Hoisting Motors (A.C.)

        1) The Imperial Electric Company

        2) Baldor Electric Company

        3) Reuland Electric Company

        4) Approved equal.

H.4 PASSENGER ELEVATORS

A. Number: Sufficient to handle 12-15% of the total building population for office/library/garage/laboratory/dormitory and 25-40% of the total building population for classroom in a five minute “balanced up-down peak” period. Lobby waiting time will be designed to range between 0-20 seconds for classroom buildings, 25-35 seconds for office/library/laboratory/dormitory buildings, and 40-50 seconds for garage buildings with 80% of hall calls answered within the design interval and no greater than 2% of wait times exceeding 1.33 times the maximum interval for the specific building type. Projected occupancy will be verified with Facilities Management. The Professional will provide detailed calculations determining the quantity, speed, and capacity of elevators to be included in a building for University review.

B. Operation:

1. Furnish a group supervisory operation that is representative of the manufacturer's most current "state of the art" technology. Solid state or rotating apparatus for field regulation is acceptable. Gearless electric traction elevators should be applied when total elevator travel exceeds 100 feet, with speeds beginning at 350 fpm. Rope compensation will be provided (for speeds under 500 fpm, encapsulated chain is acceptable). When total travel is less than 100 feet the Professional will determine the type of elevator to be utilized. In addition to group supervisory features, include the following:

    a. Anti-nuisance feature

    b. Automatic by-pass (set at 60-70% of capacity)

    c. Door detector including door nudging feature – Janus Panaforty Plus or Adams ICU Gatekeeper Plus

    d. Independent service feature

    e. Automatic self-leveling device

    f. Unintended car movement protection device

    g. Overspeed protection device

    h. Load weighing device with alarm

    i. ADA approved accessories

    j. Lobby traffic directors station (use when group exceeds 2 elevators) – includes monitor and locked panel with in-service switches, recall switches, and emergency power override switches (for buildings with four or more traction elevators, destination dispatching should be considered)

    k. Automatic emergency power provisions with manual override switches (note: emergency generators must have capacity to operate one elevator at a time--either passenger, freight, or combination passenger/freight--with the capability to operate any car at any given time; harmonic filters will be used on all motors with VFD or SCR drives; and generator sizing calculations will be done by the Professional and be provided to the University for review)

    l. Located within the car operating panel (COP) at ADA height, an emergency phone with pushbutton and speaker operation programmed to call the University of Pittsburgh Police Department and identify building and car

    m. Fire Fighter's Service Phases I and II

n. Fire alarm tie-in and programming (identify make and model of the existing fire alarm system)

o. Raceway for teledata lines from nearest CSSD closet to the machine room for emergency phones and future elevator monitoring communications (Lift-Net™)

p. All keying consistent throughout an individual building and coordinated with the University

q. Add Alternate pricing for Lift-Net™ Micro Controller Machine Room Scanners tied into the existing Lift-Net monitoring system.

2. System for elevators will be arranged so that a passenger pressing the proper button in the car will register a call at the floor where a stop is desired. When a car is ready to leave a floor, automatic timing will cause the doors to close. When the interlock circuit is established and after the doors are closed, the elevator will accelerate to full speed; and when the car is at the proper distance from the first floor in sequence of stories for which either hall or car buttons have been pressed, the car will automatically decelerate and stop at the level of the floor landing.

3. Any corridor push buttons that have been operated will be connected so that calls from these buttons will be registered in all cars of the bank approaching the floor in the desired direction, and without any action whatever on the part of the passengers, the first car approaching the floor will automatically slow down and stop level with the floor and the doors will open, same as calls originating in the car.

4. A decentralized, multi-microcomputer based control system will be provided to perform all the functions of elevator group supervisory. The supervisory system for the passenger elevators will use the Peak/Clock Peak Traffic and Relative System Response criteria as the basis for all car-to-floor assignments under all traffic conditions. Cars will continuously "bid" for potential assignments to any hall call except during preset clock period. Microcomputers will be properly shielded from line pollution and will be designed to accept software reprogramming.

5. Provide a closed-loop, high-performance door operator with encoderless VVVF drive with the following features:

   a. Minimum ½ HP motor and heavy duty sprocket, chain, belt, and sheaves

   b. Closed loop regulated speed performance

   c. Hand-held keypad programming

   d. Adjustments can be stored in the keypad and downloaded to another operator

   e. Adjustable door obstruction reversal

f. Optical cams with LED indicators

g. Test switches for open, close, and nudging.

6. Provide each elevator with an accepted car leveling device provided by the control manufacturer that will automatically bring the car to a position level ±¼" with any floor, regardless of the load in the car or its direction of motion. The device will correct overtravel and undertravel as well as rope stretch due to variations of load. Correction will be in small steps without surges to eliminate tripping hazard.

7. Provide car door detector (door re-opening device). Provide sight guards as required.

   a. The device will utilize infrared or ultrasonic beams to detect people or objects in the path of the closing doors. The device will be able to sense the presence of people or objects without physical contact.

   b. The device will generate a curtain of beams, the full height of the opening.

8. Traveling cables will be new and be of the best grade for the service with adequate capacity for the functions and devices proposed and an additional 5% of spares. Furnish and install one new shielded cable dedicated to communications which will include a coaxial cable for each elevator. In addition, furnish and install one new four (4) conductor 18AWG overall shielded cable per landing and seven (7) new twisted 20AWG individually shielded pairs for future security use. The traveling cable wiring for future security will be run from the elevator controller/machine room and terminated in the phone/intercom box(es) in each of the cabs and will be properly tagged at each end. All traveling cables will be hung so that the proper size loop may be obtained. They will have a fire-resistant outer braid which will meet the underwriter's standard tests.

9. Access limited to all or selected floors will be controlled through the use of a card swipe or proximity card reader installed within the cab's COP. Should a passenger desire access to a controlled/secured floor, the elevator controller will sequence the following events:

   a. Card is swiped

   b. Floor selection is made by pushing floor button on COP (COP floor button will light indicating selected floor)

   c. A dry contact closure signal is sent from the COP to the University's security system (RS2 Technologies, LLC) for card and floor request verification (go/no-go)

   d. If the security system denies the requested floor selection (no-go), the car remains at the floor landing with the elevator doors closed

   e. If the security system accepts the requested floor selection, a dry contact closure signal is sent back to the COP (go to selected floor), the COP locks the selected floor request, the

request is registered, and the car travels to that floor only with normal arrival and arrival sequencing.

C. Configuration:

1. Arrange elevators in a common lobby with not more than four (4) in a line. Preferred arrangement: two (2) or more opposite each other to a maximum of four (4) on a side. Other arrangements may be dictated by the aesthetics of the building design. Where more than three (3) elevators are in a group, an additional pushbutton riser should be provided.

2. For buildings with 20 or more floors, consideration should be given to high-rise and low-rise banks of elevators. Minimum acceptable speed 350 fpm (4-10 floors), 500 fpm (11-19 floors), and 700 fpm (20 floors plus).

3. Design hoistways for elevator cars of "standard" industry dimensions, with width greater than depth and with center-opening doors, minimum of 3' 6" clear opening.

D. Cab Finishes: Cab interiors will be designed to minimize the effects of vandalism. Provide operating panels with "hands-free" telephone console in compliance with the Federal ADA guidelines. Paint steel doors and frames. Provide stainless steel bar stock handrails to cab sides and back using concealed fastening.

1. Operating Panel and Telephone Console: Each car will have a stainless steel cab station containing a bank of vandal-proof illuminated stainless steel buttons marked to indicated floors served, a keyed emergency stop (variance required), call buttons, door open and close buttons, other keyed controls, etc. mounted accessible and marked in raised letters and Braille per ADA. ADA telephone/intercom console will be mounted integral to the operating panel/station. Each car station will have engraved fire service directions.

2. Lighting: Luminaires will be fluorescent or LED type consistent with University Standards and will be vandal-proof construction. Minimum illuminance level shall be 5 footcandles. Lighting controls shall be provided that turn off all car lighting when the car is not in use. For modernization projects, cut and patch ceiling/top of cab as required. An emergency luminaire will be provided in the front return with a 6"x2-1/2" high lens located approximately 70" above the finished floor.

3. Fans: Fans will be vandal-proof construction. For modernization projects, cut and patch ceiling/top of cab as required.

4. Emergency stop switch: An emergency stop switch with audible alarm will be provided to meet ANSI A17.1 Code requirements.

E. Submissions and Approvals: The following are items to be submitted for approval to Facilities Management:

1. Copy of the “two-way balanced” traffic analysis.

2. A recommendation (include capacity, speed, and type) of supervisory system to be use in the project.

3. Hall and car call button design – catalog and drawings.

4. Cab interior design drawings.

5. By the Professional, demand load analysis for the normal power source(s) and generator sizing calculations for the emergency power source(s) to confirm that the electrical systems are adequate for the non-linear elevator controller loads.

H.5 FREIGHT AND COMBINATION PASSENGER/FREIGHT ELEVATORS

A. Number: In general, a minimum of one (1) freight or combination passenger/freight elevator should be provided irrespective of building size (swing service cars should be considered in residence halls of five or more stories).

B. Operation:

1. Motor and generators should be sized to ensure that they handle specified capacity and are not at the marginal cut-off point of the intended application. Gearless electric traction machines should be applied when total elevator travel exceeds 100 feet, with a rated speed of 350 fpm. When travel is less than 100 feet the Professional will determine the type of elevator to be utilized. Include the following:

   a. Dual light ray or solid state door detection devices

   b. Automatic emergency power operation with manual override

   c. Attendant or independent service capability

   d. Automatic self-leveling device

   e. Load weighing device with alarm

   f. Overspeed protection device

   g. Unintended car movement protection device

   h. Corridor position indicators – located above entryway at heavy traffic floors; i.e., kitchen, loading dock, basement level.

   i. “Vandal resistant” fixtures for car and hall (directional lanterns included)

   j. Emergency phone with pushbutton and speaker operation located within COP at ADA height

k. Fire Fighter's Service Phases I and II

l. Fire alarm tie-in and programming.

2. The system for elevators will be arranged so that a passenger pressing the proper button in the car will register a call at the floor where a stop is desired. When a car is ready to leave a floor, automatic timing will cause the doors to close. When the interlock circuit is established and after the doors are closed, the elevator will accelerate to full speed; and when the car is at the proper distance from the first floor in sequence of stories for which either hall or car buttons have been pressed, the car will automatically decelerate and stop at the level of the floor landing.

3. Any corridor push buttons that have been operated will be connected so that calls from these buttons will be registered in all cars of the bank approaching the floor in the desired direction, and without any action whatever on the part of the passengers, the first car approaching the floor will automatically slow down and stop level with the floor and the doors will open, same as calls originating in the car.

4. Combination passenger/freight door operation should be governed by a master gearless door operator mechanism. Door openings will have a minimum width of 4' 0" and height of 7'0" with two-speed side opening arrangement. Doors will have a full cycle time of 10.8 seconds or less taken from "door start to close" at one floor to "door open" fully at next floor, assuming a 12'0" run**.**

5. For freight-only elevators, power bi-parting doors and gate should be utilized, unless exposed to extreme temperature conditions or the total landings served do not exceed three (3).

6. Provide each elevator with an accepted car leveling device provided by the control manufacturer that will automatically bring the car to a position level ±¼" with any floor, regardless of the load in the car or its direction of motion. The device will correct over-travel and under-travel as well as rope stretch due to variations of load. Correction will be in small steps without surges to eliminate tripping hazard.

7. Provide car door detectors (door re-opening device) of the non-retractable, proximity type. Provide sight guards as required.

   a. The device will utilize infrared or ultrasonic beams to detect people or objects in the path of the closing doors. The device will be able to sense the presence of people or objects without physical contact.

   b. The device will generate a curtain of beams, the full height of the opening.

8. Traveling cables will be new and be of the best grade for the service with adequate capacity for the functions and devices proposed and an additional 5% of spares. Furnish and install one new shielded cable dedicated to communications which will include a coaxial cable for

each elevator. In addition, furnish and install one new four (4) conductor 18AWG overall shielded cable per landing and seven (7) new twisted 20AWG individually shielded pairs for future security use. The traveling cable wiring for future security will be run from the elevator controller/machine room and terminated in the phone/intercom box(es) in each of the cabs and will be properly tagged at each end. All traveling cables will be hung so that the proper size loop may be obtained. They will have a fire-resistant outer braid which will meet the underwriter's standard tests.

9. Access limited to all or selected floors will be controlled through the use of a card swipe or proximity card reader installed within the cab's COP. Should a passenger desire access to a controlled/secured floor, the elevator controller will sequence the following events:

    a. Card is swiped

    b. Floor selection is made by pushing floor button on COP (COP floor button will light indicating selected floor)

    c. A dry contact closure signal is sent from the COP to the University's security system (RS2 Technologies, LLC) for card and floor request verification (go/no-go)

    d. If the security system denies the requested floor selection (no-go), the car remains at the floor landing with the elevator doors closed

    e. If the security system accepts the requested floor selection, a dry contact closure signal is sent back to the COP (go to selected floor), the COP locks the selected floor request, the request is registered, and the car travels to that floor only with normal arrival and arrival sequencing.

C. Configuration

1. Arrange elevators in a common lobby with no more than four (4) in a line. Preferred arrangement: two (2) or more opposite each other to a maximum of four (4) on a side. Other arrangements may be dictated by the aesthetics of the building design.

2. For buildings with 20 or more floors, consideration should be given to high-rise and low-rise freight or combination passenger/freight elevators. Minimum acceptable speed 250 fpm (4-12 floors), 350fpm (13-19 floors), and 500 fpm (20 floors plus).

3. Design hoistways for elevator cars of "standard" industry dimensions, with depth greater than width and with two-speed side opening. Minimum door opening clearance will be 4' 0".

4. A minimum of one (1) combination passenger/freight elevator will have a net inside clear height of 10' 0".

D. Generally, freight enclosures will conform to the manufacturer's "standard" design.

E. Freight elevators should be evaluated based upon intended load capacity. Except in special applications and then only with University approval, utilize Class A loading, where the rated load will be based on not less than 49 lb/ft^2 of inside net platform area. Floors will be heavily reinforced and overclad with diamond check plate sheet steel material.

F. For elevators with passenger use, supply an emergency phone with pushbutton and speaker operation located within COP at ADA height. Phone will be programmed to call the University of Pittsburgh Police Department and identify building and car

G. Cab Finishes

1. Wall surfaces, entrance returns, and car door surfaces will be "rigidized" type or equal. Entrance frames will be clad 7'0" up from the floor with a stainless steel mop strip. Cabs will be equipped with a double "cart crash" railing with a minimum height of 6" for lower railing and 33" for upper railing securely fastened to side and rear walls. Wall panels below the lower railing shall be easily replaceable without removing the railing.

2. Flooring will be 1/8" diamond plate stainless steel or approved equal material. Professionals will coordinate finished floor surface with Facilities Management.

3. Luminaires will be fluorescent or LED type consistent with University Standards and will be vandal-proof construction. Minimum illuminance level shall be 5 footcandles. Lighting controls shall be provided that turn off all car lighting when the car is not in use.

H. Submissions and approvals: The following items are to be submitted for approval by Facilities Management.

1. Hall and car call button design – catalog

2. Corridor signal fixture design

3. Cab interior design drawings

4. By the Professional, demand load analysis for the normal power source(s) and generator sizing calculations for the emergency power source(s) to confirm that the electrical systems are adequate for the non-linear elevator controller loads.

H.6 ESCALATORS

A. Escalators are prohibited unless requested specifically by the University.

B. Sizing of escalator units will be based upon projected peak traffic movement – typically use 48" unit from lobby to second floor level and reduce to 32" unit as successive floors typically yield less traffic.

C. Escalators with opaque balustrade and rounded newel design should be used in open visible spaces. Decks, skirts, and other finishes should match lobby area.

D. Equip all escalators with under-step lighting and controlled stop braking.

END OF DIVISION

DIVISION J
MECHANCIAL DESIGN STANDARDS
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UNIVERSITY OF PITTSBURGH
FIRE PROTECTION SYSTEMS DESIGN STANDARDS

SECTION 210100 – FIRE PROTECTION SYSTEMS

1. The design requirements contained in this tab (Division 21) shall be employed for every project. Approval must be obtained from the University of Pittsburgh Mechanical Engineer assigned to the project for any deviations made from the design requirements contained in this division. The design requirements herein shall be used as the minimum requirements.

2. Codes and Standards: The Design Professional shall comply with the requirements of all applicable codes and standards for each specific design project. The latest enforceable editions at the time of the Schematic Design submittal shall govern edition of standards to be used.
    a. National Fire Protection Association (NFPA) Standards (latest edition referenced by current codes)
    b. Underwriters Laboratories Inc (UL)
    c. International Fire Code (latest edition)
    d. International Building Code (latest edition)
    e. International Mechanical Code 2015
    f. International Plumbing Code 2015
    g. International Fuel Gas Code (latest edition)
    h. Pittsburgh Water and Sewer Authority, for Oakland Campus only
    i. National Electrical Code (latest edition)
    j. American Society of Mechanical Engineers
    k. American Institute of Architects (AIA)
    l. American National Standard Institute (ANSI)
    m. American Society of Testing and Materials (ASTM)
    n. University of Pittsburgh Environmental Health and Safety Department.
    o. Other as determined by Authority Having Jurisdiction

3. All new and renovated facilities shall be fully sprinkled regardless of code requirements.
    a. Special situations shall be handled on a case by case situation.

4. All appropriate NFPA 12, 20 and 25 Test Certificate's and documentation shall be provided to the University as part of the project Closeout documentation.

5. All designs for new and renovations with less than 50 sprinkler heads shall be based on the last available hydrant water flow test. For systems with 50 or more sprinkler heads, the design Professional shall request a hydrant flow test from the appropriate authority.
    a. As part of the Schematic Design Process a hydrant flow test will be performed and this information shall be listed on the fire protection drawings.
    b. For projects with less than 50 sprinkler heads (relocated and/or new) the final hydraulic calculations shall be based on a new hydrant water flow test as well as the latest fire pump test results, where applicable.

6. Calculations:
    a. Hydraulic calculation and piping drawings shall be prepared under the supervision of a qualified fire protection engineer or designer having a NICET level III certification in Automatic Sprinkler Systems Layout. After construction has been completed the installation contractor shall provide a set of record drawings (as-builts).
    b. Design densities and demand areas shall be determined per NFPA and IFC.

c. All hazard groups shall be approved by the University Mechanical Engineer assigned to the project AND by University EH&S.
d. Rooms dedicated for main electrical switchgear and generators may have their sprinkler protection omitted provided they have direct access to the exterior and are enclosed by 2-hour rated construction in addition to requirements by NFPA and AHJ.
e. All fire protection systems shall be monitored via the building's Fire Alarm System.
f. Design Calculations for inside pipe are to include C = 100 for dry pipe and pre-action systems and C = 120 for wet and deluge systems.
g. A 10psi safety factor shall be designed into all hydraulic designed systems.
h. Buildings shall be zoned by floor to the greatest extent possible.
i. Extended coverage sprinkler heads are not to be used without approval by the University Mechanical Engineer AND by University EH&S assigned to the project.
j. Provide a utility approved backflow device on all fire water piping entrances to buildings.
k. The Installing Division 21 Contractor shall be present at all system tests and inspections. The Designer shall require this through inclusion in their specification package.

7. University Insurance Company
    a. FM Global shall review final drawings, specifications and hydraulic calculations. Any additional comments or suggestions by FM Global shall be reviewed and where appropriate included in the design. This shall be as directed by University Mechanical Engineer assigned to project.

8. Design Drawing Requirements:
    a. A code summary table shall be provided on the Fire Protection lead drawing sheet. The summary shall include:
        i. Project name and physical address
        ii. Occupancy description and hazard classification
        iii. Design Summary:
            1. System square feet
            2. Design Area
            3. Ceiling heights
            4. Type of system (wet/dry/etc)
            5. Criteria for design (NFPA 13/20 etc)
            6. AHJ
            7. Design Density
            8. Hose Stream allowance (GPM)
            9. Sprinkler Spacing (Sqft)
            10. K-Factor
        iv. Water Supply Information
            1. Hydrant locations
            2. Date/Time of test
            3. Static Pressure
            4. Residual Pressure
            5. Flow Rate
            6. Presence of a Fire Pump, Flow, Pressure, HP

    b. All drawings shall show fire and/or smoke rated walls, floors and other assemblies. Areas not sprinkled and areas subject to freezing shall be noted.
    c. The Professional shall identify the different classifications of occupancies on each floor or area along with water density requirements by zone.

d. The drawings shall identify new and existing riser locations, sizes of risers, locations of main branches and sizes.
e. The drawings shall show locations of all new sprinkler heads, valves, test connections, fire department connections, tamper switches as well as any other items or devices that require connection to the fire alarm system.
f. The design professional shall perform a cross disciplinary check with the other professionals to ensure proper clearance between utilities, systems and components.
g. All existing to remain as well as new tamper and flow switches within the boundary of the project shall be connected to the building's addressable fire alarm system.

9. Piping and Valves:
    a. The fire service and the domestic service shall be brought into the building as separate feeds from the water main in the street as per the International Plumbing Code. Sizing of mains shall be determined by professional.
    b. Copper piping for sprinkler systems shall not be allowed on any University of Pittsburgh property.
        i. Unless required for areas, i.e. MRI suites.
    c. CPVC shall be used only if approved in writing by University Mechanical Engineer assigned to the project.
    d. Dry Pipe and Pre-Action system piping shall be required to be schedule 40 carbon steel piping or Schedule 10 Stainless Steel.
    e. Wet Pipe system piping shall be schedule 40 carbon steel piping.
    f. Grooved couplings only as manufactured by Victaulic shall be allowed for use as sprinkler piping. Couplings shall be Victaulic FireLock. A visual inspection shall be provided for in the design to ensure all couplings are properly installed. Gaskets shall be listed for their intended use and specified in the project documents. Installing contractors must have had factory/on-site training within the past 12 months prior to starting any installation.
    g. Provide an approved double detector check valve back flow preventer with a by-pass meter for every sprinkler protected building and system. This assembly shall be located within the building where it is accessible for testing and maintenance. Meter shall be provided by Utility. Obtain approval for location of meter and remote reading device from Utility. Provide shutoff valve on building side of meter. Drain off backflow device shall be routed to nearest drain or daylight to exterior. Coordinate any exterior drain with University.
    h. All alarming and supervisory devices shall be monitored by the building's Fire Alarm System.
    i. All fire protection test drains shall terminate at a floor drain or to the outside at an appropriate location approved by the University Architect and University Mechanical Engineer. Test drain discharge shall not be made through windows.
    j. Standpipes shall be installed per requirements of IFC/IBC and NFPA 14 as well as required by local AHJ (Authority Having Jurisdiction).
        i. The Professional shall provide appropriate drainage with each standpipe for testing of the fire hose valves with capped connections, confirm size with City of Pittsburgh Bureau of Fire, or local AHJ.
    k. Ensure high point vents and a drain line with quarter turn ball valve are provided on every floor/zone to allow testing, filling and draining of system. Drain shall be routed to daylight, location to be approved by University. Drain shall be routed to janitor's sink or mechanical room floor drain.
    l. All fire piping shall be painted red or labeled as fire protection. Labelling shall be visible from any vantage point where sprinkler pipe is visible.
    m. The standpipes and associated accessories in buildings with fire pumps shall be designed for a minimum of 300 psig operating pressure.

n. The fire hose valves shall be set for 100 psig operating pressure or pressure required by AHJ, whichever is greater.
o. Inspector's test connections on dry pipe systems shall be installed in a location that is fully accessible and meets all NFPA and Code requirements.
p. The Professional shall be responsible for identifying areas where the sprinkler pipes and sprinkler heads of a wet pipe system could freeze in the absence of ventilation or heat or locations being too close to the exterior wall. Means of freeze protection shall be provided in the design under these circumstances. Freeze protection means shall be provided with an alarm to the campus BAS.
q. Any heat tracing of the wet standpipes such as in garage areas or other areas shall be alarmed for freeze protection of the pipes.
r. The Professional will review the use of fire department connections on the building roof where equipment is being installed. The isolation valve for the roof connection may be located in the stairwell.
s. Provide sprinklers in the elevator shafts as per the International Fire Protection Code and NFPA 13.
t. Provides sprinklers in the elevator machine rooms. The sprinklers in the machine room shall have heat detectors located within 2 feet of each sprinkler head as per NFPA 13 and NFPA 72 requirements. The elevator motors shall be provided with shunt trip breakers. All work in existing facilities shall be coordinated with the Elevator Maintenance Contractor.
u. Valves:
    i. UL-listed and FM-approved, with 300-psig non-shock minimum working pressure rating.
        1. Valves for use with grooved piping may be grooved type, compatible with the Victaulic system.
v. Limited area sprinklers shall be allowed on a case by case basis.

10. Fire Department Connections
    a. Exposed, Wall-Type Fire Department Connections: UL 405, cast-brass body; NH-standard thread inlets according to NFPA 1963 and matching local fire department threads; and threaded NPS outlet. Include lugged cap, gasket, and chain; lugged swivel connection and drop clappers for each hose connection inlet; and round wall escutcheon plate with marking "AUTO SPRINKLER", "AUTO SPRINKLER STANDPIPE", OR "STANDPIPE" as applicable.
        i. Connections: Two 2-1/2-inch inlets and 4-inch outlet.
        ii. Direction of Outlet: Back, straight.
        iii. Finish: Polished chrome plated.
        iv. Coordinate type of Fire Department Connection required with local municipality for all regional campuses.
        v. Where an FDC serves multiple standpipes and/or zones in a facility, the signage shall also indicate which zones and standpipes are served.
    b. The City of Pittsburgh Bureau of Fire requires a combination strobe/horn to be installed above the FDC. This shall be included as part of the Building Fire Alarm system. Coordinate alarm requirements at the Fire Department Connection with local municipality for all regional campuses.

11. Sprinkler Heads
    a. Must be UL and/or FM listed.
        i. With preference to sprinkler heads approved by UL and FM.
    b. Rooms without Ceilings: Upright sprinklers.
    c. Rooms with Suspended Ceilings: Concealed sprinklers.
    d. Lobby/Reception Area: Concealed sprinklers.
    e. Wall Mounting: Sidewall sprinklers.
    f. Loading Docks/Walk-in Coolers/Freezers: Dry pendant sprinklers

g. Sprinkler Finishes: Use sprinklers with following finishes:
    i. Upright, Pendent, and Sidewall Sprinklers: Chrome-plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax-coated where exposed to acids, chemicals, or other corrosive fumes.
    ii. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
    iii. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
h. Flexible arm-overs shall not be allowed inside a building. In areas exposed to freezing, flexible arm-overs may be allowed, only upon written approval of University Mechanical Engineer assigned to the project.
i. Provide spare sprinkler heads per NFPA 13, or at a minimum of 6 per type installed. Provide spare sprinkler heads in a purpose built cabinet.
j. Provide with two sprinkler wrenches as well as concealed sprinkler cover plates equal to 25% of the number installed.
k. Where sprinkler heads are exposed to possible damage, wire guards shall be installed over heads. Sprinkler head guards shall be listed, supplied, and approved for use with the sprinkler heads by the sprinkler head manufacturer.

12. Fire Pumps:
    a. Fire pumps shall be centrifugal, horizontal split case single stage pumps with suction and discharge connections in the lower half of the case. Use of vertical pumps shall be approved by University Mechanical Engineer assigned to the project.
    b. Pumps shall not have less than 150 percent of rated capacity at not less than 65 percent of total head with a shutoff limit to 140 percent of total head.
    c. Pumps must provide, as a minimum, a residual pressure of 100 psi while flowing 500 gpm at the roof of each served facility.
    d. Provide a roof hydrant or a hose connection to allow yearly flow and pressure testing.
        i. This is a requirement for high-rise buildings only at regional campuses.
        ii. This is a requirement for all facilities within the City of Pittsburgh.
            1. In this application
        iii. AHJ shall be contacted to ensure compliance on all facilities.
        iv. Designer shall ensure proper drainage is available at the roof locations of hydrants and hose connections.
    e. Wear rings shall be renewable case bronze locked into position.
    f. Provide pump with full by-pass with check valve.
    g. Provide with a shaft grounding ring, installed per manufacturer's recommendations.
    h. The pump shall be connected to the driver with a rigid coupling.
    i. Provide a combination factory-wired as assembled fire pump controller with automatic transfer switch conforming to the latest edition of NFPA 20 and NFPA 70.
        i. The pump controller shall be arranged for manual stop only.
        ii. Controller shall be tied into the Building Automation System and monitored for troubles, alarms and on/off status.
    j. Provide a main water flow switch downstream of the fire pump discharge, this shall be an alarm initiating device and the fire pump running shall be monitored as a trouble condition not an alarm condition.
    k. Automatic and manual transfer switch shall be electrically operated and mechanically held switch. (Controller shall be soft start.)
    l. Provide with automatic and manual shutdown.
    m. Jockey pump controller shall be across the line type for combined automatic and manual operation.

n. All new fire pump rooms shall exit directly to exterior of building. No interior entrances to room shall be allowed.
    i. Rooms shall maintain a minimum of a two hour fire rating.
    ii. No storage is permitted in fire pump rooms.
    iii. No other utilities or other MEP ductwork, piping etc. are permitted to pass through the fire pump room unless directly associated with the room per NFPA 20.
o. Where fire pumps are provided, the Professional shall provide adjustable pressure reducing valves on all fire hose connections, floor control valves and any other isolation valves to the sprinkler system.

13. Miscellaneous:
    a. Air compressors for all dry systems shall be provided with an air dryer and be placed on emergency power.
        i. Size compressors for the code required 30 minute refill time limit.
    b. Clean Agent fire suppression systems may be considered for use in data centers and other computer server areas. Coordinate with University Mechanical Engineer assigned to project.
    c. Kitchen hoods shall be protected by a wet chemical fire suppression system. Coordinate with the Mechanical, Fire Alarm, Plumbing Kitchen and Architectural Design Professionals.
    d. The Professional shall indicate all service and maintenance areas. This information should be coordinated with plumbing, electrical, architectural, civil and structural drawings.

14. Personnel Training:
    a. Provide at a minimum of 8 hours of training on all aspects of fire protection system for University staff. Training shall not be held until the start-up and commissioning of the subject electrical equipment or system is complete.

15. Demonstration of System Operation (system checkout):
    a. Testing
        i. A final acceptance test of the sprinkler system, standpipes, and fire pumps conducted by the contractor in the presence of the Professional and University personnel.
        ii. The sprinkler system shall be designed to minimize maintenance.
        iii. All test stations shall be located in areas where testing does not affect occupants or programs and water discharge will not collect or freeze.

16. System Commissioning
    a. In renovations where zones are added to/modified, the zone control valves and all associated tampers and flows shall be tested prior to final project acceptance.
    b. All new zones and systems shall be functional tested.

17. “AS-BUILT” Drawings and O&M Manuals
    a. The Professional shall specify that, during the course of the work, the Contractor shall record all changes in the work on a set of the contract documents (in electronic format) to include one (1) set of corrected specifications. The Professional shall revise the original documents and provide the “As-Built” information in computer file form (PDF and DWG) to the University. This applies to all Trades involved with the work.
    b. The date of substantial completion of the construction contract takes effect on the date when both the required training and O&M manuals have been fully received.
    c. All major fire protection equipment (including but not limited to fire pump, fire pump controllers, dry-pipe cabinets, clean agent systems etc) shall have a warranty label

placed in a conspicuous place. Label shall indicate start and end date of the warranty period. The start date shall be the date of final acceptance by the University.

18. Where applicable special considerations:
    a. Provide alternate fire suppression for areas where required based on use and/or materials present in certain laboratories or other specialty spaces. All systems shall meet applicable codes and NFPA requirements. Refer to Laboratory Design Manual Section for additional guidelines.
    b. Provide pressurization of stairwells, elevators in all high rise buildings, where required, to meet the requirements of IFC/IBC/IMC, NFPA 92A and ASHRAE Guidelines.
    c. Provide atrium smoke exhaust systems where required to meet the requirements of IFC/IBC/IMC, NFPA 92A and ASHRAE Guidelines.

END OF SECTION

UNIVERSITY OF PITTSBURGH
PLUMBING DESIGN STANDARDS

SECTION 220100 - PLUMBING GENERAL REQUIREMENTS

1. The design requirements contained in this tab (Division 22) shall be employed for every project. Approval must be obtained from the University of Pittsburgh Mechanical Engineer assigned to the project for any deviations made from the design requirements contained in this division. The design requirements herein shall be used as the bare minimum requirements.

2. Codes and Standards: The Design Professional shall comply with the requirements of all applicable codes and standards for each specific design project.
    a. International Building Code (latest edition)
    b. International Mechanical Code 2015
    c. International Plumbing Code 2015
    d. International Fire Code (latest edition)
    e. International Fuel Gas Code (latest edition)
    f. International Energy Conservation Code
    g. National Fire Protection Association (NFPA) Standards
    h. Reduction of Lead in Drinking Water Act
    i. ASHRAE Standards (latest editions), including but not limited to:
        i. 188-2015
    j. American Society of Plumbing Engineers (ASPE)
    k. Allegheny County Plumbing Code (latest edition), for Oakland Campus only
    l. Pittsburgh Water and Sewer Authority, for Oakland Campus only
    m. Local Water and Sewer Authorities for Regional Campuses.
    n. National Electrical Code (latest edition)
    o. International Building Electrical Code (latest edition)
    p. American Society of Mechanical Engineers
    q. American Assoc. for Accreditation of Laboratory Animal Care (AAALAC)
    r. National Institute of Health (NIH)
    s. American Institute of Architects (AIA)
    t. American Conference of Governmental Industrial Hygienists(ACGIH)
    u. American National Standard Institute (ANSI)
    v. American Society of Testing and Materials (ASTM)

3. General:
    a. When renovating whole floors, or areas where gang toilets are located, vertical waste and vent piping shall be replaced from floor to ceiling.
    b. The minimum pipe size for domestic cold water, hot water and recirculated hot water piping shall be 3/4".
    c. Methods and materials for wet taps, where permitted by the University Mechanical Engineer and Operations shall be submitted for approval by the A/E. Submittals shall include documentation on the products to be used with complete instructions and procedures to ensure successful wet taps.
        i. This shall be approved the Design Professional and by University Operations.
    d. Refer to ATC Section 230900 for meters, switches and equipment detail.
    e. No gate valves shall be used on domestic water systems located within buildings, unless approved during design.
    f. Refer to Division 23 of Design Manual for items not specifically covered herein. Including but not limited to: General Requirements, Basic Methods and Materials, Motors, Identification, Insulation and Jacketing, etc.

4. Calculations: For each project, a copy of all Plumbing calculations shall be submitted to the University when drawings are submitted for the DD drawing and specifications submittal; then again for the 95% construction drawings and specifications review and approval. Computerized

calculations shall include zone data and building/zone summary sheets. The University reserves the right to request the detailed design data (inputs and outputs) for the entire project area.

a. As a part of renovation projects the Design Professional shall provide calculation results showing the estimated energy savings that the new system will provide to the University. This shall be in a one page summary that shall include: existing system type, new system type, approximate energy per year saved (either in percentage or KW) and brief explanation of extent of savings.

5. Design Temperatures for Domestic Hot Water:
    a. Produced and stored at: 140°F
    b. Supplied to standard fixtures: 120°F
    c. Supplied to kitchen equipment: 140°F

6. Domestic Cold Water Systems:
    a. Limit water velocity to 8fps on mains and 4fps in branches.
    b. Provide a water meter, coordinate with water utility at the entrance to every building.
    c. Provide an additional meter to be monitored by the University Energy Center. Coordinate location of meter with University Mechanical Engineer.
    d. Provide a backflow preventer at each building water entrance:
        i. 2” and smaller: Similar to Watts 909
        ii. 2-1/2” and larger: Similar to Watts 994 lead free.
    e. For buildings containing lab facilities, two backflow devices shall be provided each sized for 2/3 of the capacity.
    f. Water pressures:
        i. Provide 35psi at the furthest flush valve, 30psi at most remote safety shower or, as recommended by manufacturer and International Plumbing Code, of furthest/most remote fixture.
        ii. Water Pressure Booster Pump: Where required provide a duplex or triplex booster pumping station. Pressure sensor shall be installed at most remote fixture, controlled to maintain the pressure required at that fixture. Where using a booster pump provide a hydro-pneumatic tank to allow pump from excessive cycling.
            1. Booster Pump packages, complete with controllers shall be provided by B&G, Armstrong, Envirosep or other approved manufacturers.

7. Domestic Hot Water Systems
    a. Limit water velocity to 8fps on mains and 4fps in branches.
    b. Hot Water Generation
        i. Oakland
            1. Campus steam to hot water heat exchangers shall be provided.
            2. Solar water heaters shall be provided on new buildings and major renovations. For large classroom facilities or dorm buildings, solar water heaters should be evaluated, but are not mandatory.
                a. Provide as primary means of heating with steam as back-up as part of a “dual energy” water heater.
        ii. Regional campuses
            1. Solar water heaters shall be evaluated on all new projects and major renovations.
                a. Where used, provide as primary means of heating with gas/electric (as available) as back-up as part of a “dual energy” water heater.

8. All new buildings and building additions shall evaluate rain water and cooling coil condensate collection. Use of collected water may be cooling tower water make-up, irrigation or other as determined as feasible.

a. For facilities that may require sump pumps to remove groundwater, collection and use of infiltrated water shall be reviewed.

9. Piping
    a. All metal piping shall be certified by NSF, ANSI, CISPI per use of piping. Certifications shall be provided as part of the shop drawing submittal phase of the project and approved by the Design Professional.
    b. General:
        i. Tee drilling copper piping is not acceptable.
        ii. Pipe Hangers shall meet MSS SP-58 as well as the following requirements:
            1. Piping shall be supported to prevent sagging.
            2. Piping shall not be supported from ductwork, conduit or other piping.
            3. Piping shall be supported from the building structure using unistrut or channel support system.
        iii. Pipe Seals: Where piping passes through exterior walls or waterproofed floors, a sealing element manufactured from EPDM with interlocking links shall be used. Pipe seals shall be similar to PSI/Thunderline Link-Seal or Metraflex.
    c. Aboveground Hot and Cold Water:
        i. Type L Copper meeting ASTM B88
        ii. Fittings shall be wrought copper meeting ASME B16.22.
        iii. Pipe and fittings shall be joined by solder meeting ASTM B32. The solder shall be a Tin-Antimony compound, Grade 95TA (95% Tin/5% Antimony). The use of solder containing lead is strictly prohibited.
    d. Below ground Hot and Cold Water:
        i. 4” and smaller
            1. Copper Type K meeting ASTM B88.
            2. Fittings shall be wrought copper meeting ASME B16.22.
            3. Pipe and fittings shall be joined using solder meeting ASTM B32. The solder shall be a Tin-Antimony compound, Grade 95TA (95% Tin/5% Antimony). The use of solder containing lead is strictly prohibited. (I have used silver solder for this application, ask piping rep about use)
        ii. 4” and larger
            1. Class 52 cement lined ductile iron meeting AWWA C151.
            2. Fittings shall be compact ductile iron pressure fittings coated and rated at 350 psi meeting AWWA C110/A21.10.
            3. Joints shall be mechanical type with gland, neoprene gaskets, and 3/4" x 3-1/2" bolts with nuts meeting AWWA C111/A21.11.
    e. Aboveground Sanitary Waste and Storm
        i. Cast Iron hubless meeting ASTM A888
        ii. Fittings shall be: cast iron meeting ASTM A888;
        iii. Cast iron pipe and fittings shall be joined using neoprene gaskets, heavy duty stainless steel clamps and shield assemblies meeting ASTM A666. Gaskets shall be approved by pipe manufacturer to ensure compatibility.
    f. Belowground Sanitary Waste, Storm and Vent.
        i. Cast Iron extra heavy weight hub and spigot meeting ASTM C-564 or
        ii. Ductile iron hub and spigot with rubber gaskets.
        iii. Fittings shall be cast or ductile iron heavy duty.
        iv. Cast iron pipe and fittings shall be joined using neoprene gaskets, heavy duty clamps and shield assemblies meeting ASTM A666. Gaskets shall be approved by pipe manufacturer to ensure compatibility.
    g. Aboveground Sanitary Vent
        i. Cast iron hubless service weight meeting A888.
        ii. Fittings shall be: cast iron meeting ASTM A888

iii. Cast iron pipe and fittings shall be joined using neoprene gaskets and heavy duty stainless steel clamps. Gaskets shall be approved by pipe manufacturer to ensure compatibility.

h. Medical Gas Piping
   i. The minimum pipe size for oxygen, nitrous oxide, nitrogen, and medical compressed air piping shall be 1/2".
   ii. All medical gas piping installation shall meet requirements of NFPA 99, latest edition and International Plumbing Code, latest edition.
   iii. All medical gas brazers must be certified according to NFPA 99. A copy of the certification must be available upon request.
   iv. Onsite cleaning shall be supervised by a member of the University staff.
   v. Piping Systems Materials:
      1. Oxygen, Nitrous Oxide, Nitrogen, Medical Compressed Air and Vacuum Systems, Below Grade:
         a. For all pipe sizes:
            i. Pipe shall be Type K seamless annealed soft copper tube meeting ASTM B88
            ii. Fittings shall be wrought copper meeting ANSI B16.22.
            iii. Joints shall be BCuP silver braze meeting AWS A5.8. Ensure quality to avoid leaving excess flux on the interior off the joints.
            iv. Piping shall be factory cleaned, purged and sealed and shall include labeling which reads “cleaned for medical gas service.”
      2. Oxygen, Nitrous Oxide, and Nitrogen, Medical Compressed Air and Vacuum Systems, Above Grade:
         a. For all pipe sizes:
            i. Pipe shall be Type K or Type L seamless hard drawn copper tube meeting ASTM B819.
            ii. Fittings shall be wrought copper meeting ANSI B16.22.
            iii. Joints shall be BCuP silver braze meeting AWS A5.8.
            iv. Piping shall be factory cleaned, purged and sealed and shall include labeling which reads “cleaned for medical gas service”.
   vi. Refer to University Laboratory Design Manual for additional information.

i. Laboratory Air and Vacuum Piping
   i. The minimum pipe size for laboratory vacuum piping shall be 3/4".
   ii. The piping shall meet the requirements of the International Mechanical Code, latest edition.
   iii. Piping Systems Materials:
      1. Laboratory Air Piping:
         a. For pipe sizes 2" and smaller:
            i. Pipe shall be: Schedule 40 galvanized steel meeting ASTM A53, Grade B; type K copper meeting ASTM B88; acrylonitrile-butadiene-styrene (ABS) plastic meeting ASTM D3965; or, high-density polyethylene (HDPE) plastic meeting ASTM D1248.
            ii. Fittings shall be: malleable iron meeting ASME B16.3; wrought copper or copper alloy meeting ASME B16.22; ABS plastic meeting ASTM D3965; or, HDPE plastic meeting ASTM D1248.
            iii. Joints shall be threaded, soldered, and solvent welded, or fusion welded.
            iv. Some air compressor lubricating oils and oil additives cause deterioration of ABS piping. The Professional shall

verify the suitability of ABS piping for a particular application before specifying its use.

v. ABS and HDPE piping, pipe fittings and pipe accessories have maximum pressure limitations at specific temperatures. The Professional shall verify the suitability of ABS and HDPE piping for each application's pressure and temperature requirements before specifying its use.

b. For pipe sizes 2-1/2 inches and larger:

i. Pipe shall be: Schedule 40 galvanized steel meeting ASTM A53, Grade B; type K copper meeting ASTM B88; acrylonitrile-butadiene-styrene (ABS) plastic meeting ASTM D3965; or, high-density polyethylene (HDPE) plastic meeting ASTM D1248.

ii. Fittings shall be forged steel welding type meeting ASTM A234 wrought copper or copper alloy meeting ASME B16.22; ABS plastic meeting ASTM D3965; or, HDPE plastic meeting ASTM D1248.

iii. Joints shall be welded in accordance with AWS D1.1; soldered, solvent welded or fusion welded.

iv. Some air compressor lubricating oils and oil additives cause deterioration of ABS piping. The Professional shall verify the suitability of ABS piping for a particular application before specifying its use.

v. ABS and HDPE piping, pipe fittings and pipe accessories have maximum pressure limitations at specific temperatures. The Professional shall verify the suitability of ABS and HDPE piping for each application's pressure and temperature requirements before specifying its use.

2. Laboratory Vacuum Piping:

a. For all pipe sizes:

i. Pipe shall be: Type K or L hard drawn copper meeting ASTM B88.

ii. Fittings shall be wrought copper meeting ASME B16.22.

iii. Joints shall be BCuP silver braze meeting AWS A5.8.

iv. Alternately use stainless steel 304 ASTM A312 seamless pipe schedule 40s with stainless steel fittings, flanges, bolts and nuts and all welded construction.

iv. The discharge from the vacuum pumps shall be vented to outdoors at the roof level. The discharge from vacuum pumps 1 HP and smaller may be vented into a laboratory exhaust air ductwork for discharge to outdoors.

v. The Professional shall provide acoustical enclosures around the vacuum pumps to reduce noise to the adjacent spaces even when the units are pre-purchased by the University.

vi. The Professional shall provide oil free air compressors and desiccant dryers for -40° F dew point with appropriate filtration for the laboratory air.

vii. Equipment like NMRs require 90 psig constant air pressure for proper operation. The air compressor/s shall be sized for 1/3 operating time and operate between 130 psig to 110 psig with a 10 psi pressure drop for accessories to deliver minimum 100 psig air pressure. The Professional shall provide compressed air flow diagram on the drawings. Duplex compressors may be provided for redundancy, if required by user.

1. Compressed air systems for other equipment shall be designed with the same methodology as above.

viii. The Professional should evaluate the need to put air compressor/s on emergency power based on discussions with users.

ix. The Professional shall evaluate VFD drives for air compressors, provide to and receive direction from University Mechanical Engineer assigned to the project.
x. Pipe Identification – refer to Section 15112 for identification and color coding of pipes.
xi. Refer to University Laboratory Design Manual for additional information.

j. Laboratory Waste Piping
    i. The minimum pipe size for laboratory waste piping shall be 1-1/4".
    ii. The piping system shall meet the requirements of International Plumbing Code, latest edition.
    iii. The plumbing fixtures in the laboratories shall be provided with a drainage system separate from the sanitary drainage system as per the University Laboratory Standards.
    iv. The laboratory waste shall be controlled by an Owner program so that no waste acid or alkali is dumped to the drain system. The laboratory waste system will be connected to the sanitary waste system. Pit monitoring station and neutralizing tank on the laboratory waste will be provided only with the approval of the University's Environmental Health and Safety Department.
    v. The term "Acid Waste" for "Laboratory Waste" shall not be used on the drawings and specifications.
    vi. Piping System Materials:
        1. Laboratory Waste and Vent Piping, Below Grade:
            a. For all pipe sizes:
                i. Pipe shall be Schedule 40 polypropylene, Orion (Blue) pipe or equal.
                ii. Fittings shall be Schedule 40 socket fused polypropylene.
                iii. Joints shall be heat fused for polypropylene pipe.
        2. Laboratory Waste and Vent Piping, Above Grade:
            a. For all pipe sizes:
                i. Pipe shall be Schedule 40 polypropylene. Orion (Blue) pipe or equal.
                ii. Fittings shall be grooved Schedule 40 polypropylene
                iii. Joints shall be mechanical type with stainless steel compression clamps for polypropylene pipe.
    vii. Refer to University Laboratory Design Manual for additional information.
k. Compressed Air Piping
    i. The minimum pipe size for compressed air piping shall be 1/2".
    ii. The piping shall meet the requirements of ASPE and International Plumbing Code, latest edition.
    iii. The Professional shall provide schematic piping diagram for the compressed air system on the construction design drawings. The diagram shall include all filtering, cooling, drying and pressure regulating requirements.
    iv. The air compressors shall be sized for 1/3 operating time for the total system compressed air requirements. Dual compressors shall be provided in case one compressor fails.
    v. Piping Systems Materials:
        1. Compressed Air Piping:
            a. For pipe sizes 2" and smaller:
                i. Pipe shall be: Schedule 40 galvanized steel meeting ASTM A53, Grade B; type K copper meeting ASTM B88; acrylonitrile-butadiene-styrene (ABS) plastic meeting ASTM D3965; or, high-density polyethylene (HDPE) plastic meeting ASTM D1248.

ii. Stainless steel pipe and fittings may be used in lieu of steel or copper: Pipe shall be ASTM A312, Schedule 10S, Type 304/304L stainless steel with plain ends. Fittings shall be precision, cold drawn, stainless steel with elastomer O-ring seals, suitable for working pressure to 500-psig (3450-kPa).
    1. Vic Press stainless steel joints and fittings shall be allowed when used with stainless steel piping.
iii. Fittings shall be: malleable iron meeting ASME B16.3; wrought copper or copper alloy meeting ASME B16.22; ABS plastic meeting ASTM D3965; or, HDPE plastic meeting ASTM D1248.
iv. Joints shall be threaded, soldered, solvent welded, or fusion welded.
v. Some air compressor lubricating oils and oil additives cause deterioration of ABS piping. The Design Professional shall verify the suitability of ABS piping for a particular application before specifying its use.
vi. ABS and HDPE piping, pipe fittings and pipe accessories have maximum pressure limitations at specific temperatures. The Design Professional shall verify the suitability of ABS and HDPE piping for each application's pressure and temperature requirements before specifying its use.

b. For pipe sizes 2-1/2 inches and larger:
i. Pipe shall be: Schedule 40 galvanized steel meeting ASTM A53, Grade B; type K copper meeting ASTM B88; acrylonitrile-butadiene-styrene (ABS) plastic meeting ASTM D3965; or, high-density polyethylene (HDPE) plastic meeting ASTM D1248.
ii. Fittings shall be forged steel welding type meeting ASTM A234 wrought copper or copper alloy meeting ASME B16.22; ABS plastic meeting ASTM D3965; or, HDPE plastic meeting ASTM D1248.
iii. Joints shall be welded in accordance with AWS D1.1; soldered, solvent welded or fusion welded.
iv. Some air compressor lubricating oils and oil additives cause deterioration of ABS piping. The Design Professional shall verify the suitability of ABS piping for a particular application before specifying its use.
v. ABS and HDPE piping, pipe fittings and pipe accessories have maximum pressure limitations at specific temperatures. The Design Professional shall verify the suitability of ABS and HDPE piping for each application's pressure and temperature requirements before specifying its use.
vi. Victaulic Style 905, 907, and 908 installation-ready joints may be used in exposed areas and above lay-in type ceilings.

vi. Refer to University Laboratory Design Manual for additional information.

l. Natural Gas
i. 2" and smaller:
    1. Schedule 40 steel (ASTM 53) with malleable-iron threaded fittings and threaded joints.

ii. 2-1/2" and larger:
1. Schedule 40 steel (ASTM 53) with steel welded fittings and welded joints.
iii. Outdoor piping shall be painted with rust inhibitor, color to match Design Manual Section 230553.
iv. Underground piping shall be stainless steel gas tubing encased in conduit vented to the exterior of the building.
v. Natural gas piping shall not be buried under a building.

m. Condensate from HVAC equipment
i. Type L Copper.
ii. Ensure there are no trip hazards created by pipe routings.

n. Foundation/Footing Drains:
i. For all pipe sizes:
1. Pipe shall be SDR 35 perforated PVC meeting ASTM D3033 or D3034.
2. Fittings shall be PVC meeting ASTM D3033 or D3034.
3. Pipe and fittings shall be joined using elastomeric gaskets meeting ASTM F477.

o. All piping shall be pressure tested.
i. Sanitary and Storm piping shall be hydrostatically tested, pressure shall be determined by Design Professional.
ii. Design Professional shall recommend method and pressure of testing of all other piping systems.

10. Valves:
a. General:
i. Shut off (isolation) valves shall be provided on inlet and outlet, to each piece of plumbing equipment item and on supply to each plumbing fixture.
1. Shall be full port ball valve, quarter turn, bubble tight shutoff.
ii. Isolation valves shall be provided at each floor take-off and branch take-offs serving 3 or more plumbing fixtures or pieces of equipment.
1. Shall be full port ball valves with quarter turn, bubble tight shutoff.
iii. Drain valves
1. Shall be provided on each plumbing equipment item located so as to allow full drainage of equipment for service and repair.
2. Shall be provided at base of each riser, at low points of horizontal runs, and where required to allow drainage of water distribution piping system.
3. Shall be quarter turn, ball valve with hose end connection, hose end cap and chain.
4. Coordinate floor drains with equipment to allow proper drainage.
iv. Stop and waste valves shall be provided on branch piping upstream of hydrants and hose bibbs.
v. Spring loaded check valves shall be provided on discharge side of pumps.
vi. Swing check valves shall be provided in hot water recirculation systems to direct flow.
vii. Check valves shall be provided on domestic water piping (hot and cold) serving each janitor's closet mop basin and each ice machine.
viii. All butterfly valves shall be of lug type, unless noted otherwise herein.

b. Throttling Valves:
i. Shall be Globe or v-port type Ball valve.
ii. Other valve types for this service must be approved by the University Mechanical Engineer assigned to the project.

c. Pump Discharge Check Valves:
i. For 2-inches NPS and smaller, swing check valves.
ii. For 2 1/2-inches NPS and larger, non-slam wafer-style plate check valves.

d. Acceptable manufacturers:
i. Globe, ball and drain valves:

1. Shall be Watts, Crane, Stockham, Jamesbury, W-K-M, Jenkins, Milwaukee, Nibco, Conbraco, Lunkenheimer, or approved equal.

ii. Natural gas check valves:
1. Dezurik, Milliken or approved equal.

iii. Butterfly valves for domestic hot and cold water:
1. Center Line, Watts, Milwaukee, Jamesbury, Conbraco, Crane, Stockham, Lunkenheimer, or approved equal.

iv. Pressure reducing, safety relief valves and safety valves:
1. Watts Regulator Co., Bell & Gossett, Leslie Controls Inc., Lonergran Valve Division, Kunkle Valve Division, Spirax-Sarco, and Spence Engineering Co.

11. Valve Product Specifications:

Legend:
CI – Cast Iron
CS - Carbon Steel
SS – Stainless Steel
ISRS - Inside Screw Rising Stem
OS & Y - Outside Screw and Yoke
CMP – Composition
RPTFE – Reinforced PTFE

Domestic Cold Water:

(1) Valve Type: Gate (Underground)

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
4" & UP:	250	Ductile Iron	SS	Iron	Mech. Jt.	ISRS

(2) Valve Type: Ball

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2" & DN:	600 CWP	Bronze	RPTFE	SS	Screwed	Lever

(3) Valve Type: Butterfly

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	300	CI or DI	EPDM	CS or SS	Lugged	Gear

(4) Valve Type: Globe

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	150	CCS	CCS	CCS	Flanged	OS & Y
2" & DN:	200 CWP	Bronze	SS	SS	Screwed	ISRS

(5) Valve Type: Check

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	150	CI or CS	Bronze	CI	Flange	non-slam spring assisted
2" & DN:	200 CWP	Bronze	Bronze	Bronze	Screwed	Swing

Service: Equipment Drains, Condensate, Solar, Heat Recovery (Standard Pressure):

(2) Valve Type: Ball

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2" & DN:	600 CWP	Bronze	RPTFE	SS	Screwed	Lever

(2) Valve Type: Butterfly

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	150	CCS	CS	CS	Lugged	Lever

a. Service: Natural Gas

(1) Valve Type: Plug

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
All:	175	CI	Rubber	Steel	Screwed	Key

(2) Valve Type: Double Door Check

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2 & UP:	125	DI or SS		EPDM	SS Flanged	None

12. Backflow preventers shall be installed no more than 5 feet above floor and shall be readily accessible. Professional shall make provisions that the water can be shut down to the facility during a 4 to 8 hours duration for annual inspection of reduced pressure type backflow preventers. If the water cannot be shut down to the facility, provide a second set of back flow preventers or bypass as standby based on the functionality of the building. Provide necessary accessories for testing of each back flow preventer separately without shutting the service to the building. Drain from backflow to be routed to nearest drain or daylight to exterior; coordinate exterior drain with University Project Manager.

13. HVAC and other non-potable water system connections shall be provided with a code compliant backflow prevention device.

14. Use of pro-press type of piping connections is not permitted.

15. Water purification systems: The Engineer shall discuss the intent and approach of the design with the University prior to the start of the design.

16. Pure water systems (RO and/or DI):
    a. All pure water systems shall be looped.
    b. The system shall be designed to eliminate stagnation. Every branch shall have a re-circulated return.
    c. The piping for de-ionized water shall be stainless steel 304 of all welded construction, schedule 40 polypropylene or PVDF piping.
        i. Proper valving, gaskets, insulation and accessories shall be provided to match needs of system.

17. The Professional shall provide cold and hot water pipe riser diagrams for all new work connecting to the existing systems and for new facilities. Show all required shock absorbers.

18. The Professional shall provide waste and vent pipe riser diagrams for all new work connecting to the existing systems and for new facilities. Provide invert elevations of sanitary drains.

19. The Professional shall provide fixture load calculations on the drawings for new facilities and for renovations to evaluate new and existing sizing of cold and hot water piping systems.

20. Pipe Identifications: All piping systems shall be provided with the University's standard identification symbols and colored code banding as listed under Division 23 guidelines.

21. The Lavatory fixtures shall be battery operated auto sensing type with 0.5 GPM aerators.

22. Hot water systems shall include recirculation loops. Dead legs shall be kept to a minimum. Recirculation pumps over 2 HP shall use a variable frequency drive and differential pressure sensors at the furthest point in the system.
    a. Wait time at fixtures for hot water shall be kept to a maximum of 10 seconds.
    b. Packaged Digital Mixing Valves may be used in lieu of thermostatic mixing valves where low flow conditions dominate the use of the hot water system.

23. The contents of ALL storage tanks must be prominently displayed on the tank.

24. Domestic water systems shall include Legionella risk reduction measures as suggested by ASHRAE Standard 188 latest edition.

25. When removing domestic water piping service fixtures or equipment, remove all piping back to nearest active main pipe to avoid stagnation.

26. Plumbing fixtures shall not be installed above electrical rooms, tele/data or security closets.

27. Provide freeze proof wall hydrants on exterior walls at a maximum of 150 feet apart, at loading docks, near any outdoor mechanical equipment, at least one on exterior wall of penthouses with adjacent accessible roofs. Height of hydrant shall be above the snow line.

28. Water Hammer Arrestors shall be certified by the PDI.

29. Sanitary Piping buried beyond 5'-0"of building: Piping shall be in accordance with the requirements of the City of Pittsburgh or the requirements of the local Authority Having Jurisdiction (AHJ).

30. Sanitary and Vent buried within 5'-0" of building: Piping shall be in accordance with the requirements of the City of Pittsburgh or the requirements of the local Authority.
    a. Building traps are prohibited by International Plumbing Code Section 1002.6 except where required by the Local Authority Having Jurisdiction. In case a building trap is provided, it shall be equipped with at least one, preferably two clean-outs and a relief or fresh air vent on the inlet side of the trap. The relief or fresh air intake shall be carried above the grade outside the building and terminate with a screened outlet. Coordinate with the AHJ providing sewer service to the building.

31. All plumbing fixtures for the rest rooms shall be wall mounted. Floor mounted fixtures shall only be permitted with University Architect approval.

32. All rest rooms shall be provided with at least one floor drain. This shall include single fixture rest rooms.

33. Trap seals of floor drains subject to loss by evaporation shall be provided with trap seal primer valve as per International Plumbing Code.

34. Condensate from the cooling coils should not be connected to the storm conductor. Condensate from the cooling coils may be contaminated, as such it is considered non-potable waste by the University and should be discharged thru the waste/sanitary system.
    a. Unless being reclaimed for other purposes.
    b. Condensate recovery shall be evaluated for reclamation for use in other systems.

35. Storm
    a. The minimum pipe size for aboveground storm drainage piping shall be 3". The minimum pipe size for underground storm drainage piping shall be 4".
    b. Minimum size of roof drain shall be 3".
    c. The drainage system shall meet the requirements of International Plumbing Code, latest edition.
    d. Secondary roof drains (emergency) shall be provided as per International Plumbing Code.
    e. Pipe Sizing:
        i. The storm drainage system shall be sized for 100 year hourly rainfall rate for University's various campuses per the latest edition of the International Plumbing Code.

36. The minimum pipe size for underground sanitary piping shall be 4".

37. Flush valves shall be electronic and hard wired for urinals.

38. Faucets shall be automatic and hard wired in all public restroom facilities.

39. Low flow fixtures
    a. Pint flush urinals shall be used in all gang toilets.
    b. Use of low flow toilets shall be evaluated during design and used where approved by University Mechanical Engineer assigned to the project.
    c. Lavatories shall be low flow, 0.5gpm is ideal.
        i. Though to minimize wait for hot water recirculation point of use heaters shall be evaluated as part of design.

40. Maintenance Staff Safety
    a. Access to all pumps, motors, valves etc. that require maintenance, at least yearly per equipment manufacturer O&M's, shall be provided with adequate means of access.
    b. Unacceptable access conditions:
        i. Crawling under or stepping on or over ductwork/piping.
        ii. Access outboard of exterior railings or other fall protection means.
        iii. Greater than four feet above ceilings, unless approved by University Project Manager and University Operations.

41. **"AS-BUILT" DRAWINGS, TRAINING, AND O&M MANUALS**
    a. The Professional shall specify that, during the course of the work, the Contractor shall record all changes in the work on a set of the contract documents (in electronic format) to include one (1) set of corrected specifications. The Professional shall revise the original documents and provide the "As-Built" information in computer file form (PDF and DWG) to the University. This applies to all Trades involved with the work.
    b. The Professional shall specify that training sessions for each piece of plumbing equipment or each plumbing system shall be a minimum of eight hours each. Training shall not be held until the start-up and commissioning of the subject electrical equipment or system is complete.

c. The date of substantial completion of the construction contract takes effect on the date when both the required training and O&M manuals have been fully received.
d. All major plumbing equipment (including but not limited to water heaters, heat exchangers, domestic booster stations, RODI systems, vacuum pumps, air compressors and VFDs) shall have a warranty label placed in a conspicuous place. Label shall indicate start and end date of the warranty period. The start date shall be the date of final acceptance by the University. Warranty must also be included in the O&M Manuals.

42. Plumbing Fixture Basis of Design:
    a. Electric Water Coolers
        i. Wall hung w/ bottle filler (no filter or filter indicator light)
        ii. Oasis Model PGF8EBFSL
    b. Floor Drains
        i. Zurn
    c. Flushometer
        i. Sloan Automatic with side mount sensor
    d. Flush Valve
        i. Sloan Model 186-1.0
    e. Ionization Unit
        i. Liquitec or equal.
    f. Lavatories
        i. Comrade 0124-024 (White 020)
    g. Service Sink
        i. Basin – Zurn Model Z1996-36
        ii. Faucet – Chicago Faucet No 897
    h. Sink Faucets
        i. Symmetrix S-20
    i. Urinal
        i. Wall Hung, Automatic Hardwired – Pint Flush
        ii. American Standard 'Washbrook Flowise'
    j. Water Closets
        i. Wall hung, automatic hardwired, 1.6 GPF
        ii. American Standard AFW A2#2477016 (White 020)

43. Plumbing Equipment Allowed Manufacturers:
    a. Steam to Domestic Hot Water Heaters
        i. Shall be Bell and Gossett, PVI, Spirax Sarco, Leslie, Aerco or Armstrong.
    b. Booster Pumps
        i. ITT, Grundfos, Taco, Goulds
    c. Gas Water Heaters
        i. AO Smith, Bradford White, State, Lochinvar
    d. Backflow Preventers
        i. Hersey, Watts, Zurn.
    e. Drinking Fountains
        i. Oasis, Elkay, Halsey Taylor, Haws
    f. Lavatories
        i. American Standard, Eljer, Kohler, Crane, Zurn
    g. Sink Faucets
        i. Symmetrix, American Standard, Chicago Faucet, Kohler
    h. Water Closets
        i. American Standard, Eljer, Kohler, Crane, Zurn
    i. Urinals
        i. American Standard, Eljer, Kohler, Crane, Zurn
    j. Flush Valves
        i. Sloan, Zurn, Gebriet, approved equals

k. Thermostatic Mixing Valves
    i. Leonard, Powers, Bradley, Symmons, Lawler
l. Digital Mixing Valves – Packaged System
    i. Powers
m. Sinks
    i. Elkay, Moen, Advance Tabco
n. Mop Basins
    i. Crane, Florestone, Stern-Williams, Zurn
o. Hose Bibbs, Wall Hydrants
    i. Josam, Smith, Woodford, Zurn, Mifab
p. Emergency Eyewash and Combination Fixtures
    i. Bradley, Encon, Haws, Speakman
q. Outlet Boxes
    i. IPS, Oatey, Symmons, approved equals.
r. Water Hammer Arresstors
    i. Josam, PPP, Zurn, MiFab
s. Additional manufacturers may be used when product more closely matches the intended use. These shall be coordinated with the University Project Manager and University Mechanical Engineer assigned to the project.

44. Monitoring and Controls
    a. All equipment and systems shall be monitored by the existing Campus control system via BACnet interface. Minimum control points and graphics shall be provided for the following. Additional may be necessary depending on the scope of the project.
        i. Domestic Hot Water System
            1. Supply temperature
            2. Return temperature
            3. Mixed temperature (if using a thermostatic mixing valve)
            4. Building supply pressure
            5. Recirculation loop pump status
            6. Power draw from recirculation pump.
            7. Water Heater status
            8. Alarms for all equipment.
        ii. Domestic Cold Water System
            1. Building supply pressure
            2. Supply temperature
            3. Building Flow Meter
            4. Flow meter for Process Water systems, HVAC make-up water, closed loop HVAC, etc.
            5. Booster pump inlet and outlet pressures
            6. Booster pump status
            7. Sump and Ejector Pump status
            8. Alarms for all equipment.

END OF SECTION

UNIVERSITY OF PITTSBURGH
MECHANICAL DESIGN STANDARDS

SECTION 230100 - MECHANICAL GENERAL REQUIREMENTS

1. The design requirements contained in this tab (Division 23) shall be employed for every project. Approval must be obtained from the University of Pittsburgh Mechanical Engineer assigned to the project for any deviations made from the design requirements contained in this division. The design requirements herein shall be used as the bare minimum requirements.

2. Codes and Standards: The Design Professional shall comply with the requirements of all applicable codes and standards for each specific design project. The latest editions at the time of the Schematic Design submittal shall govern edition of standards to be used.

    a. International Building Code (latest edition)
    b. International Mechanical Code (2015)
    c. International Plumbing Code 2015)
    d. International Fire Code (latest edition)
    e. International Fuel Gas Code (2015)
    f. International Energy Conservation Code (2015)
    g. National Fire Protection Association (NFPA) Standards (latest editions)
    h. Pennsylvania Department of Labor and Industry
    i. ASHRAE Standards (2013 or latest editions), including but not limited to:
        i. 90.1-Energy Standard for Buildings Except Low-Rise
        ii. 55-Thermal Environmental Conditions for Human Occupancy
        iii. 62.1-Ventilation for Acceptable Indoor Air Quality
        iv. 188-Legionellosis: Risk Management for Building Water Systems.
        v. 15-Safety Standard for Refrigeration Systems
        vi. 52.2-Method of Testing General Ventilation Air-Cleaning Devices
    j. Pittsburgh Water and Sewer Authority, for Oakland Campus only
    k. National Electrical Code (latest edition)
    l. American Society of Mechanical Engineers
    m. American Assoc. for Accreditation of Laboratory Animal Care (AAALAC)
    n. National Institute of Health (NIH)
    o. American Institute of Architects (AIA)
    p. Sheet Metal & Air-conditioning Contractors National Assoc. (SMACNA)
    q. American Conference of Governmental Industrial Hygienists(ACGIH)
    r. American National Standard Institute (ANSI)
    s. American Society of Testing and Materials (ASTM)
    t. Other as determined by Authority Having Jurisdiction

3. Outdoor Design Temperatures:
    a. The following outdoor air temperatures shall be used for the purpose of calculating space and/or block heating and cooling loads:
        i. Winter Outdoor Air Dry Bulb Design Temperatures:
            1. Oakland Campus: 2° F
            2. Johnstown Campus: 3° F
            3. Greensburg Campus: 2° F
            4. Titusville Campus: 2° F
            5. Bradford Campus: -6° F
        ii. Summer Outdoor Air Dry Bulb and Wet Bulb Design Temperatures: (too more closely match ASHRAE 0.4% conditions)

1. Oakland Campus: 91° FDB/72° FWB 90/73 (evaporation 75WB 85F Mean Coincident Dry Bulb)
2. Johnstown Campus: 86° FDB/70° FWB 86/71 (evaporation 73WB 82F Mean Coincident Dry Bulb)
3. Greensburg Campus: 91° FDB/72° FWB 90/73 (evaporation 75WB 85F Mean Coincident Dry Bulb)
4. Titusville Campus: 89° FDB/71° FWB 88/73 (evaporation 75WB 84F Mean Coincident Dry Bulb)
5. Bradford Campus: 87° FDB/71° FWB 84/69 (evaporation 72WB 80F Mean Coincident Dry Bulb)

b. The following outdoor air temperatures shall be used for selecting HVAC equipment.
   i. Cooling Towers and Evaporative Condensers/Condensing Units:
      1. Oakland Campus: 78° FWB
      2. Johnstown Campus: 78° FWB
      3. Greensburg Campus: 78° FWB
      4. Titusville Campus: 78° FWB
      5. Bradford Campus: 78° FWB
   ii. Air Cooled Chillers, Air Cooled Condensing Units and Packaged Air Conditioning Units: (all ASHRAE 0.4% DB are below 90 for all campuses)
      1. Oakland Campus: 95° F
      2. Johnstown Campus: 95° F
      3. Greensburg Campus: 95° F
      4. Titusville Campus: 95° F
      5. Bradford Campus: 95° F

4. Indoor Air Design Conditions: The following indoor air temperatures shall be used for the purpose of calculating block and/or space heating and cooling loads as well as initial system setpoints.
   a. Winter Indoor Air Dry Bulb Temperatures
      i. All occupied spaces: 70º F ± 2º F.
      ii. Labs housing and caring for animals: As required by the current edition of “Guide for Care and Use of Laboratory Animals”. Confirm with University PM prior to design.
      iii. Unoccupied spaces (such as storage rooms, vestibules, etc.): 55ºF ± 5º F
      iv. Unoccupied spaces (such as mechanical equipment rooms, electrical equipment rooms, etc.): 55ºF minimum.
      v. Unoccupied spaces (such as toilet rooms): 68º F ± 2º F.
      vi. Elevator equipment rooms: 40°F minimum and 90º F maximum.
   b. Summer Indoor Air Dry Bulb and Wet Bulb Temperatures:
      i. All occupied spaces: 74º F ± 2º F with maximum 57º F WB
      ii. Labs housing and caring for animals: As required by the current edition of “Guide for Care and Use of Laboratory Animals”. Confirm with University PM prior to design.
      iii. Unoccupied spaces (such as storage rooms, vestibules, etc.): 80ºF ± 5º F with maximum 62º F WB.
      iv. Unoccupied spaces (such as mechanical equipment rooms, electrical equipment rooms, etc.): 90ºF maximum, non-condensing conditions at all times.
      v. Unoccupied spaces (such as toilet rooms): 78º F ± 2º F with maximum 57º F WB.
      vi. Elevator equipment rooms: 40°F minimum and 90º F maximum, non-condensing conditions at all times.

c. Indoor Air Winter Design Humidity Levels:
    i. The following humidity levels shall be maintained for the spaces as listed:
        1. General laboratory spaces: 25% RH ± 10%
        2. Labs housing and caring for animals: As required by the current edition of “Guide for Care and Use of Laboratory Animals”. Confirm with University PM prior to design.
        3. Computer rooms: 30% RH ± 5% minimum and 55% RH ± 5% maximum.

5. Supply Air Temperature:
    a. Heating supply air temperatures shall be no more than 15°F above room design set point.
        i. Where supply air temperatures are required to be 15°F above space set point, the ventilation air volume shall be adjusted upwards per ASHRAE 62.1.
    b. Cooling air supply air temperatures shall be a maximum of 55°F. Lower temperatures shall be used when lower than normal humidity levels are required.
        i. Supply air temperatures shall be allowed to reset upwards when the wet bulb temperature allows for humidity levels to be maintained at a maximum of 50%.

6. Ventilation Requirements:
    a. The design of HVAC systems shall incorporate the introduction of outdoor air meeting or exceeding the minimum quantity required by the latest edition of the either the International Mechanical Code or ASHRAE Standard 62, whichever is more stringent.
    b. All air handling equipment and packaged air conditioning equipment shall be provided with an integral economizer in order to take advantage of free cooling as required by ASHRAE 90.1 requirement.
    c. For ventilation of laboratories and animal areas, refer to the University’s Laboratory Standards.
    d. Outdoor Air Intakes: Outdoor air intakes for HVAC systems shall be located at a minimum distance from building exhaust outlets, flues from gas-fired equipment, plumbing vents, etc as per ASHRAE Standards and International Mechanical Code.
        i. For the Oakland campus, all air intakes shall be a minimum of 15’ above street level.
    e. Demand Control Ventilation:
        i. Occupancy counters similar to Ebtron CENSus or approved equal shall be used in all conference rooms, meetings rooms, classrooms and other high occupancy locations.
        ii. Alternate methods of demand control ventilation shall be suggested by the Professional based on the scope of each project.
        iii. Refer to ATC Section 230900 for Sensor information.

7. Sound Pressure Level Requirements:
    a. HVAC systems shall be designed to limit the noise transmitted to occupied spaces. Listed below are maximum allowable Noise Criterion (NC) levels for various spaces.
        i. General offices: 35
        ii. Executive offices: 30
        iii. Conference rooms and teleconference room: 30
        iv. Corridors and public areas: 40

v. Computer rooms and research laboratories: 40
vi. Classrooms: 30
vii. Libraries and auditoriums: 25
viii. Gymnasiums: 45

b. The sound pressure levels around mechanical and electrical equipment (boilers, fans, pumps, pressure reducing valves, motors, turbines, elevators, transformers, etc.) in the equipment spaces shall not exceed 85 dBA on the A scale at any point three feet from the equipment with all the equipment in the room operating simultaneously.
    i. Spaces unable to meet this criteria shall be reviewed by University and proper steps will be taken to ensure OSHA safety standards are followed as well as proper use of adjacent spaces. These spaces shall be identified on the drawings.

c. The professional shall provide sound rating of each piece of equipment that may contribute noise to the space being air conditioned. Professional shall provide means to attenuate the equipment noise so that it does not result in NC levels above the required levels above.

d. The professional shall coordinate noise reduction methods with University Engineer.
    i. The primary means of noise reduction on air handling systems shall be thru air handling unit sizing, fan sizing and air velocities thru ductwork and diffusers.
    ii. Duct liner use shall be kept to a minimum. When used for noise control is shall be provided with a perforated internal liner. All edges shall be protected from the airstream. Liners shall have a mold resistant coating approved by ASTM or another recognized agency to prevent the growth of mold and mildew.
    iii. Sound Attenuators shall be used if circumstances require. Special attention shall be given to velocities and air pressure drops thru attenuators.
    iv. The Testing and Balancing Sub-contractor shall be specified to provide sound readings for critical areas and included in their TAB report. These spaces shall be discussed and identified during the design process.
    v. All equipment installed exterior to a building shall be analyzed for their noise impact on building occupants, adjacent building occupants and, where applicable, pedestrian traffic.

8. Calculations: For each project, a copy of all HVAC/Energy, manual and computerized, calculations shall be submitted to the University when drawings are submitted for the DD drawing and specifications submittal; then again for the 95% construction drawings and specifications review and approval. Computerized calculations shall include zone data and building/zone summary sheets. The University reserves the right to request the detailed design data (inputs and outputs) for the entire project area.
    a. Fan static and pump head calculations shall be included.
    b. Friction loss for steam piping shall be provided.
    c. Interior Spaces with greater than 0.7CFM/Sqft shall be provided with documentation as to why (excluding labs and classrooms). Minimizing interior zone reheat energy is a big concern on campus.
    d. As a part of renovation projects the Design Professional shall provide calculation results comparing the existing space/building Energy Usage Intensity (EUI) with the estimated EUI that the new system will achieve. This shall be in a one page summary that shall include: existing system type, new system type, existing space EUI and new EUI with a brief explanation of reasoning and extent of savings. Calculation detail including Inputs/Outputs shall also be included in the submission.

i. Existing EUI shall be provided by the University.
ii. A blended EUI can be used when dealing with renovations in existing buildings handling multiple space types.

e. Energy Use Intensity targets for new and renovated spaces.
i. The energy targets reflect total metered energy inputs, including but not limited to chilled water, steam, gas and electricity serving heating, cooling, dehumidification, humidification, ventilation, process energy, domestic water heating, lighting, and receptacle loads.
1. Offices: 100 kbtu/gsf/yr
2. Classrooms: 100 kbtu/gsf/yr
3. Labs: 200 kbtu/gsf/yr
4. Residence Halls: 100 kbtu/gsf/yr

f. Prior to starting calculations the Design Professional shall request the latest utility costs for all systems to be used on the project (Chilled Water, Steam, Electricity, Natural Gas etc).

9. Heat Generation:
a. Oakland Campus: heat generation, year round, shall be steam fed from the Bellefield Boiler Plant and/or Carrillo Street Steam Plant unless otherwise directed by the University (by the Mechanical Engineer assigned to the project). Steam is available at 175 psig. Every building shall utilize a 2 stage pressure reducing station, dropping to 50psi then to 15psi for use in the building. Refer to Section 232113 for additional information.
i. Steam coils shall be sized for 5 psi entering steam.
ii. Steam control valves shall be selected such that a minimum of 5 psi is available entering steam coils.
iii. Oakland Campus Building's hot water systems shall be designed to operate on a 40-degree delta-T from 180F to 140F.
1. Perimeter heating hot water may use temperature resets, especially when on/off type control valves are used on the perimeter heat.

b. All Regional Campuses: heat generation for each facility shall be via gas fired condensing boilers. Boilers shall be sized to take advantage of condensing boiler efficiencies and for use as means of reheat. Reheat coils in air system shall be sized appropriately.
i. Hot water systems shall operate at a minimum of a 40-degree delta-T. Recommended 160F to 120F in heating mode and 120F to 80F for reheat mode.
ii. When steam is required, low pressure steam boilers shall be provided.
iii. Steam for building specific processes shall be provided by dedicated steam generation units, especially where high pressure steam is required. Steam boilers for building use will be provided only under written direction from the University.

c. Electric heat may only be used under extenuating circumstances and must be approved by University Mechanical and Electrical Engineers.

10. Cooling Generation:
a. Oakland and Johnstown Campuses: Building air conditioning systems shall be designed for chilled water, which shall be obtained from the campus central chilled water systems unless specifically approved otherwise by the University (directed by the Mechanical Engineer assigned to the project).
i. Building chilled water systems shall be designed to operate at a 15-degree delta-T from 42F to 57F.

b. Greensburg, Titusville and Bradford Campuses: cooling generation for each facility shall be via electric driven equipment. Chillers shall use a minimum of a

15-degree delta-T (42F to 57F). Chiller efficiency shall be the main determining factor during chiller selection.

c. Use of direct-expansion cooling shall only be allowed where use of chilled water is unavailable, cost prohibitive or does not present a payback of 10 years or less. Approval from the University Mechanical Engineer assigned to project is required.
    i. Direct expansion may be used as a secondary means of cooling for chilled water systems requiring redundancy.

11. Personnel Training: At the completion of a project, training shall be provided for University maintenance personnel to educate the personnel on the operation and maintenance of the mechanical systems and equipment, including the automatic temperature control system, installed under that project. The Design Professional shall coordinate the amount of training which shall be provided by the HVAC, plumbing and fire protection contractors for each project with the University's Project Manager (Mechanical Engineers assigned to the project) to allow for incorporation in the final project specifications. Refer to individual Design Manual Sections for full training requirements.

12. Maintenance Staff Safety
    a. Access to all filters, dampers, fans, motors, control valves etc. that require maintenance, at least yearly per equipment manufacturer O&M's, shall be provided with adequate means of access.
    b. Unacceptable access conditions:
        i. Crawling under or stepping on or over ductwork/piping.
        ii. Access outboard of exterior railings or other fall protection means.
        iii. Greater than four feet above ceilings, unless approved by University Project Manager and University Operations.

13. Acceptable Manufacturers: A minimum of 3 manufacturers shall be listed in the specifications for each major piece of mechanical equipment, unless otherwise directed by University Mechanical Engineer assigned to the project. In some situations one or two manufacturers may be provided due to size restrictions, performance capability or to match existing units/systems. University preferred manufactures are listed in Section 238000 of the design manual.

14. Energy Conservation:
    a. The University is interested in all energy conserving opportunities. All energy conservation measures shall be reviewed with, and approved by the University in the Schematic Design phase of each project.
    b. The Professional shall evaluate and provide energy recovery as per ASHRAE Standard 90.1-2016 on any system that exhausts air.
    c. All 3-phase motors shall be provided with a VFD.
    d. All single phase motors shall be ECM type and be provided with a speed controller. Refer to Section 230513 for additional motor requirements.

15. Energy Rebates:
    a. The University seeks opportunities for energy rebates through our electric utility provider, Duquesne Light.
        i. Renovation projects that provide higher efficiency equipment and systems shall be detailed enough such that the existing equipment power requirements are noted on the drawings. New power requirements shall be provided for on the drawings. This information shall be included for installation of VFD's, higher efficiency cooling systems, heat recovery systems, etc.
        ii. New projects shall meet all energy efficiency goals set by the University.

16. Mechanical equipment shall be located indoors unless the University Mechanical Engineer AND University Architect approve outdoor installations.

17. For Mechanical Equipment Room requirements, refer to Specification Section 230500 Basic Materials and Methods.

18. Air returned through a mechanical room space shall be exhausted and not re-circulated.

19. Multi-fixture restrooms shall remain under a negative pressure at all times.

20. The Professional shall indicate all service and maintenance areas for service to the AHUs, fan coil units, pumps, etc. on the drawings. This information should be coordinated with plumbing, fire protection, electrical, architectural, and structural drawings.

21. All vaults and tunnels shall be provided with a sump pit and sump pump to prevent water build-up. Discharge location shall be coordinated with University.

22. All vaults and tunnels shall be provided with a means of ventilation per OSHA requirements.

23. Drawings shall be ordered in drawings sets in same manner as Divisions in specifications; Fire Protection then Plumbing then Mechanical.
    a. Demolition plans shall be indicated by having a “D” in the drawing number.
        i. FPD for Division 21 demolition drawings.
        ii. PD for Division 22 demolition drawings.
        iii. MD or HD for Division 23 demolition drawings.

24. A drawing showing air pressure relationships shall be provided on all projects incorporating fume, or other exhaust, hoods (new or existing).

25. Refer to Section 238000 for equipment naming convention and equipment abbreviation legend.

26. Demonstration of System Operation (system checkout):
    a. University Operations Department shall be engaged during the Test and Balance phase of each project. The design professional shall specify that the Contractor shall provide 7 days’ notice to University Operations to allow for University attendance during Test and Balance of all systems.
    b. University Operations must also be present during piping system flush-outs.
    c. The Professional shall specify that the Contractor will provide air, water and noise reports on American Air Balance Council, National Environmental Balance Bureau, or SMACNA forms as per the balance procedures set forth by these associations.
    d. The balancing sub-contractor must have experience in a minimum of 5 similar types of projects in the last 3 years and provide supporting documentation.

27. System Commissioning: For certain projects the University may desire to have an independent Systems Commissioning Contractor be specified. As part of the project design, the Design Professional shall make a recommendation regarding Systems Commissioning. Refer to the Commissioning Section for further details and requirements.

28. As-Built Drawings, Training and O&M Manuals

a. The Professional shall specify that, during the course of the work, the Contractor shall record all changes in the work on a set of the contract documents (in electronic format and on one set of prints) to include one (1) set of corrected specifications. The Professional shall revise the original documents and provide the "As-Built" information in computer file form (PDF and DWG) to the University. This applies to all Trades involved with the work.
b. The Professional shall specify that training sessions for each piece of mechanical equipment or each mechanical system shall be a minimum of eight hours each. Training shall not be held until the start-up and commissioning of the subject electrical equipment or system is complete.
c. The date of substantial completion of the construction contract takes effect on the date when both the required training and O&M manuals have been fully received.
d. All major mechanical equipment (including but not limited to chillers, boilers, air handling units, cooling towers, heat exchangers and VFDs) shall have a warranty label placed in a conspicuous place. Label shall indicate start and end date of the warranty period. The start date shall be the date of final acceptance by the University.

29. Where applicable special considerations:
    a. Provide pressurization of stairwells, elevators in all high rise buildings, where required, to meet the requirements of IFC/IBC/IMC, NFPA 92A and ASHRAE Guidelines.
    b. Provide atrium smoke exhaust systems where required to meet the requirements of IFC/IBC/IMC, NFPA 92A and ASHRAE Guidelines.
    c. All critical server rooms, main telecommunication rooms and freezer rooms shall be provided with 100% redundant cooling systems independent of the central chilled water system (in Oakland Campus).
        i. Type of redundant system shall be determined by Consultant and University Mechanical Engineer assigned to the project. Use of domestic water shall not be allowed.

END OF SECTION

UNIVERSITY OF PITTSBURGH
MECHANICAL DESIGN STANDARDS

SECTION 230500 – BASIC MATERIALS AND METHODS

1. Mechanical Equipment Rooms
    a. Rooms housing boilers shall be designed in accordance with the Pennsylvania Department of Labor and Industry Standards.
    b. Provide manufacturer recommended clearances on all pieces of equipment. There will be no exceptions to this requirement.
    c. Ensure acoustic requirements set forth in Section 230100 are met for the mechanical equipment, room and adjacent spaces.
    d. Provide a floor drain adjacent to each boiler, chiller, pump, heat exchanger, pressure reducing station, backflow preventer and any other piece of equipment with a drain, blow-off relief etc.
        i. Where equipment are adjacent, sharing of a floor drain is permissible.
    e. Ensure ASHRAE 15 requirements are met.
    f. Boilers and chillers shall not be installed in the same mechanical room.
    g. All venting of systems shall vent to exterior.
    h. Means of removal and replacing of all equipment shall be considered and provided for during design of mechanical rooms or any room housing mechanical equipment.
    i. Provide hoists/infrastructure to allow for removal/disconnection/replacement of equipment.
    j. All mechanical rooms housing hydronic equipment and or piping, AND are above occupied space shall have epoxy or water proofed floors and extend up wall for a minimum of 2".

2. Refrigerant Control
    a. Any room that contains equipment or piping for refrigerant systems shall conform to the requirements of ASHRAE 15-2016 and ASHRAE 34-2016.

3. Water Treatment
    a. For each project where draining and/or filling of water systems is required, the engineer and contractor shall coordinate scope of water treatment with the University's water treatment vendor. Coordinate vendor contact info with University mechanical engineer assigned to the project.
        i. Chemical Treatment Contractor for the Oakland Campus:
            1. U.S. Water – Craig Malagise 412-354-8551 craig.malagise@uswaterservices.com
    b. All water side systems shall be provided with chemical treatment prior to startup. Chemical treatment shall be based on age of system, system medium (chilled/hot/steam) and piping materials. Blowdown systems, automatic/manual treatment stations shall be provided based on recommendations of University water treatment vendor.
    c. For new individual building stand-alone systems, 1 years' worth of chemicals shall be specified and provided under the construction contract. A one year maintenance contract shall be part of the chemical treatment scope of work. Coordinate with University chemical treatment company to identify chemicals required.
    d. Use of glycol shall be dealt with on a project by project basis. University mechanical engineer assigned to the project shall approve use of glycol.
    e. Provide only chemical products that are acceptable under National, State and local pollution control regulations.

f. Clean systems with a chemical compound specifically formulated for the purpose of removing any foreign matter. These chemicals shall be injected to the systems, circulated and completely flushed out. Repeat the process if required. After each flushing, remove and thoroughly clean all strainers.
g. Final connection shall not be made to any campus loop systems until the Chemical Contractor has filed with the Owner's representatives, a report stating that the systems are clean.

4. Pipe Leak Testing
    a. Leak testing of all hydronic systems shall be hydrostatically performed at a test pressure equal to 1-1/2 times the system working pressure or 150 psig, whichever is greater. The 300 psig systems shall be tested for 350 psig working pressure.
    b. Leak testing of natural gas piping systems inside buildings shall be done pneumatically at a maximum test pressure of 1-1/2 times the system working pressure for systems having a working pressure greater than 2 psig, or at a test pressure of 3 psig for systems having a working pressure less than 2 psig.
    c. New gas service: Testing shall meet the gas provider's requirements.
    d. Leak testing of refrigerant piping shall be done using nitrogen.
    e. Leak testing of low pressure steam systems shall be hydrostatically performed at a test pressure of 1-1/2 times the working or design pressure, or 100 psig (whichever is greater). The leak testing of high pressure steam systems shall be performed at 300 psig.

5. Equipment Pads
    a. All floor and grade mounted equipment shall require a 4" thick 3000-psi concreate pad extending a minimum of 3" from the equipment on all sides. If parts and pieces for the system impact pad at any location, the pad shall be designed to accommodate manufacturer requirements.
    b. Equipment pads shall meet requirements above while not protruding into access areas or walking paths/corridors/means of egress.

6. Roof Curbs
    a. All roof mounted equipment shall be installed on roof curbs.
    b. Curbs shall meet equipment manufacturer and University requirements.
    c. Minimum curb height shall be 16". Coordinate exact curb height with architect, roofing subcontractor, roof warranty holder and/or general contractor.
    d. Equipment rails shall be allowed for some condensing units and large fans, but only as approved by University mechanical engineer assigned to project.

7. Duct and Pipe Curbs
    a. All ductwork, piping and conduits that penetrate the roof shall do so through an appropriate curb. Similar to RPS pipe portal flashing systems and sized appropriately, while matching roof curb requirements.

8. Fans
    a. All fans shall be direct drive type. Exceptions shall be allowed by University mechanical engineer assigned to project, when cost, use or other reasons are valid.
    b. Out of air-stream belt driven in-line fans shall be provided with an access door in the fan housing to access the fan pulley to facilitate the installation of belts on fans with motors above 5 HP.

9. Vibration Isolation
    a. Provide isolation for all equipment with motors, compressors, etc.
    b. Provide vibration isolation pads for all pumps.
    c. All equipment located directly above an occupied floor shall be isolated such that vibration from the equipment is not transmitted to the structure.

10. Electrical
    a. Refer to Division 26 design guidelines for requirements.
    b. Exposed power or control wiring is not acceptable on any University of Pittsburgh Campus.

11. Equipment installed above ceilings
    a. All air moving equipment with a cooling coil above the ceiling shall be provided with a secondary drain pan and moisture sensor in case of failure from the primary drain pan as per the International Mechanical Code. A moisture sensor shall shut down the fan in the air moving equipment if moisture is sensed in the secondary drain pan and produce an alarm in the BAS system. The Professional shall explore availability of secondary drain pans from the air-moving equipment supplier or alternate means of complying with code.
    b. Access shall be provided to allow servicing, removal and replacement of all equipment.
    c. There shall be no ductwork, piping, wiring or other equipment installed below equipment located above ceilings.

12. Mechanical Sleeve Seals
    a. Shall be provided by one of the following manufacturers:
        i. Metraflex
        ii. Kenco – Thunderline
        iii. Other manufactures may be used, but shall require approval of University Mechanical Engineer assigned to the project, prior to bidding.

13. Standard Sleeves
    a. PVC may be used on non-rated walls and non-rated floor assemblies.
    b. Rated wall and floor assemblies shall use sleeves as appropriate and consistent with UL details.
        i. Provide UL details on drawings when project requires.

14. Escutcheons
    a. All escutcheons in occupied or public spaces shall be chrome plated.
    b. Use a split escutcheons where piping is existing or where a one piece escutcheon is not conducive for installation.

15. Dielectric Fittings
    a. Provide Dielectric fittings at all locations joining dissimilar materials. Fittings shall be rated for the system installed on as well as for use on the dissimilar metals.
16. Roofs
    a. Any existing roof that is disturbed for the installation of roof curbs, plumbing pipes, roof drains, steel supports etc. shall be recertified. Roof work shall be done by a bonded roofing contractor. Roofer shall recertify the existing roof warrantees.

17. Demolition
    a. All systems that are to be demolished shall be removed completely. This includes piping, ductwork, equipment, controls, wiring etc.
    b. Where partial renovations are undertaken the systems will be completely removed from scope of work area and capped at demarcation of scope area.
        i. Any abandonment in place of mechanical systems shall require written direction from University Mechanical Engineer assigned to project.
        ii. Any allowed items abandoned shall be labeled as “Abandoned” in yellow paint.

18. Pennsylvania Steel Products Procurement Act
    a. For all projects funded in full or part by State of Pennsylvania funds (DGS), compliance with the PA Steel Act shall be required and enforced.

UNIVERSITY OF PITTSBURGH
MECHANICAL DESIGN STANDARDS

SECTION 230513 – MOTORS

1. General
    a. All electric motors under 1/2HP shall be designed for 115 volt, single phase, 60 hertz alternating current service.
    b. All electric motors 1/2 HP and larger shall be designed for 460 volt, three phase, 60 hertz alternating current service. If 460v power is not available then these motors shall be 208v
    c. All motors shall be built in accordance to the latest standard rules of the National Electrical Manufacturer's Association (NEMA) and shall be built with a 1.15 service factor.
    d. All motors shall be premium efficiency as designated by NEMA.
    e. All motors installed on indoor equipment shall be open drip-proof type
    f. All motors above 5 HP shall be installed with motor shaft grounding.
        i. Acceptable Manufacturers:
            1. Aegis
            2. Helwig BPK
            3. Approved equal, approved by University prior to bid.
    g. All motors shall be direct drive, unless direct drive motors are not recommended for a specific application or if direct drive is not an option for that particular motor/equipment use.
    h. All single phase direct drive motors shall be electrically commutated motors (ECM). Unless it is specifically discussed with the University mechanical engineer assigned to the project.
        i. When available, speed controllers shall be provided with single phase motors, eg, fans.

2. Motor Starters:
    a. Three phase motor starters shall be a circuit breaker combination type (magnetic-only motor circuit protectors on motors 10 HP and above) with
        i. Non-fused disconnect switch.
        ii. Hand-Off-Auto (HOA) switch.
        iii. Red "RUN" pilot light on cover.
        iv. Integral 120 volt control transformer with primary fusing and a secondary fuse in the "hot" leg.
        v. One normally open auxiliary contact.
    b. Three phase motors 40 HP and greater shall be provided with combination reduced voltage magnetic motor starter/s.
    c. All motor starters located indoors shall be housed in NEMA 1 cabinet/s. All motor starters located outdoors shall be housed in NEMA 3R cabinet/s.
    d. All motor starters shall be UL listed.

3. All 3 phase motors shall be compatible for use with variable frequency drives.

4. Variable frequency drives (VFDs) shall be used for all fan and pump applications.

5. Fan and pump motors shall be selected such that the Brake Horsepower (BHP) is not greater than 85% of the selected motor Horsepower (HP).

UNIVERSITY OF PITTSBURGH
MECHANICAL DESIGN STANDARDS

SECTION 230523 – GENERAL DUTY VALVES

1. This section covers piping accessories for all Mechanical/Plumbing/Fire Protection systems, including, but not limited to:
    a. Steam and Steam Condensate systems
    b. Hot water systems
    c. Chilled water systems
    d. Condenser water systems
    e. Process cooling water systems
    f. System drains
    g. Make-up water systems
    h. Refrigerant systems (for HVAC related systems)
    i. Fuel Oil systems
    j. Underground piping
    k. Air Handling Systems
    l. Exhaust systems
    m. Make-up air systems
    n. Energy recovery systems

2. General:
    a. Refer to Design Manual Section 230500 – Piping Accessories for additional information.
    b. Provide extended valve stems to allow for full operator movement without damaging surrounding insulation.

3. Gate Valves
    a. Shall <u>not</u> be permitted unless specifically stated in standards below.

4. Shutoff Valves
    a. Provide on inlet and outlet for every piece of equipment and coil served by heating hot water, chilled water, steam, condenser water, process water etc.
        i. Shall be either Ball or Butterfly valves, unless noted otherwise herein.
        ii. Valves shall allow for complete isolation of equipment served including associated unions, strainers, air vents, vacuum breakers, p/t ports, control and balance valves etc.
        iii. The shutoff valve on the inlet side of the heating/cooling device shall be located upstream of all unions, strainers, vacuum breakers, air vents, pressure/temperature test ports, etc.
        iv. The shutoff valve on the outlet side of the heating/cooling device shall be located downstream of all unions, pressure/temperature test ports, control valves, etc.
    b. Provide on inlet and outlet of all control valves and pressure reducing valves.
    c. Shall have a minimum Class IV shutoff rating.
    d. Chilled water mains shall have shutoff valves on the supply and return at the building entrance.
        i. Valves shall be rated for 300psi.
        ii. Shall be either Gate valves or Triple Offset Butterfly valves
        iii. Zero Leakage - in accordance with the following standards: API 598 (Soft Seat), API 6D (Soft Seat), FCI 70-2 Class VI.

e. Steam Shutoff Valves shall be either Gate valves or Triple Offset Butterfly valves of appropriate ratings. Gate valves shall be used in all locations where they will fit and allow for full operation of valve.
    i. Butterfly valves shall be zero Leakage - in accordance with the following standards: API 598 (Soft Seat), API 6D (Soft Seat), FCI 70-2 Class VI.

5. Throttling Valves:
    a. Shall be Globe or vport Ball valve.
    b. Other valve types for this service must be approved by the University Mechanical Engineer assigned to the project.

6. Pump Discharge Check Valves:
    a. For 2-inches NPS and smaller, swing check valves.
    b. For 2 1/2-inches NPS and larger, non-slam wafer-style plate check valves.

7. Butterfly Valves
    a. All butterfly valves shall be lug type, unless noted otherwise herein.

8. Ball Valves
    a. All ball valves shall be quarter turn, full port type unless for throttling service.

9. Control valves
    a. Shall be provided with stainless steel discs and trim.
    b. Control valve shall be able to control the system down to 10% of design flow.
    c. Size valves to provide as low a pressure drop across the valve as possible while meeting the other sizing requirements.
    d. For additional information refer to the Controls Section in the Design Manual as well as Section 230500 Piping Accessories.

10. Pressure Reducing Valves (PRV) and PRV Stations
    a. Shall be selected based on an accuracy of regulation of 1 psi.
    b. Upon entering a building the Campus Steam shall be stepped down from 175psi to 15psi. This shall be done in a minimum of 2 steps.
    c. A PRV Station shall be provided at any situation where more than a 15psi drop in pressure is required.

11. Safety Relief Valves
    a. Boilers
        i. Shall be selected for 3% above the maximum allowable working pressure of the boiler.
    b. Other Pressure Vessels
        i. Shall be selected based on ASME Boiler and Pressure Vessel Code Section VIII.

12. All high pressure (above 75psi) steam valves 4” and above, shall have a warm-up line and valve of the size noted below.
    a. 4” and 6” steam valves shall have a 1” warm-up valve and piping.
    b. 8” steam valves shall have a 1-1/2” warm-up valve and piping.
    c. 10” and above steam valves shall have a 2” warm-up valve and piping.

13. Installation
    a. All valves shall be installed with stems or spindles above the horizontal plane.
    b. All 4” and above shutoff valves installed 6’ and greater above finished floor shall have a chain-wheel operator.

14. Acceptable Manufacturers (unless noted otherwise on the drawings and specifications):
    a. All gate, globe, check, ball and drain: Adams, Crane, Stockham, Jamesbury, W-K-M, Walworth, Jenkins, Milwaukee, Nibco, Conbraco, Lunkenheimer, Vogtor approved equal.
    b. Butterfly valves for liquid flow: Center Line, Adams, Milwaukee, Jamesbury, Conbraco, Crane, Stockham, Lunkenheimer, or approved equal.
    c. Triple Offset Butterfly Valves: Adams, Vanessa
    d. Pressure reducing, safety relief valves and safety valves: Watts Regulator Co., Leslie Controls Inc., Lonergran Valve Division, Kunkle Valve Division, Spirax-Sarco, and Spence Engineering Co. The Professional should work Leslie as the basis of design.
    e. Gaskets: Flexitallic preferred on steam systems.

15. Product Specifications:

Legend:
CI – Cast Iron
CS - Carbon Steel
CCS – Cast Carbon Steel
Dutile - Iron
SS – Stainless Steel
ISRS - Inside Screw Rising Stem
OS&Y - Outside Screw and Yoke
CMP – Composite
RPTFE – Reinforced PTFE

a. Service: High Pressure Steam (Above 100 PSIG):

(1) Valve Type: Gate

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	300	CCS	Bronze	SS	Flanged	OS&Y
2" & DN:	800	CS	SS	SS	Screwed	ISRS or OS&Y

(2) Valve Type: Butterfly

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	300	DI	EPDM	SS	Lugged	Gear
2" & DN:	800	DI				

(3) Valve Type: Ball (Three Piece, 4 bolt clamp)

Size	Class Operator	Body	Trim Material	Seat	Disk	Body Connect	Operator
2" & DN:	400 WOG	CS or SS	High Temp RPTFE		SS	Screwed	Lever

(4) Valve Type: Globe

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	300	CCS	Bronze	SS	Flanged	OS&Y
2" & DN:	800	CS	SS	SS	Screwed	ISRS or OS&Y

(6) Valve Type: Check – Spring Assisted Non-Slam

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	750 CWP	SS	SS	SS	Flanged	None
2" & DN:	750 CWP	SS	SS	SS	Screwed	None

b. Service: Medium Pressure Steam (15-100 PSIG):

(1) Valve Type: Gate

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	300	CCS	Bronze	CI	Flanged	OS&Y
2" & DN:	800	CS	Bronze	Bronze	Screwed	ISRS or OS&Y

(2) Valve Type: Butterfly

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	300	CS	SS	SS	Lugged	Gear

(3) Valve Type: Ball (Three Piece, 4 bolt clamp)

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2" & DN:	400 psi	CS or SS	High Temp RPTFE	SS	Screwed	Lever

(4) Valve Type: Globe

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	150	CCS	Bronze	Bronze	Flanged	OS&Y
2" & DN:	800	CS	Bronze	Bronze	Screwed	ISRS or OS&Y

(5) Valve Type: Check

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	150	CS or CS	Bronze	CI	Flanged	on-slam spring assisted
2" & DN:	200 CWP	Bronze	Bronze	Bronze	Screwed	None

c. Service: Steam Condensate Return (High Pressure):

(1) Valve Type: Gate

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	300	CCS	Bronze	CI	Flanged	OS&Y
2" & DN:	800	CS	Bronze	Bronze	Screwed	ISRS or OS&Y

(2) Valve Type: Butterfly

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	300	CS	SS	SS	Lugged	Gear

(3) Valve Type: Ball (Three Piece, 4 bolt clamp)

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2" & DN:	400 psi	CS or SS	High Temp RPTFE	SS	Screwed	Lever

(4) Valve Type: Check

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	300	CS or CS	Bronze	CI	Flanged	non-slam spring assisted
2" & DN:	750 CWP	Bronze	Bronze	Bronze	Screwed	None

d. Service: Central Chilled Water (High Pressure):

(1) Valve Type: Gate (Building Entrance Only)

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	300	DI or CI	Bronze	CI	Flanged	OS&Y
2" & DN:	300	Bronze	SS	Bronze	Screwed	ISRS

(2) Valve Type: Butterfly

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	300	CS or DI	SS	SS	Lugged	Gear

(3) Valve Type: Globe

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	250	CCS	CS	CS	Flanged	OS & Y
2" & DN:	300	Bronze	SS	SS	Screwed	ISRS

(4) Valve Type: Check

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	250	CI or CS	Bronze	Bronze	Flanged	non-slam spring assisted
2" & DN:	300	Bronze	SS	Bronze	Screwed	Swing

e. Service: Low Pressure Steam (15 PSIG & Less), Low Pressure Steam Condensate Return, Pumped Condensate:

(1) Valve Type: Ball

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2" & DN:	150 S.W.P.	Bronze	RPTFE	SS	Screwed	Lever

(2) Valve Type: Gate

Size	Class	Body Material	Trim Seat	Trim Disk	Body Connect	Operator
2-1/2" & UP:	125	CI	Bronze	CI	Flanged	OS & Y
2" & DN:	125	Bronze	Bronze	Bronze	Screwed	ISRS

(3) Valve Type: Butterfly

Size	Class	Body Material	Trim Seat	Trim Disk	Trim Connect	Body	Operator
2-1/2" & UP:	300	CS		SS	SS	Lugged	Gear

(4) Valve Type: Globe

Size	Class	Body Material	Trim Seat	Trim Disk	Trim Connect	Body	Operator
2-1/2" & UP:	125	CI		Bronze	Bronze	Flanged	OS & Y
2" & DN:	150	Bronze		Bronze	Bronze	Screwed	ISRS

(5) Valve Type: Check

Size	Class	Body Material	Trim Seat	Trim Disk	Trim Connect	Body	Operator
2-1/2" & UP:	125	CI		Bronze	CI	Flanged	None
2" & DN:	150	Bronze		Bronze	Bronze	Screwed	Swing

f. Service: Chilled Water, Hot Water and Condenser Water (Standard Pressure):

(1) Valve Type: Ball

Size	Class	Body Material	Trim Seat	Trim Disk	Trim Connect	Body	Operator
2" & DN:	600 CWP	Bronze		RPTFE	SS	Screwed	Lever

(2) Valve Type: Butterfly

Size	Class	Body Material	Trim Seat	Trim Disk	Trim Connect	Body	Operator
2-1/2" & UP:	300	CI or DI		EPDM	CS or SS	Lugged	Gear

(3) Valve Type: Globe

Size	Class	Body Material	Trim Seat	Trim Disk	Trim Connect	Body	Operator
2-1/2" & UP:	150	CCS		CCS	CCS	Flanged	OS & Y
2" & DN:	200 CWP	Bronze		SS	SS	Screwed	ISRS

(4) Valve Type: Check

Size	Class	Body Material	Trim Seat	Trim Disk	Trim Connect	Body	Operator
2-1/2" & UP:	150	CI or CS		Bronze	CI	Flanged non-slam	spring assisted
2" & DN:	200 CWP	Bronze		Bronze	Bronze	Screwed	Swing

g. Service: Equipment Drains, Condensate, Heat Recovery (Standard Pressure):

(1) Valve Type: Ball

Size	Class	Body Material	Trim Seat	Trim Disk	Trim Connect	Body	Operator
2" & DN:	600 CWP	Bronze		RPTFE	SS	Screwed	Lever

(2) Valve Type: Butterfly

Size	Class	Body Material	Trim Seat	Trim Disk	Trim Connect	Body	Operator
2-1/2" & UP:	150	CCS		CS	CS	Lugged	Lever

END OF SECTION

UNIVERSITY OF PITTSBURGH
MECHANICAL DESIGN STANDARDS

SECTION 230553 – IDENTIFICATION FOR MECHANICAL SYSTEMS

1. This section covers identification for all Mechanical/Plumbing/Fire Protection systems, including, but not limited to:
    a. Steam and Steam Condensate systems
    b. Hot water systems
    c. Chilled water systems
    d. Condenser water systems
    e. Process cooling water systems
    f. Domestic Hot and Cold Water systems
    g. System drains
    h. Make-up water systems
    i. Refrigerant systems (for HVAC related systems)
    j. Fuel Oil systems
    k. Underground piping
    l. Air Handling Systems
    m. Exhaust systems
    n. Make-up air systems
    o. Energy recovery systems
    p. Sprinkler systems
    q. Compressed air
    r. Lab air and gases, med air and gases, vacuum

2. Identifying Devices and Labels:
    a. Equipment nameplates: All equipment shall have name plates of metal permanently fastened to the equipment with data engraved or stamped.
        i. The name plate shall have manufacturer's name, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances and essential data.
        ii. Location shall be accessible and visible.
        iii. In case of pumps, the name plates shall include flow rate in gpm and pump head in ft.
        iv. In case of air-handling equipment, the name plates shall include air flow rate in cfm and external and total static pressure in inches w.g.
    b. Snap-on Plastic Pipe Markers: manufacturer's standard preprinted, color coded, semi-rigid, snap-on type. Include color coding according to ASME A13.1 unless otherwise noted.
    c. Pipes with OD Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degree around pipe at each location.
    d. Pipes with OD Including Insulation, 6 Inches and Larger: Either full band or strip type pipe markers, at least 3 times letter height and of length required for label.
    e. Pipeline Lettering: Manufacturer's standard preprinted captions as selected by the Professional.
    f. Pipeline Arrows: Either integral with the piping system service lettering or as separate unit on each pipe marker to indicate direction of flow.
    g. Duct Markers: Manufacturer's standard laminated plastic in the following color codes:
        i. Cold supply air – Safety Green
        ii. Hot supply air – Safety Yellow
        iii. Exhaust, outside air, return and mixed air – Safety Blue
        iv. Terminology – include direction of airflow, duct service such as supply, return or exhaust air, duct origin (typically AHU # or EF #).
    h. Valve Tags: Stamped or engraved with 1/4 -inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.

i. Material: 0.0375 inch thick stainless steel.
ii. Shape: Round.
iii. Size: 1 ½ inch diameter unless otherwise indicated.

i. Valve Tag Fasteners: Stainless steel, beaded chain or S-hooks.
j. Access Panel Markers: 1/16-inch thick, engraved plastic laminate markers with abbreviated terms and numbers corresponding to concealed valve/VAV box etc. Provide 1/8-inch center hole for attachment.
k. Valve schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include screws.
    i. Frame: Extruded aluminum.
    ii. Glazing: ASTM C 1036 Type I, Class 1, glazing quality B, 2.5-mm, single thickness glass.
l. Engraved Plastic Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic resin laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine sub-core, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
    i. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
    ii. Thickness: 1/16-inch, for units up to 20 sq. in. or 8 inches in length and 1/8-inch for larger units.
    iii. Fasteners: Self-tapping, stainless steel screws or contact type permanent adhesive.
m. Plastic Equipment Markers: Manufacturer's standard laminated plastic 2 ½" x 4" for control devices and valves and 4 ½" x 6" for equipment. Use following color codes:
    i. Cooling equipment and components: Green
    ii. Heating equipment and components: Yellow
    iii. Energy reclaim equipment and components: Brown
    iv. Equipment and components that do not meet above criteria: Blue
    v. Hazardous equipment: Use colors and designs recommended by ASME A13.1.
    vi. Terminology: Match schedules as closely as possible. Include the following:
        1. Name and plan number
        2. Equipment service
        3. Design capacity
        4. Other design parameters such as pressure drops, entering and leaving conditions, and speed.
n. Plasticized Tags: Preprinted or partially preprinted, accident prevention tags, of plasticized card stock with mat finish suitable for writing.
    i. Size: 3 ¼" x 5 5/8"
    ii. Fasteners: Brass grommets and wires.
    iii. Nomenclature: large size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
o. Lettering and Graphics: Coordinate names, abbreviations and other designations used in mechanical system identification with University Mechanical Engineer assigned to the project and with University Operations.

3. Installation
    a. Piping Systems:
        i. Install pipe markers on each system.
        ii. Locate pipe markers and color bands where piping is exposed, machine rooms, accessible maintenance spaces such as shafts, tunnels and plenums, and exterior non-concealed locations according to the following:
            1. Near each valve and control device.
            2. Near each branch connection.
            3. Near penetrations through walls, floors, ceilings, or non-accessible enclosures.

4. At access doors, manholes and similar access points that permit viewing of concealed piping.
5. Near major pieces of equipment and other points of origination and termination.
6. Spaced at a maximum of 50 feet intervals along each run. Reduce intervals to 25 feet in areas of congested piping and equipment. And at least one per room.
7. Provide identification labels at ceiling tiles to locate valves above removable ceilings.
8. Provide identification labels at access panels to locate concealed valves.

b. Valve Tags:
   i. Install valve tags on valves and control devices in the piping system. List tagged valves in valve schedule.
   ii. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
      1. The valve tag schedules shall be framed with glass face and metal frame and mounted in accessible location in each major equipment room. Multiple framed schedules shall be provided on projects with multiple mechanical equipment rooms.
      2. A copy of the Valve-tag schedule shall be included in operation and maintenance data.
      3. Number shall take existing valve schedules into consideration to prevent multiple instances of same numbers.

c. Equipment Identification:
   i. Install and permanently fasten equipment nameplates on each piece of equipment that does not have a name plate.

d. Duct Systems
   i. Identify air supply, return, exhaust, intake and relief ducts with duct markers or provide stenciled signs and arrows showing service and direction of air flow.
      1. Locate signs near points where duct enter into concealed spaces, at maximum intervals of 50 feet and at least once within each room.
   ii. Damper Markers: Mark locations of balancing damper handles with green paint on duct wrap in concealed locations.

4. Above Ceiling Access Identification
   a. For equipment concealed above ceilings, use clear labels with ¾" text using the alphanumeric tag of the equipment, located on the ceiling grid or access panel at the location necessary to access the equipment.
   b. System accessories:
      i. Markers:
         1. Use colored markers with pressure sensitive adhesive on one side.
         2. Make colored markers of paper or plastic, 6 to 9 mm (1/4 to 3/8 inch) in diameter.
         3. Use markers of the same diameter throughout building.
         4. Locate markers on ceiling grid near device
      ii. Color Code
         1. Safety Red: Sprinkler System: Valves and Controls
         2. Safety Green: Domestic Water: Valves and Controls
         3. Safety Blue: Chilled Water
         4. Safety Orange: Heating Water
         5. Safety Red: Ductwork: Fire Dampers and Smoke Detectors
         6. Safety Green: Ductwork: Dampers and Controls

7. Gray: Gas, Laboratory, Medical, Air and Vacuum

iii. Provide identifications labels at ceiling tiles to locate duct accessories above ceilings.

iv. Provide identification labels at access panels to locate concealed duct accessories.

5. Warning Signs and Labels
   a. On all equipment, pipes and ducts that can be harmful if touched, disturbed or otherwise.
   b. Label as appropriate, “Danger”, “Do Not Touch”, “Caution” etc…
   c. Labels shall be Yellow with Red lettering. Follow marker requirements for pipe/duct/equipment labels for material and installation.

6. Gas and Vacuum systems shall be provided with identification symbols and color banding as follows:

Service	Symbol	Colors (Background/Text)
Medical air	Med Air	Yellow/Black
Carbon Dioxide	CO_2	Gray/Black
Helium	He	Brown/White
Nitrogen	N_2	Black/White
Nitrous Oxide	N_2O	Blue/White
Oxygen	O_2	Green/White or White/Green
Oxygen/Carbon Dioxide mixture	O_2/CO_2 n% (n is % of CO_2)	Green/White
Medical-surgical Vacuum	Med Vac	White/Black
Waste anesthetic gas disposal	WAGD	Violet/White
Other mixtures	Gas A% / Gas B% Major gas for background/ Minor gas for text	Major gas for background/ minor gas for text
Non-medical air (level 3 Gas-powered device)	Non-Med Air	Yellow & White diagonal stripe/Black
Non-medical and level 3 vacuum	Non-Med Vac	White & Black diagonal stripe/Black boxed
Laboratory air	Lab Air	Yellow & White checker-board/Black
Laboratory vacuum	Lab Vac	White & Black checker-board/Black
Instrument air	Comp Air	Red/White

7. All chilled water, hot water, condenser water, domestic cold and hot water, and coil condensate drain piping shall be provided with identification symbols and color code banding as follows:

Service	Symbol	Color
Hot Water Heating Supply	HWS (Zone No.)	Safety Orange
Hot Water Heating Return	HWR (Zone No.)	Safety Orange
Hot Water Heating Expansion Line	Exp. (Zone No.)	Safety Orange
Hot Water Heating Drain	Drain	Safety Orange
Chilled Water Supply	CHWS (System No.)	Safety Blue
Chilled Water Return	CHWR (System No.)	Light Blue (Windfall)
Coil Condensate Drain	Drain	Black
Condenser Water Supply	Cond. Sup.	Safety Green
Condenser Water Return	Cond. Ret.	Light Green
Domestic Cold	Dom Cold	Safety Green
Domestic Hot Water	DHW	Safety Green
Domestic Hot Water Return	DHWR	Light Green

8. All steam, steam condensate return and pumped condensate piping shall be provided with the identification symbols and color codes as follows:

Service	Symbol	Color
Steam, High Pressure	HP Steam - 175	Safety Yellow
Steam, High Pressure	HP Steam - 125	Safety Yellow
Steam, High Pressure	HP Steam - 100	Safety Yellow
Steam, Medium Pressure	MP Steam - 65	Safety Yellow
Steam, Medium Pressure	MP Steam - 25	Safety Yellow
Steam, Medium Pressure	MP Steam - 15	Safety Yellow
Steam, Low Pressure	LP Steam - 5	Safety Yellow
Condensate Return From:		
High Pressure Steam	HP Cond. - 175	Safety Yellow
High Pressure Steam	HP Cond. - 125	Safety Yellow
High Pressure Steam	HP Cond. - 100	Safety Yellow
Medium Steam Pressure	MP Cond. - 65	Safety Yellow
Medium Steam Pressure	MP Cond. - 25	Safety Yellow
Medium Steam Pressure	MP Cond. - 15	Safety Yellow
Low Pressure Steam	LP Cond. - 5	Safety Yellow
Condensate Pump Discharge	Cond. P.D.	Safety Yellow

9. Refrigerant piping shall be provided with the identification symbols and color codes as follows:

Service	Symbol	Color
Refrigerant Liquid	RL-(Refrigerant Type)	Purple
Refrigerant Suction	RS-(Refrigerant Type)	Purple
Refrigerant Hot Gas	RHG-(Refrigerant Type)	Purple

10. Painting
    a. All Paint shall be PPG.
        i. Safety colors are PPG – 7 Line Industrial Enamel Gloss Interior/Exterior Oil.
        ii. Other colors are PPG – Pitt Tec Industrial Enamel Stain and Gloss Acrylic Safety.
    b. Pipe/Equipment Paint Schedule and Color Codes:
        1. Mechanical room equipment shall be painted in accordance with the following color code, however, the Contractor shall obtain approval from the Owner's representative prior to proceeding with any of the following colors:
            a. Piping Systems:

i. Chilled water supply piping (insulated) – Safety Blue.
ii. Chilled water return piping (insulated) - Light Blue (Windfall).
iii. Condenser water supply piping - Safety Green.
iv. Condenser water return piping - Light Green.
v. Domestic cold water piping (insulated and uninsulated) – Safety Green.
vi. Domestic hot water piping (insulated) – Safety Green.
vii. Storm piping (insulated and uninsulated) – Black.
viii. Sanitary waste piping – Dark Brown.
ix. Sanitary vent piping – Light Brown.
x. Fire piping and associated drain lines – Safety Red.
xi. Pump base drain lines – color to match applicable system.
xii. Strainer drain lines - color to match applicable system.
xiii. Condensate drain lines - Black.
xiv. Miscellaneous drain lines - color to match applicable system.
xv. Water chilling unit rupture disc piping (inside building) - Purple.
xvi. Miscellaneous pressure relief lines (inside building) - Purple.
xvii. Natural gas piping – (inside building) – Safety Yellow.
xviii. Fuel Oil gas piping – (inside building) – Safety Yellow.
xix. Steam and Condensate piping (insulated) – Safety Yellow
xx. Heating hot water supply piping (insulated) – Safety Orange.
xxi. Heating hot water return piping (insulated) – Safety Orange.
xxii. Mechanical make-up water piping – Safety Blue.

2. Equipment
   a. Primary chilled water pumps - Match piping.
   b. Secondary chilled water pumps - Match piping.
   c. Condenser water pumps - Match piping.
   d. Domestic water pumps - factory finish.
   e. Fire pump and jockey pump – Safety Red to match piping.
   f. Insulated vessels such as chilled water compression tank and pot feeder - Match piping.
   g. Concrete equipment pads - Gray.
   h. Indoor Air handling units - factory finish.
   i. Outdoor Air handling units – submit standard and factory optional colors to architect for review and selection.
   j. Fans - factory finish.
   k. Double wall ductwork - standard galvanized finish.
   l. Exposed insulated ductwork – color shall be specified by architect, obtain architect approval prior to painting.
   m. Water chilling units - painted factory finish
   n. Water heaters - factory finish.
   o. Sump pit covers - factory finish, free of finish defects and corrosion.
   p. Heating hot water pumps – Safety Orange to match piping.
   q. Equipment not listed – match system or coordinate with University Project Manager
3. Additional Requirements:
   a. Areas of pumps, tanks, vessels, pot feeders and any other items insulated with Armstrong Armaflex, or approved equal, insulation

shall be painted with Armstrong Armaflex paint, PPG paint or approved equal. The Armstrong factory color is typically white. The Contractor shall add a compatible pigment to obtain the color that matches the appropriate piping system. The Contractor shall receive from the Manufacturer written approval of the pigment to be used before proceeding to work.

b. Areas of water chilling units insulated with Armstrong Armaflex insulation, or approved equal shall be painted with Armstrong Armaflex or PPG paint. The color shall match the factory painted finish of the uninsulated areas. Refer to Paragraph a) hereinbefore for pigment requirements.
c. All items shall be painted with a minimum of two coats of the specified paint.

4. The Paint Schedule and Color Code specifications apply to the following areas: central plant, mechanical rooms, air handling unit rooms, stairwells, pump rooms, storage and janitor's closets, penthouses, generator rooms, garages, exposed corridors, exposed office space, computer rooms, truck docks, plus any other areas where piping and equipment are visible.

11. Any existing or new identification materials and devices that have become visually blocked by other items in the project scope of work shall be relocated as part of the project.

UNIVERSITY OF PITTSBURGH
MECHANICAL DESIGN STANDARDS

SECTION 230700 - MECHANICAL INSULATION

1. This section covers insulation on all Mechanical systems, including, but not limited to:
    a. Steam and Steam Condensate systems
    b. Hot water systems
    c. Chilled water systems
    d. Condenser water systems
    e. Process cooling water systems
    f. Condensate drain systems
    g. Make-up water systems
    h. Refrigerant systems (for HVAC related systems)
    i. HVAC ductwork
    j. Mechanical equipment
    k. Vents, breeching and other accessories

2. Codes and Standards: The Design Professional shall comply with the requirements of all applicable codes and standards for each specific design project. The latest editions at the time of the Schematic Design submittal shall govern edition of standards to be used.

    a. International Building Code (latest edition)
    b. International Mechanical Code (2015 or latest edition)
    c. International Plumbing Code 2015 or (latest edition)
    d. International Fire Code (2015 or latest edition)
    e. International Fuel Gas Code (2015 or latest edition)
    f. International Energy Conservation Code (2015 or latest edition)
    g. National Fire Protection Association (NFPA) Standards (latest editions)
    h. ASHRAE Standards (latest editions), including but not limited to:
        i. 90.1 (2016)-Energy Standard for Buildings Except Low-Rise
        ii. 55-Thermal Environmental Conditions for Human Occupancy
    i. American Society of Mechanical Engineers
    j. American Assoc. for Accreditation of Laboratory Animal Care (AAALAC)
    k. National Institute of Health (NIH)
    l. Sheet Metal & Air-conditioning Contractors National Assoc. (SMACNA)
    m. American Conference of Governmental Industrial Hygienists(ACGIH)
    n. American National Standard Institute (ANSI)
    o. American Society of Testing and Materials (ASTM)
    p. Other as determined by Authority Having Jurisdiction

3. Insulation Materials:

Material	Preferred Material	Maximum Thermal Conductivity	Minimum Density (lb./c.ft.)	Pipe Size	Thickness
Hot Water and Dual Service (200°F and Below)	Fiberglass Pipe Insulation	0.25	3	2" and smaller, 2 ½" and larger	1 ½" 2"
Hot Water and Dual Service (201°F and Above)	Fiberglass Pipe Insulation	0.25	3	4" and smaller, 5" and larger	2 ½" 3"

[2]Chilled Water	Fiberglass Pipe Insulation	0.20	3	4” and smaller 5" and larger	1 ½” 2"
[1]Low Pressure Steam (15 psig and below)	Fiberglass Pipe Insulation	0.27	3	3”and smaller 4” and larger	2 ½” 3”
[1]Medium Pressure Steam (15 to 70 psig)	Fiberglass Pipe Insulation	0.29	3	1 ¼”and smaller 1 ½” and larger	4” 4 ½”
[1]High Pressure Steam (70 psig and greater)	Fiberglass Pipe Insulation	0.32	3	All	5”
[1]Steam Condensate Return and Pumped Condensate	Fiberglass Pipe Insulation	0.27	3	3" and smaller 4" and larger	2 ½” 3"
Hot Water Air Separators	Fiberglass Pipe Insulation	0.25	3.0	All	4"
[1]Steam Vent and Relief Valve Piping	Fiberglass Pipe Insulation	0.27	3	All Sizes	1"
Coil Condensate Drain and City Water Make-up	Fiberglass Pipe Insulation	0.20	3	1 ½” and smaller 2" to 5" 6" and larger	1" 1 ½” 2"
Refrigerant Suction and Hot Gas	Flexible Elastomeric or Polyolefin	0.22	3	1 ½” and smaller 2" to 5" 6" and larger	1" 1 ½” 2"
Indoor Free Cooling and Outdoor Condenser Water Piping	Fiberglass Pipe Insulation	0.22	3	1 ½” and smaller	1"
Hot Water Valves	Fiberglass Pipe Insulation	0.25	3	4" and smaller, 5” and larger	2 ½” 3”
[1]Valves for Steam and Steam Condensate Return	Fiberglass Pipe Insulation	0.27	3	1 ¼”and smaller 1 ½” and larger	4” 4 ½”
Domestic Cold Water	Fiberglass Pipe Insulation	0.20	3	1 ½” and smaller 2" to 5" 6" and larger	1" 1 ½” 2"
Domestic Hot Water and Hot Water Recirculation	Fiberglass Pipe Insulation	0.25	3	4" and smaller, 5” and larger	2” 2 ½”
Rainwater Conductors and Roof Drain Bodies	Fiberglass Pipe Insulation	0.21	3	All	1"
Engine Exhaust	Calcium Silicate Pipe Insulation and Ceramic Cloth	0.32		All	4”

Boiler Breeching, Induced Draft Fans, Converter Shell, Condensate Receivers, Flash Tanks, Deaerator Heaters, Hot Water Generator Shell, Boiler Feed Water Heaters, Boiler Feed Water Pumps, and Fuel Oil Heaters	Calcium Silicate Equipment Insulation	0.32	14	All	4"
Boilers (not factory insulated)	Calcium Silicate Equipment Insulation	0.32	14		4"
Condensate Storage Tanks and Other Tanks Above 100°F	Calcium Silicate Equipment Insulation Or Fiberglass Pipe and Tank Insulation with All Service Jacket			All	3"
Tanks with Temperature Below 100°F	Flexible Elastomeric Insulation			All	1 ½”
Chilled Water Pumps, Plate and Frame Heat Exchangers, Air Handling Unit Coil Headers, Centrifugal Refrigeration Machines, and Chilled Water Valves	Foamed Plastic Equipment Insulation Or Flexible Elastomeric Insulation	0.21	3		1 ½”
Cooling Tower Sumps	Foamed Plastic Equipment Insulation	0.21	3		2"
Flexible Duct Connections	Integral insulation	0.23	6		3/4"
Rectangular Supply Air, Outdoor Air and Mixed Air Ductwork and Plenums Located in Mechanical Equipment Rooms	Rigid Fiberglass Board Insulation Or Extruded Polystyrene Board Insulation	0.23	R-6 Or R-11	All	2”
Rectangular Supply Air, Return Air and Mixed Air Ductwork and Plenums Located Outdoors	Rigid Fiberglass Board Insulation Or		R-6 or R-11		2”

	Extruded Polystyrene Board Insulation				
Terminal Air Boxes (Interior Lining)	Fiber-Free Foam	0.25	R-6		¾"
Duct Mounted Coils, and Air-to-Air Heat Exchangers	Fiber-Free Foam	0.23	R-6		Mfgr's Standard Thickness
Supply Air, Outdoor Air and Mixed Air Ductwork – Exposed	Double Wall – Expanded Foam or Fiberglass	0.26	R-6		1"
Supply Air, Outdoor Air and Mixed Air Ductwork and Plenums	Fiberglass Duct Blanket Insulation	0.23	R-6		2"
Kitchen Exhaust (Grease Laden)	Fire-Rated Blanket similar to 3M Fire Barrier Duct Wrap 615+	0.17@ 1000°F	6		To achieve required fire rating

[1]In Vaults and Tunnels the use of Pyrogel XT-E is preferred, as manufactured by Aspen Aerogels. Use of Pyrogel shall be evaluated in Mechanical Rooms. Five wrapped layers shall be provided to allow exterior surfaces to be at a safe OSHA "touch" temperature. In Vaults and Tunnels an aluminum jacket shall be provided to completely enclose insulation. Interior insulation shall receive a PVC jacket, color to match requirements of Section 230553.
[2]In Vaults and Tunnels the use of Cryogel Z is preferred, as manufactured by Aspen Aerogels. Use of Cryogel shall be evaluated in Mechanical Rooms. Provide the number of layers required to meet ASHRAE 90.1 – 2016 insulation value requirements. In Vaults and Tunnels an aluminum jacket shall be provided to completely enclose insulation. Interior insulation shall receive a PVC jacket, color to match requirements of Section 230553.

4. A continuous vapor barrier shall be provided on all piping systems that operate at ambient or below.
    a. For system temperatures with fluids under 100°F and piping located in tunnels and vaults, this includes all insulation ends, cuts, etc.

5. Valve and Equipment Insulation
    a. Provide removable jackets at all components requiring servicing.
    b. Shall be similar to HotCaps manufactured by Ohio Valley Industrial Services or Thermaxx Jackets.
        i. Pyrogel XT-E shall be evaluated for us in these jackets for any service above 200°F.
    c. For items not requiring yearly or more frequent servicing, provide standard means of insulation.

6. Insulation Jackets coordinate jacket with University Project Manager and University Mechanical Engineer.
    a. Exterior
        i. VentureClad or Alumaguard
        ii. Corragated Aluminum
        iii. Stainless Steel
            1. Where exposed to Caustic environment.

iv. Metal jackets shall use stainless steel banding, self-adhering jackets are not acceptable.

b. Below-grade exterior
   i. Refer to Underground Piping in Section 232113
c. Other exterior finishes
   i. All piping that is installed outside but not insulated shall be painted.
d. Interior
   i. PVC
      1. In locations where it will receive no direct sunlight.
      2. When used in mechanical rooms, provide colored PVC to match system color of piping system. Refer to Section 230553 for system colors.
   ii. Canvas
      1. Where exposed, painted to match system color, refer to Section 230553.
   iii. Aluminum
   iv. Stainless
      1. Where exposed to caustic environment.
   v. Provide stainless steel banding on metal jackets.
e. Interior Below Slab
   i. Shall match Below-Grade Exterior requirements.

7. Insulation shall be continuous through hangers, floor and wall penetrations.

8. Duct liners, sound or insulation, shall be handled on a project by project basis.
   a. Any duct liner used shall have zero fibers in touch with the air streams and have a hospital grade anti-microbial coating on the air stream surface.
   b. Any installation must meet the requirements of the manufacturer and SMACNA guidelines.
   c. No lining of any kind shall be used in labs and vivarium type spaces.

9. All mastics, sealants and adhesives shall be low VOC as approved by the USGBC and/or per EPA standards.

END OF SECTION

UNIVERSITY OF PITTSBURGH
MECHANICAL DESIGN STANDARDS

SECTION 232113 – MECHANICAL PIPING SYSTEMS

1. This section covers piping on all Mechanical systems, including, but not limited to:
    a. Hot water systems
    b. Chilled water systems
    c. Condenser water systems
    d. Steam and Steam Condensate systems
    e. Process cooling water systems
    f. System drains
    g. Make-up water systems
    h. Refrigerant systems (for HVAC related systems)
    i. Fuel Oil systems
    j. Underground piping
    k. Expansion fittings and loops
    l. Meters and Gauges

2. <u>All metal piping shall be certified by NSF, ANSI, ASTM, CISPI per use of piping. Certifications shall be provided as part of the shop drawing submittal phase of the project and approved by the Design Professional.</u>

3. Chilled water, heating hot water, condenser water and cooling coil condensate piping:
    a. Piping shall be sized as set forth in the latest ASHRAE 90.1-2016 Table 6.5.4.6.
    b. The minimum pipe size for chilled water, heating hot water and condenser water shall be 3/4".
    c. The minimum pipe size for coil condensate drain piping shall be one size larger than the equipment's coil condensate discharge connection and not less than 1".
        i. A clean-out shall be provided at each change of direction on drain piping.
    d. Unions or a pair of flanges shall be provided at each piece of hydronic equipment.
    e. The piping shall meet the requirements of International Mechanical Code, latest edition.
    f. Hot water that is to be used to provide reheat during summer shall be installed on a separate heat exchanger/pump loop so that the hot water used for the winter heating system can be shut down during summer and vice versa.
    g. Piping Systems Materials:
        i. Chilled Water, Condenser Water and Hot Water Piping, Aboveground
            1. For pipe sizes 2" and smaller:
                a. Pipe: type L hard drawn copper meeting ASTM B88 or Schedule 40 steel meeting ASTM A53, Grade B with the approval of the University.
                b. Fittings: wrought copper meeting ASME B16.22. Malleable iron meeting ASME B16.3 when steel pipe is used.
                c. Copper pipe and fittings shall be joined using solder. Steel pipe shall be threaded.
            2. For pipe sizes 2-1/2" and larger, Aboveground:
                a. Pipe shall be Schedule 40 steel meeting ASTM A53 or A106, Grade B.
                b. Fittings shall be either 150 pound or 300 pound (depending on system operating pressure) wrought steel meeting ASME B16.9, ASME B16.28 or ASTM A420.
                c. Pipe and fittings shall be joined via welding.

ii. Chilled Water, Condenser Water and Hot Water Piping, Below Ground:
    1. For pipe sizes 2" and smaller:
        a. For below ground piping, a piping conduit system shall be used unless otherwise approved by the University. Carrier pipe shall be Schedule 40 steel meeting ASTM A53, Grade B.
        b. Fittings shall be 2000 pound, forged steel meeting ASME B16.11.
        c. Pipe and fittings shall be joined via socket welding.
        d. System shall be insulated with expanded polyurethane with a FRP jacket.
    2. For pipe sizes 2-1/2 and larger:
        a. For below ground piping, a piping conduit system shall be used unless otherwise approved by the University.
        b. Pipe shall be Schedule 40 steel meeting ASTM A53 or A106, Grade B.
        c. Fittings shall be standard weight steel meeting ASTM A105 or ASTM A106.
        d. Pipe and fittings shall be joined via butt welding.
        e. System shall be insulated with expanded polyurethane with a PVC or FRP jacket.
    3. Underground piping shall be by Thermacor, Insul-Tek, Perma-Pipe or Rovanco.
iii. Coil Condensate Drain Piping, Aboveground:
    1. For pipe sizes 4" and smaller:
        a. Pipe shall be type L hard drawn copper meeting ASTM B32.
        b. Fittings shall be wrought copper meeting ASME B16.22.
        c. Pipe and fittings shall be joined using solder. The solder shall be a Tin-Antimony compound, Grade 95TA (95% Tin, 5% Antimony). The use of solder containing lead is strictly prohibited.
iv. Other piping material may be considered when requested or required by the University end-user.

h. Mechanical Joint Piping
    i. The use of mechanical joint piping in lieu of threaded and welded piping is permitted (only with University's approval) in above ground chilled water, chilled water within vaults, above ground hot water, and condenser water piping systems, providing all of the following conditions are met.
        1. The piping system materials described in paragraph 3, Piping System Materials, above are utilized.
        2. Couplings shall be 2-segment
        3. Roll groove type mechanical joints are used. Cut groove type mechanical joints are not permitted.
        4. The piping is installed in accessible locations such as in Mechanical Equipment Rooms where the piping is exposed, vaults and tunnels where welding of systems is difficult to impossible. Mechanical joint piping shall not be installed in inaccessible locations such as in shafts and chases, above lay-in ceilings, plaster and spline ceilings, and in walls.
        5. The use of abrupt type reducing fittings is strictly prohibited.
        6. A minimum of one pipe hanger shall be provided between each mechanical joint coupling.
        7. A manufacturer's trained representative shall inspect all couplings and sign off on system prior to start-up.

ii. Use of pro-press style of pipe connections is not permitted.

i. The pressure rating of the chilled water piping and accessories for the lower six floors of various buildings connected to the Oakland Lower Campus chilled water system shall be 300 psig. Any chilled water piping and accessories above the sixth floor shall be of 150 psig rating.
    i. The Design Professional shall confirm this requirement and if 300 psig is required above the sixth floor.

j. The pressure rating of chilled water pipes and accessories for the lower six floors of buildings south of O'Hara Street in Oakland campus connected to the Upper Campus chilled water system shall be 300 psig while any chilled water piping above the sixth floor shall be of 150 psig rating.
    i. The Design Professional shall confirm this requirement and if 300 psig is required above the sixth floor.

4. Steam and Condensate Piping
    a. Steam piping shall be designed as follows:
        i. High pressure steam piping shall be designed for a maximum velocity of 1,000 feet per minute/inch diameter of pipe or 1.0 psi pressure drop per 100 feet of pipe whichever is the lower of pressure drops. Precautions shall be taken to prevent noise transmission from flow of steam in the steam pipes in the interior spaces. The above limits can be increases based on good engineering practice and/or availability of pressure drop.
        ii. Low pressure steam should be designed for a maximum of 0.25 psi pressure drop per 100 feet of pipe and depending on direction of condensate flow as per ASHRAE guidelines.
    b. Steam condensate return piping shall be gravity type, everywhere possible, and shall be designed as per ASHRAE guidelines and good engineering practice.
    c. Pumped condensate piping shall be sized in accordance with the requirements given for hot water piping and good engineering practice.
    d. All steam coils, steam-to-hot water heat exchangers and terminal equipment utilizing steam shall be designed for low steam pressure, 10 psig or less. Steam service feeding this equipment shall be approximately 10 psig maximum. Do not size equipment for higher than 15 psig operating pressure.
    e. For pressure reducing valve requirements, refer to Section 230100. Precautions shall be taken to prevent noise transmission to adjacent spaces from pressure reducing valves. High pressure reduction shall be accomplished in two steps.
    f. The piping system shall meet the requirements of the International Mechanical Code, latest edition.
    g. Pipe Materials:
        i. High Pressure Steam Piping (100 psig to 250 psig):
            1. For pipe sizes 2" and smaller:
                a. Pipe shall be Schedule 40 steel seamless meeting ASTM A53, Grade B.
                b. Fittings shall be 300 psig with threaded joints. In steam tunnels the fittings shall be malleable 2000 pound forged steel meeting ASME B16.11 with welded joints.
                c. Pipe and fittings shall be joined via socket welding.
            2. For pipe sizes 2-1/2" and larger:
                a. Pipe shall be Schedule 40 steel type E meeting ASTM A53 or A106, Grade B.
                b. Fittings shall be standard weight wrought steel meeting ASME B16.9 or B16.28.
                c. Pipe and fittings shall be butt welded and flanged joints.
            3. For below ground piping, a piping conduit system shall be used. The conduit system shall be a factory fabricated piping system and

the outer casing shall be designed to protect against corrosion over the life of the system. Piping materials shall be as described in paragraphs above. Alternately steam and condensate pipes may be installed in tunnels or mini trenches. No pipes shall be buried inside the buildings.

a. System shall be insulated with expanded polyurethane with a FRP jacket.

4. Underground piping shall be by Thermacor, Insul-Tek, Perma-Pipe or Rovanco.

ii. Low Pressure (up to 15 psig) and Medium Pressure (up to 100psig) Steam Piping:

1. For pipe sizes 2" and smaller:
   a. Pipe shall be Schedule 40 steel seamless meeting ASTM A53, Grade B.
   b. Fittings shall be class 125 cast iron or 150 psig malleable iron with threaded joints.
2. For pipe sizes 2-1/2" and larger:
   a. Pipe shall be Schedule 40 steel type E meeting ASTM A53 or A106, Grade B.
   b. Fittings shall be standard weight wrought steel meeting ASME B16.9 or B16.28.
   c. Pipe and fittings shall be butt welded, mechanically joined using Victaulic Style 870 couplings or shall have flanged joints.
   d. Mechanical Grooved Steam pipe (on piping up to 15 psig) is allowable, shall be grooved using a Victaulic grooving tool equipped with R9S roll sets, in accordance with Victaulic Specification OGS-200. A factory trained manufacturer approved representative of the coupling manufacturer shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and product installation. The contractor, with assistance from grooved manufacturer, shall keep a torque log on joints due to required torque for correct installation.
      i. A manufacturer's trained representative shall inspect all couplings and sign off on system prior to start-up.

iii. High and Medium Pressure Steam Condensate Return Piping; Aboveground and Below Ground:

1. For pipe sizes 2" and smaller:
   a. Pipe shall be Schedule 80 steel type S meeting ASTM A106, Grade B.
   b. Fittings shall be extra heavy duty wrought steel meeting ASME B16.9, ASME B16.28 or ASTM A420.
   c. Pipe and fittings shall be joined via socket welding for below ground service and in steam tunnel service.
2. For pipe sizes 2-1/2" and larger:
   a. Pipe shall be Schedule 80 steel Type E meeting ASTM A53 or A106, Grade B.
   b. Fittings shall be extra heavy duty wrought steel meeting ASME B16.9, ASME B16.28 or ASTM A420.
   c. Pipe and fittings shall be butt welded.

iv. For below ground piping, a piping conduit system shall be used. The conduit system shall be a factory fabricated piping system and the outer

casing shall be designed to protect against corrosion over the life of the system. Piping materials shall be as described above.

1. Alternately steam and condensate pipes may be installed in tunnels or mini trenches. No pipes shall be buried inside the buildings.

h. Low Pressure Steam Condensate Return and Pumped Condensate Return Piping; Aboveground and Below Ground:
    1. For pipe sizes 2" and smaller:
        a. Pipe shall be Schedule 80 steel type S meeting ASTM A53, Grade B.
        b. Fittings shall be 300 psig malleable iron with screwed joints meeting ASME B16.3 for aboveground service and shall be forged steel meeting ASME B16.11 for below ground and tunnel service.
        c. Pipe and fittings shall be joined via socket welding for below ground service and in steam tunnel service.
    2. For pipe sizes 2-1/2" and larger:
        a. Pipe shall be Schedule 80 steel Type E meeting ASTM A53 or A106, Grade B.
        b. Fittings shall be extra heavy duty wrought steel meeting ASME B16.9, ASME B16.28 or ASTM A420.
        c. Pipe and fittings shall be butt welded, mechanically joined using Victaulic Style 870 couplings or shall have flanged joints.
        d. Mechanical Grooved Steam pipe shall be grooved using a Victaulic grooving tool equipped with R9S roll sets, in accordance with Victaulic Specification OGS-200. A factory trained manufacturer approved representative of the coupling manufacturer shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and product installation. The contractor, with assistance from grooved manufacturer, shall keep a torque log on joints due to required torque for correct installation.
            i. A manufacturer's trained representative shall inspect all couplings and sign off on system prior to start-up.
    3. For below ground piping, a piping conduit system shall be used. The conduit system shall be a factory fabricated piping system and the outer casing shall be designed to protect against corrosion over the life of the system. Piping materials shall be as described above.
        a. System shall be insulated with expanded polyurethane with a FRP jacket.
        b. Alternately steam and condensate pipes may be installed in tunnels or mini trenches. No pipes shall be buried inside the buildings.
    4. Underground piping shall be by Thermacor, Insul-Tek, Perma-Pipe or Rovanco.

ii. Steam Traps:
    1. Where available, provide traps with universal connection, for easy disconnection and replacement.
    2. Steam traps serving low pressure (15 psig and below) coils, terminal equipment and end-of-main drips shall be the float and thermostatic (F&T) type.

3. Steam traps off pre-heat steam coils shall be an inverted bucket trap with a thermostat wafer type trap in parallel.
4. Steam traps serving high pressure end-of-main drips shall be the thermodynamic type.
5. All steam traps shall be provided with check valves and isolation valves on either side of trap.
6. Provide a strainer with a capped hose end connection on inlet of traps.
7. Trap sizing shall take cold start-up of associated heating apparatus into consideration, typically with heat exchangers and preheat coils.
8. The Professional shall provide a schedule of steam traps on the drawings.

i. Each existing to remain steam radiator within a project scope area shall be provided with a steam control valve as the renovations in any of the University buildings are carried out.
j. All high pressure condensate shall be flashed before being drained into the low pressure condensate system and condensate drain tank. Low pressure steam shall be extracted from the flash tanks.
    i. Use of heat recovery devices (heat exchangers or other means) shall be considered for all flash tank installations.
k. The manhole covers on steam manholes and vaults shall have shall five 1" diameter holes for light.
l. The steam tunnels shall be ventilated with supply and/or exhaust fans.
m. Steam and/or condensate vaults not connected to tunnels shall be provided with ventilation. Temperatures shall be kept to a maximum of 100°F.
n. Steam pressure reducing stations shall be self-contained or pilot operated from downstream steam pressure. Electrically operated or compressed air operated pressure reducing valves are not acceptable.
o. Each pressure reducing valve shall have a strainer installed upstream prior to each pressure reducing valve.
p. Steam is available at 175 psig from the Carrillo and Bellefield Steam Plants on the Oakland Campus.
q. A high pressure reducing station shall be provided in each new or existing facility/building and shall be designed to reduce pressure to 5-15 psig in two steps. Single pressure reducing valves are not acceptable. Provide 1/3 and 2/3 capacity control system with a bypass at each reducing step and station. Provide relief valve piped to outdoors per the Codes. The Professional shall clearly identify high pressure 175 psi steam system to be provided with 300 psig duty piping and accessories on the drawings.
    i. PRV valves shall be by Spence, Spirax-Sarco, Leslie or approved equal.

5. Refrigerant Piping
    a. Refrigerant piping shall be sized per equipment manufacturer's recommendations.
    b. Manufacturer shall approve in writing all sizing and routing of refrigerant piping prior to equipment start-up.
        i. Approval shall be submitted to the Engineer of Record AND the University and included in Warranty package provided to the University.
    c. Each system shall be provided with the following refrigerant specialties:
        i. Liquid line sight glass.
        ii. Refrigerant filter-drier.
        iii. Liquid line solenoid valve.
        iv. Oil receivers (as required).
        v. Discharge line oil separator (as required).
    d. Unions shall not be used in the refrigerant piping system.

e. The refrigeration system shall shut down only after the pump down cycle of refrigeration system by the control of refrigerant liquid line solenoid valve.
f. The piping shall have suction line traps at all suction pipe risers and low ambient temperature head pressure controls. Refrigerant systems 15 tons and larger shall have liquid line solenoid valves for pump down cycle and double suction pipe risers at DX coils for oil return at partial loads. The Professional shall include low ambient control, all safeties and accessories for a proper operating system that will prevent any malfunction or damage to the compressors in any situation.
g. The Professional shall request and approve the shop drawings for the installation of refrigerant piping before the Contractor installs the piping making sure that all the conditions in paragraph "g" are complied with.
    i. Installation of refrigerant piping shall comply with the requirements of ASHRAE Standard 15 (latest edition) and International Mechanical Code, latest edition. This shall include any required refrigerant exhaust systems.
    ii. Hot gas bypass shall be specified only after consultation with the University.
    iii. Time delay relay shall be installed in the refrigeration equipment to prevent short cycling of the refrigeration system.
    iv. Oil traps shall be provided on all refrigerant suction risers at the cooling coils, condensing units etc.
h. Piping Systems Materials:
    i. All aboveground refrigerant piping shall be type L, hard drawn ACR copper meeting ASTM B280 or ASTM B88.
    ii. All below ground 2" and smaller shall be Type K annealed-copper tubing.
    iii. All below ground 2-1/2" and larger shall be type L, hard drawn ACR copper meeting ASTM B280 or ASTM B88, installed within a PVC carrier pipe.
    iv. Fittings shall be wrought copper meeting ASME B16.22.
    v. Pipe and fittings shall be joined with the use of BCuP silver alloy brazing meeting AWS A5.8.

6. Fuel Oil Systems, Piping and Accessories
    a. All tanks shall be the aboveground type and shall be of double wall construction.
    b. Tanks shall comply with UL142, NFPA 30, 31, 110, IMC latest edition and the City of Pittsburgh (or other local AHJs) Above Ground Storage Tank Installation Protocol.
    c. All above ground storage tanks greater than 1,100 gallons must be installed by a DEP certified installer.
    d. Aboveground Secondary Containment Storage Tanks
        i. Aboveground tanks shall be designed and UL listed as atmospheric tanks with a maximum working pressure of 1 PSI.
        ii. The primary tank and the secondary containment tank shall be tested and certified for a minimum hydrostatic pressure of 5 psig.
        iii. Each tanks shall be equipped with the following female NPT openings as a minimum:
            1. 6-inch opening for fill port.
            2. Two 8-inch openings for emergency vent; one on the primary tank and one on the secondary tank.
            3. 2-inch opening for interstitial leak detection.
            4. 2-inch opening for drop tube.
            5. 18-inch minimum opening for access (manway).
            6. 2-inch opening for working vent.
            7. 2-inch opening for liquid level gauge.
            8. 2-inch opening for supply piping.
            9. 2-inch opening for high level alarm.
            10. 2-inch opening manual liquid level measurement.
            11. Visual fuel level gauge.

iv. The secondary containment tank shall incorporate the openings of the primary tank, as applicable.
v. The tank shall be equipped with lifting lugs.
vi. The tank Manufacturer shall provide proof (upon request) of a minimum 10 years' experience in manufacturing UL listed rectangular or cylindrical tanks.
vii. The above ground tank shall have a minimum 20-year warranty.
viii. The tanks shall have a base frame or support system to accommodate installation on a concrete pad.

e. Primary Storage Tank:
i. The primary storage tank shall be rectangular or cylindrical in design.
ii. The tank will store No. 2 fuel oil. The primary storage tank shall be constructed of ASTM A-569 or A-36 carbon steel as required for compatibility of product being stored.
iii. The primary tank shall be pressure tested in the factory to the UL 142 specifications; a minimum of 3 psig.
iv. The primary tank exterior shall be provided with an epoxy finish.
v. Visual fuel level gauge.

f. Secondary Containment Tank:
i. The secondary containment tank shall be rectangular or round in design.
ii. The secondary containment tank shall be listed by Underwriters Laboratories as secondary containment.
iii. The secondary containment tank shall provide a minimum of 110% secondary containment.
iv. The secondary containment tank shall be equipped with a 2-inch monitoring port and an 8" emergency vent port as required by Underwriters Laboratories Inc.
v. The secondary containment tank exterior shall be provided with an epoxy finish.
vi. The secondary containment tank shall be pressure tested in the factory to the UL 142 specification; that is a minimum of 3 psig.

g. Accessories:
i. One man-holes shall be provided such that the interior of the primary tank can be accessed. Access shall meet OSHA requirements. Tanks greater than 20' in length shall have two man-holes.
ii. 5-gallon spill box (12" x 12" x 8" high) with a 1/2" drain on fill lines.
iii. 2-inch drop tube with a 2-inch quick disconnect (camlock type) and padlock for future evacuation of the tank.
iv. 4-inch lockable fill cap.
v. Fuel fill limiter valve which automatically limits the fill rate when the fuel level in the tank reaches 95% of full capacity.
vi. 2-inch pressure vacuum vent with riser pipe and vent cap.
vii. Two 8-inch pressure vacuum vents, each with a riser pipe and vent cap; one for the primary tank and one for the secondary tank.
viii. A Morrison liquid level clock gauge.
ix. Steps with handrail and a non-slip, grated platform for fill operations. The steps and platform shall provide safe and convenient access to the fill tube and shall be secured in place per the manufactured instructions and in accordance with OSHA Standards.
x. A rain and ice shield, unless the tank design incorporates rain and ice protection for the secondary containment tank.
xi. An electric monitoring and alarm system with an interstitial leak detection sensor and a high/low level sensor for remote monitoring of primary tank fuel leaks and high and low primary tank fuel levels.
xii. Anti-siphon device where applicable.

xiii. All remote fuel fill stations shall have level alarms to indicate that the tank is filled to the 90% level and a secondary alarm at 95% fill level. Tanks shall never be filled completely as per NFPA and the City of Pittsburgh Fire Department. The Professional shall take into consideration the distance between the fuel tank and the remote fill station in determining the appropriate level to stop filling the tank to prevent over filling.

xiv. All fuel caps and remote filling stations shall be locked and keyed to the University requirements.

h. Fuel Oil Transfer System/Day Tanks:

i. Unless otherwise directed by the University, a packaged day tank shall be provided to ensure a reliable, local source of fuel oil for stationary diesel or turbine engine driven equipment such as generator sets, pumps and mechanical drives, or for fuel oil burning equipment.

ii. The day tank shall have 2 – 4 hour capacity or a minimum of 5% of the main storage tank.

iii. Packaged day tanks shall be provided with the following accessories:

1. Duplex oil transfer pumps
2. 5 GPM (5 strokes/gallon) hand pump
3. Integral rupture basin.
4. 2" tank vent connection. This vent line shall be extended to the exterior and protected from water, debris and insects. Terminate a minimum of 5'-0" higher than any other fuel oil system piping.
5. 4" emergency vent connection. 4" emergency vent shall have a weighted cap.
6. 3/4" supply connection.
7. 1" return connection.
8. 1" overflow connection.
9. 1/2" drain connection.
10. 1-1/2" fuel level gauge connection.
11. 1/2" duplex pump port.
12. 1" hand pump port.

ii. When the main storage tank is located below the day tank, the centerline of the fuel oil transfer pump to the minimum useable fuel level in the main storage tank shall not exceed 20 ft. maximum lift.

iii. When the day tank is used to support an engine generator, the day tank's normal fuel level must be below the centerline of the engine injectors.

iv. When the main storage tank is located above the level of the day tank, an anti-siphon valve must be located in the high point of the day tank intake line.

v. A check valve must be located on the inlet of each pump to maintain the pump's prime.

vi. In a duplex pumping system, each pump shall have its own intake line from the main storage tank. Each intake line shall terminate 4" above the bottom of the main storage tank and shall have a foot valve with screen.

vii. A fuel strainer shall be installed in the transfer pump intake line. Minimum 5 GPM capacity.

viii. Final fuel oil piping connections to engine driven generators shall be made using flexible piping connectors.

ix. When returning fuel oil to the day tank from an engine driven generator, the oil shall be cooled using an air-to-fuel oil cooler similar to the 10 Series Temp-Trollers.

x. A check valve shall be installed on the fuel pipe that rises vertically over 100 ft. from the fuel supply in a lower location.

xi. Pipe installation that runs through a building in the occupied spaces shall be schedule 40 steel pipes with welded construction.
xii. All tests will be witnessed by the City's Bureau of Fire; Fire Prevention Division, Contractor shall be responsible for all associated City fees.
xiii. All fuel tanks and fuel fill stations serving emergency generators shall have 2" male cam lock fuel line connectors. The connector shall come with a cam lock dust cap. A manual 2" full port ball valve shall be installed in the system.
xiv. The system shall have a minimum 5 gallon containment sump with drain port.

b. Fuel Oil Piping Systems:
i. Materials for Piping Systems:

Pipe Size	Systems	Materials
2" and smaller, above ground	Fuel Oil Piping	Pipe: Carbon steel, threaded, ASTM A53 or ASTM A120, standard weight, black. Fittings: Cast iron, threaded, Class 125 and Class 250, ANSI B16.4.
3" and smaller, under ground	Fuel Oil Containment Piping	Carrier Pipe and Fittings: UL listed HDPE double wall flexible piping. With supports every 5'-0" off of inner wall of containment piping. Secondary Containment Piping: PVC conduit.
2" and smaller, under ground	Vent Piping	Pipe and Fittings: FRP filament wound type with bell and spigot, adhesive-bonded type fittings and couplings.
2" and smaller, above ground	Vent Piping	Pipe: Carbon steel, threaded, ASTM A53, standard weight, black (indoor) or wrapped galvanized (outdoor). Fittings: Cast iron, threaded, Class 125, ANSI B16.4

ii. Materials for Piping Systems Pipe Threads:
1. Pipe threads shall conform to ANSI B2.1. Threads that are corroded, stripped, chipped, flattened, or damaged in any other way, are not acceptable.
2. Unions shall be used on threaded pipe for pipe sizes 2-1/2 inches and smaller.
3. Unions for steel pipe shall be in accordance with ANSI B16.39, malleable iron, threaded, Class 150 and 250, black or galvanized to match adjacent piping.
4. Dielectric unions shall have metal connections on each end threaded to match adjacent piping. Metal components shall be separated by nylon

insulator to prevent current flow between dissimilar metals. Unions shall be suitable for the required system operating temperatures and pressures.

iii. Pipe Fittings:
   1. Pipe fittings, where applicable, shall have the manufacturer's trademark affixed in accord with MSS SP-25 so as to permanently identify the manufacturer.

iv. Cutting Oil:
   1. Thread-cutting oil shall be an all-purpose lubricant free from animal or vegetable compounds.

v. Pipe Thread Compound:
   1. Screwed pipe joints shall have male threads only coated with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene (PTFE) tape applied to male threads.
   2. For oil piping, pipe thread compound shall be oil based similar to Permatex.

vi. Unions shall not be concealed in walls, partitions, or above inaccessible ceilings.

vii. DO NOT use galvanized pipe or galvanized fittings in oil piping lines.

viii. Use Permatex on threaded connections in oil piping.

ix. Elbows shall be the long-radius type.

x. For underground fuel oil piping, a flexible (swing) joint shall be installed at every change in direction from the vertical to the horizontal or from the horizontal to the vertical in an underground piping system. A flexible joint shall be a joint that makes a single change in direction with either an approved flexible connector or two fittings with a nipple between the fittings. The fittings shall not be street fittings, nor shall the nipple be a close nipple.

xi. The installation shall be tested as per the requirements of the Authority having jurisdiction.

c. Pipe Sizing:
   i. Recommended Nominal Size for Fuel Oil Suction Lines from Tank to Pump

(Distillate Grades, Numbers 1 and 2)

Pumping Rate	Length of Run in Feet at Maximum Suction Lift = 10 ft.									
gal/h	25	50	75	100	125		150	175	200	250	300
10	½	½	½	½	½	½	¾	¾	¾	1	
40	½	½	½	½	½	¾	¾	¾	¾	1	
70	½	½	¾	¾	¾	¾	¾	1	1	1	
100	½	¾	¾	¾	¾	1	1	1	1	1½	
130	½	¾	¾	1	1	1	1	1	1½	1½	
160	¾	¾	¾	1	1	1	1	1½	1½	1½	
190	¾	¾	1	1	1	1	1½	1½	1½	2	
220	¾	1	1	1	1	1½	1½	1½	1½	2	

7. The contents of ALL storage tanks must be prominently displayed on the tank.

8. T-Drill Piping: Tee drill connections are NOT permissible.

9. Bullhead Tees are NOT permissible.

10. Use of bushings will not be permitted. Change in direction shall be made with fittings.

11. Threaded joints shall be made with tapered threads in accord with ANSI B2.1, and made tight with an approved pipe thread joint compound or material, applied to the male threads only.

12. Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges. Use of a bronze or brass valve is NOT a substitute for a dielectric union.

13. Pipe Hangers shall meet MSS SP-58 as well as the following requirements:
    a. Piping shall be supported per industry standards to prevent sagging.
    b. Piping shall not be hung from ductwork, conduit or other piping.
    c. Piping shall be supported from the building structure using unistrut and/or channel support system.

14. Pipe Seals: Where piping, exposed to standard operating temperatures, passes through exterior walls or waterproofed floors, a sealing element manufactured from EPDM with interlocking links shall be used.
    a. Pipe seals shall be similar to PSI/Thunderline Link-Seal or Metraflex.

15. Use propylene glycol in run around heat recovery glycol-water piping system.

16. During construction, the project plan, as required in the project specifications, shall dictate how all piping shall be protected from dirt, dust and moisture. Systems shall be flushed prior to connection to central systems or prior to operating any connected equipment.
    a. The University shall be notified of when systems will be flushed.

END OF SECTION

UNIVERSITY OF PITTSBURGH
MECHANICAL DESIGN STANDARDS

SECTION 232115 – PIPING ACCESORIES

1. This section covers piping accessories for all Mechanical/Plumbing/Fire Protection systems, including, but not limited to:
    a. Steam and Steam Condensate systems
    b. Hot water systems
    c. Chilled water systems
    d. Condenser water systems
    e. Process cooling water systems
    f. System drains
    g. Make-up water systems
    h. Refrigerant systems
    i. Fuel Oil systems
    j. Underground piping
    k. Air Handling Systems
    l. Exhaust systems
    m. Make-up air systems
    n. Energy recovery systems
    o. Domestic Cold and Hot Water
    p. Domestic Hot Water Recirculation
    q. Natural Gas and Propane
    r. RO and RODI
    s. Compressed air
    t. Lab air and gases, med air and gases, vacuum

2. The pressure rating of the chilled water piping and accessories for the lower six floors of various buildings connected to the Oakland Lower Campus chilled water system shall be 300 psig. Any chilled water piping and accessories above the sixth floor shall be of 150 psig rating.
    a. The Design Professional shall confirm this requirement and if 300 psig is required above the sixth floor.

3. The pressure rating of chilled water pipes and accessories for the lower six floors of buildings south of O'Hara Street in Oakland campus connected to the Upper Campus chilled water system shall be 300 psig while any chilled water piping above the sixth floor shall be of 150 psig rating.
    a. The Design Professional shall confirm this requirement and if 300 psig is required above the sixth floor.

4. Expansion Compensation
    a. General:
        i. Where physical conditions permit, expansion compensation for piping shall be accomplished by "pre-fabricated" type pipe expansion compensation.
        ii. Where physical conditions do not permit, expansion compensation for piping shall be accomplished using:
            1. Pack-less, externally pressurized, metal bellows type expansion joints similar to Hyspan Series 3500 and/or equal.
            2. Pack-less expansion compensator type expansion joints similar to Hyspan Series 8500.
            3. Grooved end, pack-less, gasketed type, with grooved end telescoping body, suitable for axial end movement for up to 3" and 300psi, Victaulic Style 150 Mover shall be allowed.
        iii. Use of expansion joints shall be approved by the University.

iv. Pipe anchors shall be designed and fabricated in accordance with ASME B31.1 or B31.9 and with AWS D1.1.
v. Pipe guides shall be the spider type similar to Metraflex Style IV Spider or Hyspan Series 9500.

b. Design risers to connect to mains with at least 4 pipe fittings, including tee in main.
c. Design risers to connect to terminal units with at least 3 pipe fittings, including tee in riser.
d. Fabricated type pipe expansion loop shall be designed in accordance with ASHRAE.
e. Special considerations shall be made in tight spaces. Alternate methods of pipe expansion compensation must be approved by University Mechanical Engineer assigned to the project.

5. Meters and Gauges
   a. General: The following paragraphs provide guidance for the design, installation, operation, and testing of chilled water and steam Btu metering stations installed in pipe lines up to eight inches in diameter.
   b. Pressure gages shall be provided across all pressure regulating/reducing valves, at control valves, make-up water valves, pumps, chillers, boilers, steam heating coils etc.
   c. Thermometers shall be provided at inlet and outlet of air handling unit and blower unit coils, boilers, chillers, heat exchangers.
   d. P/T ports shall be provided on supply and return piping at all heating/cooling coils, radiant panels and any other equipment served by hot/chilled/condenser water systems.
   e. Sources: All flow calculations and primary flow element installation techniques shall be performed in accordance with Fluid Meters, Their Theory and Application, most current edition, ASME.
   f. Meters:
      i. Environmental Conditions
         1. The meter shall be installed in a space suitable for inspection, protection and service. The space shall be adequately lighted and ventilated to prevent development of a toxic atmosphere or temperature extremes.
         2. Isolation valves shall be provided on the inlet and outlet of the primary element. Follow ASME guidelines and the manufacturer's recommendations to determine the length of straight pipe required before and after the primary flow element.
         3. The space must be physically large enough to accommodate the entire meter configuration.
         4. A Btu meter for chilled water consists of a primary flow element and transducer, two temperature sensors, and communication sub-assemblies.
         5. A Btu meter for steam consists of a primary flow element and transducer, one pressure sensor, and communication sub-assemblies. All components must be suitable for the environment where it is installed.
      ii. Characteristics of Construction
         1. All the constituents of a meter shall be solidly constructed of materials having appropriate qualities to resist the various forms of corrosion and wear which occur under normal working conditions, especially those due to impurities in the flowing medium. Correctly installed meters shall also be able to withstand the normal external influences. Meters shall, in all circumstances, withstand the normal pressure and temperature for which they are designed without malfunction.
         2. Primary flow element and transducer for chilled water and steam measurement shall be a piezoelectric based vortex shedding device.
         3. The proper direction of the flowing medium shall be marked on the primary measuring element. Primary element flow measurement range, pipe diameter, serial number and manufacturers name shall be stamped on a metal tab welded to the element and which will be visible when the element is installed in the piping system.

4. All system flow sensors shall be Rosemount Smart Vortex Flow Meters Model 8800 or approved equal, suitable for use with ANSI class 300 flanges. The flowmeter shall be certified for use in hazardous areas by Factory Mutual, and shall operate on 12 to 42 volts dc with no load. Output shall be a 4-20mA analog signal.

iii. All system pressure sensors shall be Rosemount Smart Transmitters Model 3051 C. Pressure sensors for steam flow pressure correction, if required, shall be installed in locations approved by the University of Pittsburgh Mechanical Engineer assigned to the project.

iv. Temperature sensors for the measurement of differential temperature shall be installed in locations approved by the University Mechanical Engineer assigned to the project. The sensor shall be a 100 ohm platinum RTD with a 2-wire 4-20 ma output transmitter contained within a single housing. Temperature sensors shall be installed in stainless steel thermo-wells and shall be filled with a heat conductive medium.

g. Installation Requirements
   i. All valves shall be 600 psi rated ball valves with stainless steel body, stainless steel ball and glass reinforced TFE packing and seats.
   ii. A minimum #18 AWG twisted shielded pair of wires in ¾" conduit shall be run from the pressure and temperature transmitters to a Building Automation System control panel which will be identified by the University of Pittsburgh.

h. Maximum Ambient Operating Conditions
   i. The components of steam and chilled water metering stations must operate satisfactorily over an ambient temperature range of -40°F to 185°F.

i. Performance Requirements
   i. Accuracy:
      1. Liquids (for Reynolds numbers over 20,000)
         a. Pulse output: ± 0.65% of rate
         b. Analog output: ± 0.70% of rate
      2. Gas and Steam (for Reynolds numbers over 15,000)
         a. Pulse output: ± 1.35% of rate
         b. Analog output: ± 1.40% of rate
   ii. Stability:
      1. ± 0.1% of rate over six months

j. The acceptable manufacturers for steam meters are Foxboro, Rosemont and/or Siemens. Acceptable models are Vortex, Verabar, Accelabar or similar models. Orifice plates are not acceptable for meter use.

k. Vortex type flow meters may be used to measure chilled water, condenser water, steam flows similar to Siemens Sitrans FX or approved equal.

l. The Professional shall determine the summer and winter minimum and maximum flows for each meter. Meters shall have certified operation thru the whole range of flows.

6. Air Separators shall be provided on all chilled water and hot water systems.
   a. Tangential type air separators shall be used.
      i. Size separators for 1 psi pressure drop.
      ii. Shall have a quarter turn ball valve on the blowdown. Blowdown shall not be directly above any piping or equipment.
      iii. Basis of design shall be Rolairtrol manufactured by B&G. Other manufacturers are allowed provided they meet the performance and component specifications of the Rolairtrol.
   b. Air And Dirt Separators
      i. Where the Professional deems necessary a combination air and dirt separator shall be provided. University Mechanical Engineer assigned to the project shall approve this use.

ii. Pressure drop shall be kept to a minimum.
iii. Basis of design shall be Spirotherm. Other manufacturers are allowed provided they meet the performance and component specifications of the Spirotherm model.

c. Provide high capacity automatic air vent off the top of the air separator.
d. Shall have a quarter turn ball valve on the blowdown. Blowdown shall not be directly above any piping or equipment.

7. Expansion Tanks
    a. All chilled and hot water systems shall be provided with an Expansion Tank.
        i. Professional shall determine if a replaceable bladder tank or a compression tank best meets the needs of the project.
        ii. Replaceable bladder expansion tanks shall be similar to Wessels, Bell and Gosset or Armstrong with ASME ratings.
            1. Other manufacturers may be submitted for approval in the design phase of projects, if approved they may be listed in the project specifications.

8. Automatic Air Vents
    a. Automatic air vents shall be installed only in the mechanical rooms in consultation with the University.
    b. Provide automatic air vents on equipment side of isolation/shutoff valves; on chillers, heat exchangers.

9. Manual Air Vents
    a. Manual air vents shall be provided at all high points, at pipe turn downs in the direction of water flow, heat exchangers and coils.

10. Strainers
    a. Y-pattern
        i. Steam:
            1. Y-type strainers shall be provided at all pressure regulating valves, control valves, steam traps etc
            2. For steam systems use size 20 mesh for strainers up to 2", 0.045 perf from 2-1/2"to 6" and 0.062 per above 6"
            3. For Steam Condensate strainers use 0.045 perf up to 2" and 0.125 perf above 2".
        ii. Chilled and Hot Water
            1. Y-type strainers shall be provided at all control valves
    b. Basket
        i. Provide at inlet of each condensate receiver.
    c. Temporary pump strainers
        i. Shall be provided on suction side of every new pumps during construction. Once systems has been flushed and treated but prior to balancing, the temporary strainer shall be removed.

11. Storage and/or Buffer Tanks
    a. The contents of ALL storage tanks must be prominently displayed on the tank.

12. Drain Valves
    a. Drain valves shall be full port quarter turn ball valves with capped hose ends
    b. ¾" drain valves shall be provided on both sides of pumps, coils, heat exchangers, chillers and boilers. Additional locations may be added based on project scopes.

13. Drip Legs:
    a. On steam piping provide drip legs before control valves to protect control valve seats. Slope steam supply piping between the drip and the control valve back towards the drip.

14. Make-up Water
    a. A reduced pressure zone backflow preventer shall be used. Similar to Watts LF009 for 3" and smaller piping.
        i. Backflow protection shall meet all applicable code and AHJ requirements.
    b. All make-up water to the hot and chilled water shall be provided with pressure reducing valves, strainers, pressure gauges etc.
    c. Make-up water for hot and chilled water systems shall be introduced into the systems thru or adjacent to the air separator. Follow manufacturer's recommendations for this tie-in piping arrangement.
    d. Make-up water for cooling tower condenser water systems shall be introduced into the cooling tower sump basin.
    e. Other systems requiring make-up water shall be handled on a case by case basis.

15. Pressure gages shall be provided across all pumps, heating/cooling coils at air-handling units, heat exchangers, chillers, boilers etc. Thermometers shall be provided across all heating/cooling coils, heat exchangers, chillers, boilers etc.

16. Flow Control Devices:
    a. All air handling units over 1500 cfm shall be provided with a pressure independent control valve on the chilled water coil.
        i. Valves shall be similar to Flow Control Industries, TA/Victaulic, FDI, Belimo or approved equal.
    b. Automatic type flow control devices shall be installed on hot water heating systems such as fin tube radiation, VAV box reheat coils or wherever else permitted by the University at the equipment with low hot water flows. Automatic flow control devices shall also be installed on chilled water piping to fan coil units, under 1500 CFM.
    c. All manual balancing valves shall be wide pattern globe valves and shall be Tour and Anderson, Armstrong, Nibco or approved equal.
    d. Actuators shall be matched with and approved by Control Valve manufacturer.
    e. Provide Cv values on drawings for all chilled water control valves. Provide Cv values on drawings for steam and hot water equipment with a flow rate of 20GPM or greater.

17. Methods and materials for wet taps, where permitted by the University Planning Mechanical Engineer and Operations Mechanical Engineer, shall be submitted for approval by the A/E. Submittals shall include documentation on the products to be used with complete instructions and procedures to ensure successful wet taps.
    a. This shall be approved by the Design Professional and University Operations.

END OF SECTION

UNIVERSITY OF PITTSBURGH
MECHANICAL DESIGN STANDARDS

SECTION 233100 – DUCT AND AIRSIDE ACCESORIES

1. This section covers duct and ductwork accessories for airside systems, including, but not limited to:
    a. Outdoor air
    b. Supply air
    c. Return air
    d. Exhaust air

2. An IAQ plan shall be incorporated into every construction project where ductwork is replaced, new, connected to, or otherwise involved. SMACNA guidelines should serve as a guide.

3. For all airside sensors and switches refer to ATC Section 230900 for details and equipment requirements.

4. The use of fiberglass duct board as a means of conveying air is strictly prohibited.

5. The use of flexible ductwork is permitted on supply air systems provided that the following conditions are met.
    a. Maximum length of the flexible ductwork for any single application shall be 5' - 0".
    b. All flexible ductwork shall be insulated.
    c. Maximum total change in direction shall be equivalent to 90º. Flexible duct shall not be accepted with any kinks due to direction change.
    d. The flexible duct shall be directly connected to a supply diffuser at one end.
    e. Flexible ductwork shall be connected to diffusers via stainless steel bands with cadmium plated hex screws. Plastic connecters are not permitted.

6. Duct systems shall be constructed in accordance with the latest edition of SMACNA Duct Construction Standards.
    a. Duct systems shall be constructed for the operating pressures of the system which they serve.
    b. Except where connecting to equipment or louver plenums, the maximum duct aspect ratio shall be 4 to 1.

7. Duct Design Sizing Criteria:
    a. Low pressure supply air ductwork shall be sized for a maximum pressure drop of 0.08 inches wg per 100 feet of duct.
    b. Medium pressure supply air ductwork shall be sized for a maximum air velocity of 2,000 feet per minute.
    c. Supply air ductwork branch run-outs serving a single diffuser shall be sized for a maximum air velocity of 600 feet per minute or 0.08 inches wg per 100 feet of duct, whichever is less.
    d. Return air ductwork mains shall be sized for a maximum pressure drop of 0.08 inches w.g. per 100 feet of duct or a maximum air velocity of 1,500 feet per minute, whichever is less.
    e. General exhaust air ductwork mains shall be sized for a maximum pressure drop of 0.08 inches w.g. per 100 feet of duct or a maximum air velocity of 1,500 feet per minute, whichever is less.
    f. General exhaust air duct branches serving more than two grilles/registers shall be sized for a maximum air pressure drop of 0.08 inches w.g. per 100 feet of duct or a maximum air velocity of 1,000 feet per minute.
    g. Laboratory Exhaust Ductwork shall be sized for a minimum air velocity of 1,500 feet per minute.

h. Kitchen exhaust ductwork shall be sized for a minimum air velocity of 2,000 feet per minute and a maximum air velocity of 2,500 feet per minute.

8. Branches and Branch Connections:
    a. Rectangular branch ducts connecting to the main duct shall be made with a 45º boot type connection per SMACNA Duct Construction Standards, no splitter dampers shall be used.
    b. Bullhead tees and 4-way crosses are not allowed under any circumstances.

9. Transitions: In order to avoid high air pressure fitting losses, the maximum permissible angle for any side of a converging or diverging duct transition shall be 18.4° (3:1 ratio).

10. Volume Dampers:
    a. Each branch duct run-out serving a diffuser, register or grille shall contain a volume damper. This applies to supply, exhaust and ducted return diffusers, registers and grilles.
    b. The volume dampers shall be the opposed blade type for rectangular ducts in which the smallest side is larger than 12 inches.
    c. Volume dampers shall be the butterfly (single blade) type for round ductwork and for rectangular ductwork in which the smallest side is 12 inches or less.
    d. The volume and control dampers close to the exhaust fans or equipment shall be sized for the operating exhaust pressure of the fans and/or equipment.
    e. The volume dampers and control dampers in high pressure ductwork shall be low pressure drop type with maximum pressure drop of 0.30" at 3,000 fpm velocity.
    f. Dampers shall have a handle extension to allow operation of damper without damage to the adjacent insulation.
    g. Dampers shall not be installed at the diffuser/grille unless installed in an inaccessible ceiling with no other possible location for volume dampers. As this condition creates preventable noise, avoid as much as possible.
    h. Dampers shall be fully gasketed.
    i. Provide with shaft seals to prevent air leakage.

11. Control Dampers:
    a. Refer to the Controls Section in the Design Manual.

12. Turning Vanes:
    a. Single thickness turning vanes having a trailing edge shall be provided in all mitered rectangular duct elbows having an angle greater than 45º.
13. Ductwork Construction Materials:
    a. General supply air, return air and exhaust air ductwork shall be constructed of galvanized steel or aluminum.
    b. Laboratory exhaust ductwork shall be constructed of stainless steel 304 with welded construction.
    c. Kitchen exhaust ductwork shall be constructed of minimum 18 gauge stainless steel in areas where the duct is exposed and minimum 16 gauge black steel in areas where the duct is concealed. Kitchen exhaust ductwork shall be of all welded construction and enclosed in a two hour fire rated enclosure or three hour fire rated insulation.
    d. Other materials may be considered due to nature of air being exhausted on a project by project basis.

14. Fire Dampers, Smoke Dampers and Fire/Smoke Combination Dampers
    a. Dampers shall be Greenheck, Tamco, Arrow, Ruskin or approved equal.
    b. All dampers shall be UL and FM listed complete with a UL approved sleeve.
        i. Provide UL details on plans when fire/smoke/combination dampers are used.
    c. Contractor shall ensure proper access is available to allow full functional testing and maintenance.
        i. Access doors in ductwork and ceilings/walls.

d. Where possible use ‘blades out of the airstream’ type dampers.

15. HVAC Systems Requirements:
    a. Separate air systems shall be provided for each of the following classifications of areas. Specialized areas not specifically mentioned in these standards shall be reviewed with the University Mechanical Engineer assigned to the project for final design determination.
        i. Laboratories
        ii. Animal Facilities
        iii. Office Space and Classroom Space
        iv. Standards for space not listed shall be obtained from the ASHRAE Handbook.
        v. Deviations from this shall be reviewed on a case by case basis.

16. Laboratory Supply Air Systems:
    a. The following Laboratory supply air systems shall be provided that meet the design guidelines/performance criteria as follows:
        i. Provide a "Once through" air system with heat recovery.
        ii. Air supply to laboratories must keep temperature gradients and air turbulence to a minimum, especially near the face of laboratory fume hoods and biological safety cabinets. Diffusers shall be located so that they do not affect air flow patterns at the fume hood face.
        iii. Outside air intakes shall be located to prevent entrainment of relief air, exhaust air, or fume hood effluent. Wind/wake test shall be performed, as directed by the University Project Manager, to assure adequacy of the design configuration where multiple buildings are located at the same site.
        iv. All the supply air ductwork in the laboratories shall be tested for minimum 4 inches, or 125% of design whichever is higher, of static pressure for air leaks and air leak noise as per SMACNA guidelines.
    b. Refer to University Laboratory Design Manual for additional information.
    c. Refer to Controls Section 230900 for additional information.

17. Laboratory Exhaust Systems:
    a. The University Project Architect shall determine the type of laboratory fume hood to be employed for each application. Variable air volume type fume hoods are required, non VAV-hoods shall be discussed on a case by case basis.
    b. Provide laboratory exhaust systems that shall meet the following design guidelines/performance criteria:
        i. Laboratory exhaust system design approach and requirements shall be discussed with the University during the initial design phase.
        ii. All lab fume hoods and safety cabinets shall be equipped with local visual and local audible alarms to warn the lab workers of unsafe air flows.
        iii. All fume hood exhaust fans shall be located outside on the roof, or shall be in an approved, by University Project Manager, location.
        iv. Fume hood exhaust plumes shall be discharged to escape the building envelope. Professional shall design vertical discharge ducts with a minimum exit velocity of 3,000 FPM and a minimum height of 10 feet above the roof.
        v. Fume hood exhaust ducts may be manufactured of galvanized iron or stainless steel depending on the corrosive nature of the effluent.
        vi. Fume hood exhaust effluents shall not be filtered unless directed otherwise by the University.
        vii. Labs shall be maintained at an air pressure that is at least 0.05 inches W.C. negative relative to the corridors or adjacent non-laboratory areas.
        viii. "Automatic fire dampers shall not be used in lab hood exhaust systems. Fire detection and alarm systems shall not be interlocked to automatically shut down lab hood exhaust fans". (Refer to NFPA Standard 45.)
        ix. Auxiliary air supply hoods shall not be used.

x. Corridor's adjoining lab spaces shall be kept positive to the lab rooms where the release of the chemicals or air borne bacteria may be hazardous to the health of the University personnel.
xi. The Professional shall provide area pressurization plans complete with excess air flow.
xii. All the exhaust air ductwork in the laboratories shall be tested for minimum 4 inches, or 125% of design whichever is higher, of static pressure for air leaks and air leak noise as per SMACNA guidelines.

c. Refer to University Laboratory Design Manual for additional information.
d. Refer to Controls Section 230900 for additional information.

18. Laboratory Fume Hood Systems - Designers Guidelines:
    a. Fume Hood System General Design Requirements:
        i. Engineered control of the laboratory atmosphere shall be designed as part of a system consisting of the make-up air system, fume hood(s), exhaust ductwork, exhaust fan, and configuration of effluent discharge point. Refer to University's Laboratory Design Standards for additional requirements. Due to the large number of variations possible in system configurations, it is necessary that the Professional work closely with the University to define the system.
        ii. The design intent for a new system shall be to provide a variable volume make-up air system, a variable exhaust flow at the hood based upon sash position, a hood bypass or general exhaust controlled by sash position to maintain suitable air changes of outside air per hour and an exhaust fan to maintain 3,000 FPM exit velocity. The minimum air changes per hour shall be four (4) in the unoccupied mode and six (6) in the occupied mode as per National Institute of Health (NIH, latest edition). Necessary supply air shall be provided by VAV boxes/air control valves.
            1. Additional or fewer air changes can be discussed on a project by project basis.
        iii. All laboratory fume hoods shall meet the standards of the Occupational Safety and Health Act, the Scientific Equipment & Furniture Association Standard SEFA latest edition, the American Conference of Governmental Industrial Hygienists, ASHRAE Standard 110, the American National Standards Institute and the Americans with Disabilities Act.
        iv. Hoods shall be designed for a face velocity of 80 to 100 FPM at 18 inch high sash opening and 60 FPM with full sash opening. Hood sashes shall be normally closed.
        v. Any hood that is open in the unoccupied mode shall exhaust air at 60 FPM. The face velocity of the hood shall be increased to 80 to 100 FPM with the motion sensor when the Lab Operator comes into the lab.
        vi. Fume hoods shall function as ventilated, enclosed workplaces, designed to capture, confine and exhaust fumes, vapors and particulate matter produced or generated within the enclosure.
        vii. Design fume hoods for consistent and safe air flow through the hood face. Negative variations of face velocity shall not exceed 10% of the average face velocity at any designated measuring point. The negative variance on the minimum face velocity of 60 fpm is zero.
        viii. Coordinate and provide for all plumbing, ductwork and electrical connections required for fume hoods.
        ix. Safety Monitor/Alarm System: Provide Safety/Monitor/Alarm System which monitors face velocity and provides audible and visual alarm if face velocity drops below 55 FPM or rises above 200 FPM.

19. Animal Facilities:

a. Provide the following Animal Facilities supply and exhaust systems that meet the following design guidelines/performance criteria:
    i. The University will provide temperature constraints for each application or project.
    ii. The animal facility shall have a once through variable volume air system (with heat recovery where needed).
    iii. Supply fan systems shall be capable of using either 85 percent or 95 percent efficient filters based upon ASHRAE Standard 52-76 Test Method. Filter selection will be determined based on the laboratory usage. Provide pre-filters as part of the air handling unit system.
    iv. Exhaust plumes shall be discharged to escape the building envelope. Professional shall design the vertical discharge ducts with an exit velocity of 3,000 FPM and minimum height of 10'-0" above the roof.
    v. Filtering of exhaust will be determined by the University and relevant code and health regulations for each project.
    vi. Controls and dampers shall be of a type that in the event of failure, will fail open to assure continuous draft and control of temperature.
    vii. Laboratory animal rooms shall be maintained at an air pressure that is at least 0.05 inches W.C. positive relative to the adjacent corridors. The entire animal facility shall be at least 0.05 inches W.C. negative with respect to all other parts of the building.
    viii. The outside air intake shall be located to prevent entrainment of relief air, exhaust air, or fume hood effluent.
    ix. Laboratory animal room air conditioning shall be designed in accordance with the ASHRAE HANDBOOK HVAC Systems and Applications and AAALAC.
    x. The use of air contaminant monitoring shall be used to vary the amount of air exhaust and supplied to the space. Air volume shall be determined by appropriate regulations and standards governing the particular animals in the facility.
b. Refer to University Laboratory Design Manual for additional information.
c. Refer to Controls Section 230900 for additional information.

20. Clothes Dryers:
    a. The exhaust duct for the clothes dryer shall be constructed of stainless steel and shall have a smooth interior finish. It shall meet the requirements of International Mechanical Code, latest edition.
    b. If an exhaust fan is installed for multiple dryer installations, the fan shall operate when any individual dryer is in operation. Fan motor shall be located outside the air stream. Fan shall be variable volume and controlled off of static pressure sensor in dryer exhaust duct.
    c. The ducts shall have a minimum clearance of 6" to the combustible materials and single lengths from each dryer shall not exceed 8 ft. Any duct transitions shall not be concealed and appropriate clean out shall be provided on alternate floors.
    d. The exhaust ducts shall transition into duct chases without a fire damper with construction as per the NFPA Code section 90A.
    e. An exhaust fan shall be provided on top of the duct chase or inline in a mechanical room. The fan shall be sized based on the number of dryers and their exhaust requirements.
        i. Fans shall be Tjernlund or approved equal.
    f. Provide access for any exterior dryer exhaust fans. Ensure access is sufficient for interior dryer exhaust fans.

21. Access doors:
    a. Provide to allow access to the following items: fire/smoke dampers, smoke detectors, control dampers, turning vanes, humidifiers, flow stations, duct coils as well as any other items that require inspection or maintenance.
    b. Access doors shall be of sufficient size to allow proper access.

22. Ventilation rates shall meet the requirements of International Mechanical Code and ASHRAE 62.1-2016.

23. Duct Silencers
    a. Provide IAC, Ruskin or Vibro-Acoustics.
    b. Provide as needed for systems with sound concerns. Design and install per manufacturer's recommendations.
    c. Sound attenuators that are matched to VAV or other terminal devices may be provided by the manufacturer of the VAV or other terminal devices.

24. Louvers
    a. Provide Greenheck, Ruskin or approved equal.
    b. Maximum velocity over net free area shall be 500fpm in inlet louvers. Provide inlet louvers with ½" mesh screen.
    c. Inlet louvers shall meet requirements of ASHRAE 62.1 – 2016 Section 5.5.2, for rain entrainment and Section 5.5.4 for snow entrainment.
    d. Intake louvers shall not be located along Forbes or 5th Avenue side of buildings.
    e. Provide a plenum on the back side of every louver, plenums shall be between 6" and 36" in depth. Depth shall be based on size and location of duct connections to allow for full face area use of louver.
    f. Louver distance to pollutant sources shall meet requirements of ASHRAE 62.1 – 2016 Table 5.5.1.

25. Filters
    a. Every supply air system shall be provided with a filter bank.
    b. The Design Professional shall specify that three (3) sets of filters be provided for each filter bank; one (1) set of filters shall be installed during construction, second set of filters shall be installed after substantial completion and a third set of filters shall be delivered to the University in sealed cartons.
    c. Filter banks shall be designed for a maximum 300 feet per minute face velocity through the media unless otherwise approved by the University.
    d. While calculating air pressure drop for the supply air and exhaust fume ductwork, the Professional Engineer shall use dirty filter pressure drops.
    e. Filters shall meet the requirements of ASHRAE 62.1-2016.
    f. All filter banks in air handling units (supply and exhaust, if applicable) shall be provided with filter static pressure gauges. Static pressures shall be viewable at unit and via the building controls system. Setpoints shall be provided to control system to allow for setting up of dirty filter alarms. Setpoints for dirty filter status shall be recommended by filter manufacturers.
    g. Access areas for filter banks shall be shown on the engineering drawings, shop or coordination drawings and as-builts.
    h. Filter Efficiency Requirements:
        i. Residential Dormitories: MERV 7
        ii. General Offices and Classrooms: MERV 8
        iii. Laboratories – MERV 13 (Higher if required by Lab type)
        iv. Animal Rooms - MERV 15 (Higher if required by AAALAC or other standards)
        v. Or required by ASHRAE 55.1, which ever requirement is more stringent.
    i. A pre-filter bank with a rating of MERV 7 shall be installed upstream of each MERV 12 or greater filter.
    j. HEPA filters of 99.97% efficiency shall be provided in consultation with the University.
    k. Other space applications shall be determined on a case-by-case basis.

26. Duct Cleaning
    a. All new ductwork shall be cleaned prior to final acceptance.
    b. During construction the project IAQ plan shall dictate how all ductwork shall be protected from dirt, dust and moisture.

c. Any return duct being used during construction shall be protected with MERV 8 filters.
d. Cleaning shall comply with NADCA ACR latest edition.
e. Contractors responsible for cleaning shall be certified by NADCA.
f. Existing ductwork shall be cleaned if the associated project encompasses either a full floor or if all the ductwork from a single air handling unit is contained within the project scope boundary.

END OF SECTION

UNIVERSITY OF PITTSBURGH
MECHANICAL DESIGN STANDARDS

SECTION 238000 – HVAC EQUIPMENT

1. This section covers all HVAC equipment including but not limited to:
    a. Pumps
    b. Fans
    c. Terminal Units
    d. Diffusers, Grilles and Registers
    e. Steam Condensate Pumps
    f. Utility Tunnel and Vault Sump Pumps
    g. Variable Frequency Drives (VFDs)
    h. Boilers
    i. Water Cooled Chillers
    j. Air Cooled Chillers
    k. Cooling Towers
    l. Heat Exchangers
    m. Energy Recovery Units
    n. Indoor/Outdoor Air Handling Units
    o. Packaged Rooftop Units
    p. Make-up Air Units
    q. Split System Air Conditioning Units
    r. Computer Room Air Conditioning Units
    s. Heat Pumps
    t. Fan Coil Units
    u. Louvers
    v. Unit Heaters
    w. Humidifiers
    x. Air Coils
    y. Chilled Beams
    z. Fin Tube Radiators
    aa. Radiant Heaters

2. General requirements
    a. All wiring within equipment shall be run in conduit or flexible metal conduit. Bare wiring shall NOT be allowed.
    b. Equipment efficiencies shall be equal to or better than ASHRAE 90.1-2016 minimum requirements.
        i. The University may require more stringent requirements based on the scope and size of the project.
    c. Equipment located outdoors shall be reviewed to determine if additional protections, via material or coatings, are needed to add to the equipment's expected lifetime.
    d. Approved equals must be approved prior to project bidding.

3. Equipment naming requirement
    a. Large pieces of equipment, AHUs, pumps, chillers etc shall be labeled sequentially based on building/floor level.
        i. For example 2 AHU's on the 10th floor of a building shall be labeled AHU-10-1 and AHU-10-2.
    b. Terminal equipment shall be numbered based on room serving.
        i. For example a VAV box serving room 1305 shall be tagged VAV-1305.
        ii. For equipment that serves more than one room, the tag shall reflect the room in which the primary controller/thermostat is located.

c. On ALL equipment schedules, an extra column shall be provided and left blank. At the 95% drawing review submission the University will provide equipment ID numbers that will be used by Operations to allow input into the University Operations and Maintenance database.
    i. Any equipment added after the 95% submission (next to last submission) shall be noted and coordinated with the University such that any piece of equipment does not obtain a University ID.
d. Refer to Abbreviation chart at end of this Section.

4. Pumps
    a. Pumps for building chilled or hot water systems shall be inline or base mounted.
        i. Pumps shall be B&G, Armstrong, Patterson or Approved Equal.
    b. Pumping systems shall be designed for N+1 redundancy.
    c. For applications of pumps over 500 GPM, the pumps shall be vertical split case.
    d. Use of horizontal inline pump use is OK where an acceptable pump curve is available.
    e. All 3 phase pumps shall be controlled by a VFD.
    f. Pumps shall be designed for motors at 1750 RPM. Pumps motors selected otherwise shall be approved by the University Mechanical Engineer. Motors shall be selected such that they are non-overloading for the complete operation of the pump.
    g. Pumps shall be selected near their peak efficiency.
    h. Pump shall be rated for 150% of the system pressure.
    i. Bearings on the pump shall be rated for an average life of L-10, 200,000 hours.
    j. All pump motors shall be premium efficiency.
    k. Pumps shall not be selected with the minimum or maximum impeller size.
    l. Pumps installed above occupied floors shall be provided with an inertia pad.
    m. End suction pumps shall be laser aligned.
    n. Pumps shall be installed only in dedicated mechanical rooms.
    o. Provide pressure gauges on inlet and outlet of every pump.
    p. Triple Duty Valves shall not be installed on pumps. Provide shutoff valves on suction and discharge as well as a check valve on the discharge side of the pump.
        i. Single phase pumps shall be provided with a balancing valve as well as valves mentioned above.
    q. Pumps shall be able to be serviced individually without effecting the operation of the system. Design Professional shall allow a minimum of 3 feet around the pump to allow proper maintenance.
    r. Pumps shall be provided with an extra seal kit.

5. Fans
    a. Fans shall be Greenheck, Cook, Penn, Twin City or approved equal.
    b. All 3 phase fans shall be provided and controlled by a VFD.
    c. Motors shall be selected such that they are non-overloading for the complete operation of the fan.
    d. All fans shall be AMCA certified.
    e. All single phase fans shall be provided with a speed controller to allow proper balancing.
    f. Fans shall be provided as direct drive. If direct drive is not available for the specific application belt drive shall be allowable.
    g. Fans shall not be selected over 90% of their fan's maximum speed.
    h. Bearings on the fan shaft shall be rated for an average life of L-10, 200,000 hours.
    i. To allow access, extend bearing grease lines to an accessible location.
    j. Vibration isolation and sound attenuation shall be considered on fan installations.
    k. Belt driven fans shall have their sheaves aligned by the Contractor prior to Substantial Completion.
    l. Two sets of extra belts shall be provided for each belt driven fan installed. These shall be handed over to the University at the time of Substantial Completion.
    m. Fan access shall be provided for.

i. Especially for fans on roofs, ensure a path of travel is provided, with appropriate protections to meet OSHA standards.
ii. Fans installed above 10'-0" shall be provided with a means of access, i.e. catwalk, permanent ladders etc.

6. Laboratory Fans
    a. Fans shall be Strobic, MK Plastics, Greenheck or approved equal.
    b. Fans shall be installed with N+1 redundancy.
    c. All laboratory exhaust fans shall be direct drive, complete with VFDs, isolation dampers, exhaust plenums.
    d. All components shall be provided with a corrosion resistant coating where exhaust air stream contains corrosive components.
    e. Sounds attenuation and vibration shall be taken into account during design and provided where necessary.
    f. Wind-wake studies shall be undertaken on all new buildings and major renovations ($2M or more where labs are being created). For smaller projects wind-wake studies may be required, as determined by the University.
    g. Access shall be provided on all sides of exhaust fans including platforms, rigging to allow motor removals and as required to meet OSHA safety standards.

7. Terminal Units
    a. Fan Powered and VAV boxes shall be provided by:
        i. Nailor, EnviroTec, Metalaire, Krueger or approved equal.
    b. Terminal boxes shall be ARI Certified.
    c. All Fan Powered Boxes shall be provided with ECM motors.
    d. Refer to Insulation Design Manual for insulation lining of Terminal Units.
    e. Flow sensors shall be multi-quadrant averaging type utilizing velocity and differential pressure.
    f. Provide an access door to allow proper maintenance of the air damper and the reheat coil.

8. Laboratory Terminal Units
    a. Pressure independent venturi air valves shall be used to on supply air, general exhaust air and fume hood exhaust air.
        i. Valves shall be by Phoenix or Price. Alternate manufacturers may be evaluated on a case by case basis.
        ii. All supply air valves shall be provided with a reheat coil.
        iii. Valves shall be responsible for maintaining proper air flows, pressures, hood face velocities and temperature/humidity in laboratories and support spaces.
        iv. The valve shall be pressure independent over a 0.6-inch to 3.0-inch wc drop across the valve. An integral pressure independent assembly shall respond and maintain specific airflow within one second of a change in duct static pressure irrespective of the magnitude of pressure and/or flow change or quantity of airflow controllers on a manifolded system.
        v. Each venturi air valve shall be provided with a pressure sensing device, which will alarm the system if adequate pressure differential is not sensed.
        vi. Airflow accuracy shall be plus or minus 5 percent of reading (not full scale) over an airflow turndown range of no less than 15 to 1. No minimum entrance or exit duct diameters shall be required to ensure speed of response, accuracy, or pressure independence.
        vii. The airflow control device shall use closed loop control to linearly regulate airflow based on a digital control signal. The device shall generate a digital feedback signal that represents its airflow.
        viii. The airflow control device shall use industry standard 24 VAC power.

ix. The airflow control device shall meet FCC Part 15 Subpart J Class A, and be UL916 listed.
x. The air valve shall be constructed of one of the following two types:
xi. General exhaust air valves shall be constructed of 16 gage aluminum. All bearing surfaces shall be made of a composite Teflon or Teflon-infused (versus coated) aluminum. The assembly's shaft, pivot arm, shaft support brackets, and internal mounting hardware shall be made of 316 series stainless steel; lesser grade stainless steel materials are unacceptable.
xii. Fume hood exhaust valve assemblies and canopy hood valve assemblies shall have two baked-on coats of a corrosion resistant phenolic coating (Heresite P403 or Phenolflex 957). The assembly's shaft shall be 316L stainless steel with two additional baked-on coats of a corrosion resistant phenolic coating. The pivot arm, shaft support brackets, and internal mounting hardware shall be made of 316L stainless steel. All bearing surfaces shall be made of a composite Teflon or Teflon-infused (versus coated) aluminum; non-coated shafts and lesser grade stainless steel materials are unacceptable.
xiii. Loss of power to the actuator shall cause exhaust valves and supply valves to fail to the pressurization of the zone. Fail in last position electric actuators are not acceptable.
xiv. Certification:
    1. The air flow device shall be factory calibrated to the job specific airflows as detailed on the plans and specifications using NIST traceable air stations and instrumentation having a combined accuracy of at least plus or minus 1 percent of signal over the entire range of measurement. Electronic valves shall be further calibrated and their accuracy verified to plus or minus 5 percent of signal at 8 different airflows per valve. All valve calibration shall be adjusted for the elevation of the specific location (above sea level).
    2. All airflow valves and measuring stations shall be individually marked with valve specific, factory calibration data. As a minimum, it should include: valve tag number; serial number; model number; 8-point point valve characterization information (electronic valves); and quality control inspection numbers. All information shall be stored on computer diskette in ASCII format for future retrieval or for hard copy printout to be included with "as-built" documentation.
xv. Refer to ATC Section 230900 for control requirements.

9. Diffusers, Grilles and Registers
    a. These devices shall be provided by Metal-Aire, Krueger, Nailor, Price or Approved Equal.
    b. Square plaque type supply diffusers are preferred. Other types of diffusers shall be provided as needed (eg. 3-way or 2-way blow patterns, laminar flow for labs, etc.)
        i. Eggcrate or perforated supply diffusers shall NOT be allowed at the University.
    c. Linear diffusers shall have their pattern controllers adjusted prior to balancing. The design engineer shall provide for this provision in the design drawings AND specifications. The design engineer shall specify how the pattern controllers shall be set in the field. If the airflow pattern controllers are set after balancing, then the linear diffusers shall be re-balanced along with their associated terminal units and other diffusers connected to the same terminal unit.
    d. Linear diffusers shall not be used in interior space applications, unless required to accommodate architectural features.
    e. Return grilles in a plenum return application with a lay-in ceiling shall be a full tile (22x22 face) grille.

10. Steam Condensate Pumps

a. These pumps shall be provided by Domestic Pump, ShipCo, MEPCO, Spence or Spirax Sarco.
b. All pumps shall be electric, duplex, floor mounted pumps and tank, with control panel, motor controller for each pump, pump alternator, float switches, sight glass, high level alarm to BAS and pump status to BAS.
c. All components shall be rated to 210°F
d. Provide an inlet strainer on the condensate return line.
e. Provide shutoff valves on suction side of each pump. Provide check valve and shutoff valve on discharge side of each pump.

11. Utility Tunnel and Vault Sump Pumps
    a. Pumps shall be hard-wired electrically, with a local disconnect on the nearest adjacent wall.
    b. Provide high level alarm and on-off floats.
    c. Pumps shall be selected for high temp (minimum 210°F) operation and conditions.
        i. GRI Pumps, centrifugal pumps with mechanical seals, may be used when installed properly in a sump basin.

12. Variable Frequency Drives
    a. Variable frequency drives (VFDs) shall be for all fans and pumps that have 3-phase motors.
    b. Variable frequency drives (VFDs) of all horsepower sizes shall be 6-pulse with 5% line reactors or equivalent DC link reactors. VFDs shall utilize pulse-width modulation technology with diode bridge rectifiers and insulated gate bipolar transistor inverters. Reactors shall be mounted within the VFD enclosure.
    c. For elevator motors or motors greater than or equal to 50HP, VFDs shall be equipped with passive hybrid harmonic mitigation filters. Harmonic mitigation filters shall be Mirus Lineator AUHFs, TCI HG7 model STCs or approved equal. Filters shall be integrated into the same enclosure as the VFD, built and tested at a UL508C factory.
    d. VFDs shall be ABB ACH550 Vertical E-clipse Bypass Drive or similar by:
        i. Benshaw SG Series
        ii. Square D Altivar 61
        iii. Danfoss VLT HVAC or PHD-102
        iv. Eaton HMax or CFX
        v. Siemens
    e. Where practicable, VFDs shall be mounted nearby their associated motor to limit motor cable length to less than 75 feet. VFDs shall not be mounted outdoors. Provide a disconnect at outdoor equipment when VFD's are located indoors.
    f. VFDs shall be in NEMA 1 enclosures, when located indoors. Outdoor located VFDs shall be rated appropriate for their use and location.
    g. For motor cable lengths exceeding the VFD manufacturer's recommended maximum cable length or 300ft, whichever is less, VFDs shall be equipped with DVDT output filters. DVDT output filters shall reduce VFD-created overshoot voltages to less than the motor insulation voltage rating (1600V for new inverter duty motors and 1200V for existing standard motor VFD retrofits).
    h. VFDs, except those used in a duty/standby configuration, shall include FVNR bypass starters. The bypass shall include drive output and bypass circuit contactors and a drive input service switch (three-contactor bypass systems may utilize finger-safe disconnect fuses upstream of VFD to guarantee isolation beyond input contactor). Control of the bypass shall utilize a VFD-Off-Bypass selector switch with pilot lights for status. Test functionality shall be provided to test operation of the power converter while operating the motor in bypass.
    i. Duty/standby configurations shall utilize two VFDs without bypasses—one each for both the duty and standby motors.
    j. The following devices shall be mounted on the front of the VFD enclosure:

i. A power-on pilot light that indicates that the VFD is being supplied by the incoming power feeder.
ii. A fault pilot light indicating the VFD is in the fault mode.
iii. A keypad display. The display shall be a backlit LCD type and shall be in complete English words for programming, fault diagnostics, and monitoring (LED and alpha-numeric codes are not acceptable). A minimum of three monitoring values shall be capable of being displayed at all times such as output frequency (Hz), motor speed (RPM), and motor current (A).
iv. A Hand-Off-Auto selector switch. In the auto position, VFD start/stop shall be controlled from a BMS contact closure, and motor speed shall be determined by a BMS speed-setting analog signal. In the hand position, motor speed shall be determined by manual one-touch keypad control or via a potentiometer mounted on the enclosure front.
v. A padlock-able input circuit breaker interlocked with the enclosure door.
vi. When bypass is required, a drive service switch (or finger-safe disconnect fuses) and a VFD-Off-Bypass selector switch with pilot lights.

k. VFDs shall have the following minimum inputs and outputs:
    i. Inputs
        1. One analog input that can accept the following BMS speed setting signals:
            a. 0-10VDC
            b. 4-20mA
        2. Digital inputs for the following:
            a. A BMS dry contact start/stop signal for two-wire control.
            b. Safety interlocks such as freeze and smoke shut-down.
    ii. Outputs
        1. One analog 4-20mA output signal for operating speed feedback input to the BMS that can be programmed to output frequency (Hz) or motor speed (RPM).
        2. Dry contact outputs for the following inputs to the BMS:
            a. Motor running
            b. Fault and warning indication (over temperature or over current)
            c. Hand-Off-Auto selector switch status (closed contact in Auto).

l. All VFDs to have the following adjustments:
    i. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed. The lockout range must be fully adjustable, from 0 to full speed.
    ii. Two (2) PID Set point controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed-loop control. The VFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID set point shall be adjustable from the VFD keypad, analog inputs, or over the communications bus. There shall be two independent parameter sets for the PID controller and the capability to switch between the parameter sets via a digital input, serial communications or from the keypad. The independent parameter sets are typically used for night setback, switching between summer and winter set points, etc.
    iii. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain the set point of an independent process (i.e. valves, dampers, etc.). All set points, process variables, etc. to be accessible from the BAS network.
    iv. Two (2) programmable analog inputs shall accept current or voltage signals.
    v. Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage,

Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, Active Feedback, and other data.

vi. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC.

vii. Three (3) programmable, digital Form-C relay outputs. The relay outputs shall include programmable on and off delay times and adjustable hysteresis. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating of 2 amps RMS. Outputs shall be true Form-C type contacts; open collector outputs are not acceptable. Drives that have only two (2) relay outputs must provide an option card that provides additional relay outputs.

viii. The VFD control shall include a programmable time delay for VFD start and a keypad indication that this time delay is active

ix. Seven (7) programmable preset speeds.

x. Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.

xi. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise. The VFD shall have selectable software for optimization of motor noise, energy consumption, and motor speed control.

xii. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency settings without derating the VFD.

xiii. The VFD shall include password protection against parameter changes.

m. VFD's shall connect to the BAS via a BACnet interface.

n. VFD/bypass system shall operate at +10% and -15% line voltage tolerance without contactor chatter or loss of contactor control.

o. The VFD shall be of construction that allows operation in a pollution Degree 3 environment. The VFD shall meet IEC 664-1 and NEMA ICS 1 Standards. VFD's that are only rated for Pollution Degree 2 environment shall not be allowed.

p. Single phase protection in bypass shall prevent operation of the motor in bypass while a single phase condition exists. The system shall be capable of powering the motor in VFD mode during single phase power conditions.

q. There shall be a built-in time clock in the VFD keypad. The clock shall have a battery backup with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. VFD programming shall be held in non-volatile memory and is not dependent on battery power

r. VFDs shall include momentary power loss ride-through and fault restart functions that allow the VFD to continue operation without the need for attended restart. In the power loss ride-through, the drive shall use the energy generated by the rotating load as a power source for all electronic circuits. When a run signal is present, VFDs shall automatically restart and catch a spinning load when return-to-normal conditions occur.

s. VFDs shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction without damage to controller, motor, or load.

t. The VFD manufacturer shall provide start-up service for each VFD and training commensurate with the scale of the project. Training shall consist 8 hours of classroom training.

u. Factory-trained, 24/7 service technicians must be located within a two-hour drive time.

v. The VFD shall be warranted by the manufacturer for a period of 36 months from date of start-up. The warranty shall include parts, labor, travel costs, and living expenses incurred to provide factory authorized service.

13. Boilers

a. Boilers for individual buildings shall be:
    i. Steam:
        1. Cleaver Brooks, Fulton, Bryan or approved equal
    ii. Hot Water non-condensing:
        1. Fulton, Cleave Brooks, Weil-McClain, Bryan or approved equal
    iii. Hot Water Condensing:
        1. Lochinvar, Patterson Kelley, Aerco, Fulton or approved equal.
b. Boilers for the Universities Central Plants shall be discussed and approved during the design process.
    i. All Central Plant boilers and associated burners shall be factory tested. Tests for Central Plant boilers shall be witnessed by University Mechanical Engineer assigned to project and Operations Lead Mechanical Engineer.
c. Boilers shall be natural gas fired, for all Campuses.
d. Steam and non-condensing boilers shall have a minimum efficiency of 81% AFUE.
e. Condensing boilers shall have a minimum efficiency of 95%.
    i. Designs using condensing boilers shall incorporate condensing under all operating conditions.
f. The condensing type hot water and steam boilers shall be provided with condensate drain pipes. Provide cooling means of boiler drain to allow temperature of condensate to meet Code as it is discharged to sanitary drain.
g. Condensing boilers where installed in multiples, shall come complete with a packaged control system. The boiler control system shall be able to operate the boiler system on a stand-alone basis, but shall be connected to the campus BAS via a BacNet connection. The campus system shall be able to control all actions of the boiler system
h. All mechanical rooms with hot water and steam boilers shall be approved and stamped by State's Labor and Industry Division. The Professional shall provide drawings with necessary clearances and other requirements for the L&I approval.
i. Boilers and Chillers shall be located in separate mechanical rooms as per the latest International Mechanical Codes.
j. Boiler shut down switches shall be installed at each door into the boiler room.
k. Boiler Flues
    i. All double wall metal vents and chimneys shall be UL listed and shall comply with the latest edition of NFPA 211.
    ii. Double wall metal vents and chimneys shall be sized in strict accordance with the latest edition of the International Mechanical Code.
    iii. An induced draft fan shall be provided when one of the following conditions apply:
        1. Wind-produced downdrafts due to the location or configuration of the building occur which can or will adversely impact the performance/operation of the equipment.
        2. The routing of the metal vent system is such that a high pressure drop will occur which exceeds the natural draft of the vent system and the available pressure of the burner.
    iv. Double Wall Vents and Chimneys - Atmospheric Applications:
        1. For atmospheric draft type applications, Type 'B' double wall vents and chimneys shall be used and shall comply with the following criteria and shall be similar to Selkirk Metalbestos Model DF.

CRITERIA	TYPE B GAS VENT	BUILDING HEATING APPLIANCE CHIMNEY
Application	Gas Appliances listed for use with Type B Gas Vents	Commercial/Industrial Building Heating Equipment suitable for the use with a Neutral or Negative Pressure Chimney
Fuels	Natural Gas or LP Gas	Natural Gas, Propane, Butane, LP Gas or Equivalent. #2 Fuel oil or better, some heavier fuel oils.
Maximum Flue Gas Temperatures	400ºF above Ambient	1000ºF, Continuous 1400ºF, Intermittent
Maximum Flue Gas Pressure	Neutral and Negative Pressures only.	
Clearances to Combustibles	Exterior & Interior All sizes - 1"	All sizes - 6" Exterior - 9" Interior (DO NOT ENCLOSE)
Clearances to Non-Combustibles	Exterior & Interior All sizes - 1" Interior Chase: As above or greater as required for installation and access.	10" - 18" I.D. - 2" 20" - 24" I.D. - 4" Interior Chase: As above or greater as required for installation and access.

2. The double-wall metal vent piping shall have a minimum outer jacket thickness of 0.025" aluminized coated steel (for indoor installation) or Type 430 Stainless Steel (for outdoor installation), and a minimum inner liner thickness of 0.015" Type 430 Stainless Steel. The outer jacket and inner liner shall be separated by 1/2" air space except as required for construction of the pipe, which shall be in accordance with the terms of the product's UL listing.

v. Double Wall Vents and Chimneys - Pressurized Applications:

1. For forced draft and induced draft applications, double wall vents and chimneys designed specifically for positive pressure and negative pressure applications shall be used and shall be similar to Selkirk Metalbestos Model IPS. Double wall vents and chimneys used for positive and negative pressure applications shall comply with the following criteria:

CRITERIA	BUILDING HEATING APPLIANCE CHIMNEY
Application	Low and High Pressure Steam Boilers Diesel & Turbine Exhausts Building Heating Equipment
Maximum Operating Temperatures	1000º□F. Continuous 1400º□F. Intermittent
Clearances To Combustibles	6" -36" I.D. - 6" Exterior - 10" Interior 42" -48" I.D. - 6" Exterior - 18" Interior

Clearances To Non-Combustibles	6" Thru 18" I.D. - 2" Over 18" I.D. - 4" Interior Chase: As above or greater as required for installation and access.

2. The double wall metal vent shall have an inner liner type 304 stainless steel for gas and fuel #2 fuel oil and type 316 stainless steel for #4, #5, or #5 oil; coal; or any other solid fuel. There shall be a nominal 1 inch insulated space between the walls. The outer jacket shall be aluminum coated steel (for indoor installations) or type 304 stainless steel or type 316 stainless steel (for outdoor installations). The materials and construction of the modular sections and accessories shall be as specified by the terms of the product's UL listing.

vi. Terminations:

1. Power Exhaust Termination:
    a. The termination of the chimneys or vents equipped with power exhausters shall be located a minimum of 10 feet from the lot line or from adjacent buildings. The exhaust shall be directed away from the building.
    b. Flues for all boilers shall terminate a minimum of 10' above grade, and shall not be near windows and/or intake louvers for the air distribution system.

2. Horizontal Terminations - Horizontal terminations shall comply with the following requirements:
    a. Where located adjacent to walkways, the terminations of mechanical draft systems shall be not less than 7 feet above the level of the walkway.
    b. Vents shall terminate at least 3 feet above any forced air inlet located within 10 feet.

14. Water Cooled Chillers
    a. The boilers and the chillers shall be located in separate mechanical rooms as per the latest International Mechanical Codes
    b. Chiller type and manufacturer shall be determined on a project specific basis. Direction shall be provided by University Mechanical Engineer assigned to the project.
    c. All new chillers shall incorporate energy/heat recovery and VFD control.
        i. Energy/heat recovery shall be used for preheat of domestic water, or additional heating for the hot water reheat system.
    d. All water cooled chillers shall be factory tested. A certified test report shall be provided indicating chiller matches performance requirements at design conditions and partial load design conditions. Tests for Central Plant boilers shall be witnessed by University Mechanical Engineer assigned to project and Operations Lead Mechanical Engineer.

15. Air Cooled Chillers
    a. Chillers shall be Trane, Carrier, Johnson Controls or Daikin.
    b. Chillers shall be selected shall be high efficiency and maximized to provide as low a kw/ton as possible when considering over the life-cycle of the system.
    c. Access to roof mounted chillers shall be via a stairwell to the roof or at a minimum via a "ship's ladder". Rigging points shall be provided to allow for compressors, motors and other pieces of equipment shall be provided to aid in maintenance of the unit.

d. All air cooled chillers over 100 tons shall be factory tested. A certified test report shall be provided indicating chiller matches performance requirements at design conditions and partial load design conditions.

16. Cooling Towers
    a. Cooling towers shall be BAC, Marley or Evapco.
    b. All distribution pans shall be stainless steel, or other material to provide added protection against pre-mature failure. Professional shall coordinate final selection with University Mechanical Engineer.
    c. Fans shall be direct drive with VFD control.
    d. Towers shall come complete to allow for free cooling operation down to 0°F.
    e. Shall be provided with ships ladders, landings at each access point, catwalks, railings etc. to allow proper access to all tower components.
    f. Use of FRP or other plastic tower material may be considered, use shall require approval of University Mechanical Engineer assigned to the project.
17. Heat Exchangers
    a. For steam to hot water provide a U-Tube type exchanger similar to Bell and Gossett model SU.
        i. Steam inlet pipe size shall match the inlet opening size.
    b. For condenser water free cooling provide plate and frame type.
    c. All heat exchangers must meet ASME standards for temperature and pressure.
    d. Other allowed manufacturers shall be Armstrong, Envirosep and approved equals.

18. Air Handling Units
    a. Design drawings shall indicate all sections of air handling units, i.e. return fan, mixing box, filter rack, access, hot water pre-heat etc. This shall either be in the equipment schedule or in a detail.
    b. Modular indoor/outdoor
        i. Air Handling Units shall be Trane, Carrier, JCI or Daikin.
        ii. Direct drive fans, and fan arrays are preferred.
        iii. Outdoor units shall be double wall with a minimum of 20 gauge inside panel and minimum 16 gauge outdoor panel. Where custom outdoor units are required 18 gauge and 14 gauge shall be used for indoor and outdoor panels, respectively.
        iv. Casings:
            1. Insulation shall be 2” expanded foam and have insulation rated at R-13.
            2. No through-metal.
        v. Drain pans shall be stainless steel.
        vi. Piping to outdoor units shall be contained in “dog houses” and fed from below, piping exposed on roof shall be kept to an absolute minimum.
        vii. Access sections shall be 24” minimum. Sections smaller than this shall be approved by University Mechanical Engineer assigned to the project.
        viii. Units greater than 10,000 CFM shall be provided with service lights in fan, coil access, filter access and mixing sections.
    c. Custom air handling units (indoor, outdoor and packaged)
        i. Custom Units shall be Buffalo, Mammoth, Ventrol, Haakon, Engineered Air, Governair or approved equal.
        ii. Custom units shall meet the modular unit requirements with the following upgrades.
            1. Casing shall meet ASHRAE 111, low leakage Class 6 with less than 1.0% leakage at 8.0-inches w.g. pressure.
                a. Custom air handling units shall be factory tested for operation and for leakage. Testing reports shall be provided to Engineer of Record and Owner prior to installation.
    d. Packaged Rooftop Units
        i. Rooftop Units shall be Trane, Carrier, York or Daikan

e. Make-up Air Units
    i. Make-up air units shall be Aaon, Addison, Reznor, DesertAire or approved equal.
f. Energy recovery is required on all air handling units with at least 50% outdoor air as well as directed by ASHRAE 90.1-2016. If it is not feasible to have energy recovery, it shall be agreed to by the University Mechanical Engineer assigned to the project.
    i. Air-side energy recovery shall be considered on every project.

19. Ductless Mini-Split System Air Conditioning Units
    a. Split Systems shall be Mitsubishi, Daikin, Sanyo, LG or approved equal.
    b. Split systems used on the Oakland Campus shall require written approval of the University Mechanical Engineer assigned to the project.
    c. Where split systems are used, VRF systems shall be reviewed for use.
    d. Where needed provide a small integral condensate pump to allow cooling coil condensate to be discharged to the nearest drain.

20. Computer Room Air Conditioning Units
    a. CRAC Units shall be Leibert.
    b. A second means of cooling shall be provided. City water shall NOT be used as a means of cooling.
    c. All controls for rooms containing Leibert units shall be done by control modules provided by Leibert. A Bacnet interface shall be provided by Leibert to allow monitoring, alarming and trending.

21. Fan Coil Units
    a. Fan Coils shall be by Trane, Airtherm, Carrier, Daikan, JCI/York, Greenheck, Krueger, Enviro-Tec or approved equal.
    b. Units shall be direct drive with ECM Motors. Provide units will speed adjustment.

22. Louvers
    a. All louvers shall be drainable-blade type. Point of water penetration shall be at a minimum of 800 fpm.
    b. Minimum 4” deep, 500fpm velocity on intake louvers with no more than 0.10” wg static pressure drop.
    c. Provide bird screen on interior face of louver that is 1/2”x1/2” galvanized mesh screen.
    d. Access to plenum shall be provided thru the attached plenum, 12” deep as a minimum.
    e. Louver color to be selected by University Architect.
    f. Louver to be by Ruskin, Carnes, Greenheck, NCA, Arrow, United Enertech or approved equal.
    g. On large louvers, provide means of internal draining of plenum.

23. Humidifiers
    a. Humidifiers shall be Dri-Steem, Armstrong, Nortec or approved equal.
    b. Shall be stainless steel to maximize life of humidifier.

24. Air Coils
    a. All air coils shall be constructed of aluminum fins mechanically bonded to copper tubing.
    b. All air coils shall be hydrostatically tested in the factory at a minimum pressure of 250 psig for a 150 psig chilled/hot water system and 400 psig for a 300 psig chilled water system.
        i. Cooling Coil Sizing Criteria:
            1. Air coils for cooling service shall be sized for a maximum face velocity of 500 feet per minute.
            2. Each cooling coil shall be provided with the coil manufacturer’s stainless steel insulated drain pan. The drain pan shall be pitched toward the drain.
        ii. Air coils for heating service shall be sized for a maximum face velocity of 800 feet per minute.

iii. Cooling coils shall be designed for chilled water temperature differential of 15ºF. Coils shall be provided with turbulators for turbulent flow of water for higher heat transfer. Maximum chilled water pressure drop shall not exceed 12 ft. wg.
iv. For large air-handling units, size cooling coils with 10% extra cooling capacity, minimum 6 rows and maximum 10 fins per inch shall be provided. The Professional shall indicate inlet and outlet air conditions at the coils on the construction drawing schedules.
v. Chilled water coils shall be piped in a counter-flow arrangement.

c. Steam Coils
    i. Steam coils used for preheat service shall be integral face-and-bypass type when mixed air temperatures are below 40°F.
        1. Coils shall be LJ Wing Coils or approved equal. Vertical or horizontal face and bypass shall be decided as part of the design.
    ii. Steam coil shall be designed to provide for proper drainage of the steam condensate and shall be self-draining type.
    iii. Provide clearance below the bottom of the coil for proper installation of the steam trap and associated steam condensate return piping.
d. Cooling coil condensate drain pipe traps shall be a minimum of twice (2 times) the fan static pressure in inches.
e. Auxiliary drain pans shall be installed above the ceilings as per the International Mechanical Code. An auxiliary drain pan is not required for appliances that automatically shut down in case the condensate pan is provided with a high limit condensate switch.

25. Chilled Beams
    a. Chilled beams shall be Trox, Semco, Price or approved equal.

26. Fin Tube Radiators
    a. Active lengths shall be kept to a maximum of 6'.

27. Radiant Heaters
    a. Radian Heaters shall be by Marley, Runtal or approved equals.

END OF SECTION

UNIVERSITY OF PITTSBURGH
MECHANICAL DESIGN STANDARDS

SECTION 239000 – HVAC INSTRUMENTATION AND CONTROLS

1. General:

   a. The majority of buildings in Oakland Campus have Automated Logic controls that are connected to the University's building automation system. The University has negotiated pricing with Automated Logic (phone 412-444-0440) for DDC controls on a unit by unit basis. The unit prices are designed to cover all typical mechanical installations and include design, drawings, project management, materials and programming. This price does not include installation of the controls and control wiring. The Professional shall specify on the drawings and specifications - The ATC bidders shall carry the Automated Logic price in their bids as a separate line item as well as obtain installation price from the following ATC electrical sub-contractors:

      (1) Automated Logic
      (2) Bronder Technical Services
      (3) Hoffman Electric
      (4) Supply Electric
      (5) Miller Electric

   b. The Professional shall work with Automated Logic right from the Design Development stage of a project to provide I/O summary of control points. Automated Logic shall furnish control drawings and construction cost estimates. The Professional is responsible for developing the sequence of operation based on his design.

   c. In Oakland Campus the facilities operators will interface to the system via the existing Automated Logic front-end graphic system. The proposed system will include all hardware and software required to program the controllers to seamlessly integrate to the existing Automated Logic System.

   d. For other campuses, the Professional shall develop his own construction drawings complete with I/O summary of all points, a control schematic, the sequence of operation and a flow diagram for each piece of equipment with the help of any of the control suppliers listed under Acceptable Manufacturers.

   e. All controls shall be DDC with electric actuation unless otherwise specified. The pneumatic actuation shall be employed with the written approval of the University.
      (1) Pneumatic actuation shall be employed only if electric actuation is not feasible.

   f. The DDC system shall integrate multiple building functions including mechanical equipment supervision and control, alarm management, energy management and historical data collection.

   g. Each building shall have DDC controllers that act on a stand-alone basis to provide control for each individual mechanical piece of equipment. The DDC controllers shall be networked via campus-wide data communications to tie all control and monitor functions back to the Central Workstations located in Posvar Hall and the Eureka Building for Oakland Campus. They shall be tied back to the head end systems at the respective branch campuses.

h. The ATC sub-contractor shall be responsible for coordinating tie-ins, detailed point list containing proper points, names and addresses that will allow the campus-wide EMS system to read and write all required information between the new and the existing control systems.

i. Provide a complete automatic temperature control system including all sensors, actuators, end devices, display devices, stand-alone local control panels, network subsystems, all communication and application software, all power and control wiring and all computer equipment consoles as required by the drawings and specifications. The system shall be modular in nature and shall permit expansion of both capacity and functionality. If a building does not have an existing computer terminal, the contractor must provide one.

j. All controllers in a building shall be networked together. At least one controller in each building shall have a local keypad and display if a personal computer operator workstation is not available.

k. The new DDC system must be able to seamlessly integrate to the existing campus wide system via BACnet, level 4 interoperability. The proposed system will include front-end graphics, all hardware and software required to program the controllers and provide all work required to create necessary graphics, trends, schedules and alarms.

l. Provide a complete set of submittals, start-up and testing services and training to the owners as described herein.

m. Provide owners manuals, complete operating instructions and spare parts lists as described herein.

n. Provide As-built drawings.

2. Acceptable Manufacturers:

a. The acceptable Automatic Temperature Control provider shall be limited to:

(1) Oakland Campus
  (a) Automated Logic

(2) Johnstown Campus
  (a) Schneider I/A Series Controls

(3) Bradford Campus
  (a) Johnson Controls Inc. – Metasys
  (b) Automated Logic

(4) Titusville Campus
  (a) Johnson Controls Inc. – Metasys

(5) Greensburg Campus
  (a) Automated Logic

b. In the event that two or more Contractors are bidding then each ATC Bidder must submit with their bid a statement of compliance. This statement of compliance will become

part of the contract documents. This statement of compliance will list each paragraph number of the ATC specifications with one of the following statements:

Comply – which mean that the bidder completely complies with the requirements of the paragraph.

Comply with Exception – which means that the bidder complies, but not in the manner described in the paragraph. The bidder will describe how their system meets the specification.

Does Not Comply – which means that the bidder does not meet the specifications. The bidder will then describe how they intend to provide whatever is necessary to meet the specification.

3. DDC Product Specifications:

a. Peer-to-Peer Network: Operator workstations and DDC controllers shall directly reside on a network such that communications may be executed directly between DDC controllers, directly between workstations and between DDC controllers and workstations on a peer-to-peer basis.

b. DDC controllers shall be stand-alone, microprocessor-based, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of the specification and the attached points list. Each DDC controller shall have sufficient memory, a minimum of 1 megabyte, to support its own operating system and databases, including energy management applications, alarm management applications including custom alarm messages for each level alarm for each point in the system; historical/trend data for points specified; maintenance support applications, custom processes, dial-up communications, and manual override monitoring.

c. Remote application specific controllers (ASCs) shall extend the performance and capacity of the DDC controller. Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor. Controllers shall accommodate point databases; operating programs, local alarming and local trending and non-volatile EEPROM or a minimum of 72-hour battery backup shall be provided. All programs shall be field-customized to meet the user's exact control strategy requirements. All ASCs shall be networked together with the DDC controller and the campus wide system.

d. Furnish one portable operator terminal, which shall plug directly into DDC panel if one does not exist with the Campus Facilities Management. The terminal shall have the following features:

(1) Operator's Terminal shall provide keypad/display and shall mount directly on DDC controller in Mechanical Room. Provide a user-friendly, English language-prompted interface for quick access to system information, not codes requiring look-up charts.

OR

(2) The portable operator's terminal shall be a laptop personal computer that can access all DDC controllers and application specific controllers located in the building, display all point, selected point and alarm point summaries, display trending and totalization information, and command, change setpoint, enable/disable any system point. The portable operator's terminal shall come complete with Windows XP Professional operating system and all software, cables, hardware necessary to connect to the DDC controllers.

e. If a portable operator terminal does not exist with the Campus Facility Management, a personal computer operator workstation may be provided for command entry, information management, network alarms management and database management functions with the University's approval. This PC shall be capable of monitoring all the DDC controllers on the network. If a workstation does exist in the building, graphic displays for each system shall be created and added to the campus system at the building workstation and the Central Campus System Operator's Workstations.

(1) Dynamic color graphic displays shall include floor plan displays and system schematics for each piece of mechanical equipment, including air handling units, chilled water systems and hot water boiler systems, shall be provided by the BAS contractor as indicated in the point I/O summary of the specification to optimize system performance analysis and speed alarm recognition.

(2) Multiple-level password access protection shall be provided to allow the user/manager to limit workstation control, display and data base manipulation capabilities as deemed appropriate for each user, based upon an assigned password.

(3) If a workstation is necessary, it shall consist of a color monitor, personal computer with minimum 512 MB RAM, minimum 40 GB hard drive, controller, 3-1/2" diskette drive, mouse and 101-key enhanced keyboard. Personal computer shall include a minimum 2 GHz processor and include a rewriteable CD ROM for system backup. The display provided for system operation shall have a diagonal screen measurement of no less than 15" and a minimum display resolution of no less than 640 x 480 pixels. Separate controls shall be provided for color, contrasts and brightness. The screen shall be non-reflective.

4. Field Devices and Equipment

a. General:

(1) Temperature transmitters, differential pressure transmitters, relative humidity transmitters, water sensors in thermal wells, etc., shall consist of two components, the sensing element and the transmitter. The transmitter shall be capable of converting the resistance of the sensing element to the appropriate 4-20 mAdc signal which shall represent the measured range. Unless otherwise specified, the accuracy shall be $\pm$ 0.5.

b. Temperature Sensors:

(1) The sensing element shall be a 100 ohm RTD type with a 4-20 mAdc transmitter. The accuracy shall be $\pm$0.5 degrees.

(2) For classroom and office spaces with room thermostat, provide setpoint adjustment and override switch to allow switching from unoccupied to occupied mode for a timed period programmed by software. Do **not** include a room temperature display unless otherwise directed.

c. Static Pressure Sensors:

(1) Static pressure sensors shall be Setra or approved equal. The sensors shall have a ± .25" w.g. range for space applications and they shall have a range of 0 to 1" w.g. or 0 to 5" w.g. for duct applications unless noted otherwise. The sensors shall provide a 4 to 20 milli-amp output and they shall have an end-to-end accuracy of ± .25%.

d. Control Valves:

(1) The Professional shall size the control valves based on approximately 30% pressure drop of the available system pressure differential in consultation with the University. The Professional shall provide schedule of control valves with C_v values on the drawings.

(2) Globe Pattern:

(a) Up to 2 inches: Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with back seating capacity repackable under pressure.

(b) Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc.

(3) Butterfly Pattern: Iron body, bronze disc, resilient replaceable seat for service to 250 degrees F. wafer or long ends, extended neck.

(4) Electric Actuators: Size to operate with sufficient reserve power to provide smooth modulating action or 2-position action. The automatic control valve actuators shall be oil immersed gear train types with a metal housing for all valves that are 2.5 inches up to 6 inches. Spring return models shall have a minimum of 220 pound inches of torque. On valves 6 inches or greater, the actuator shall be an industrial type gear train with 800 to 1300 pound inches of torque. Provide solid state positioning relays for all modulating actuators. Direct mount actuators shall not be acceptable on valves 2.5 inches or larger. Provide spring return type for all applications with outside air.

(5) Pneumatic Actuators: Rolling diaphragm, spring loaded, and piston type with spring range of 3 to 8 psig or 8 to 13 psig, as required. Valves shall spring return to normal position as indicated on freeze, fire or temperature protection. (These shall be used only in very limited applications.)

(6) Hydronic Systems: Refer to Section 15110 for valve requirements.

(7) Two-way valves shall have equal percentage characteristics, three way valves linear characteristics. Size two way valve operators to close valves against pump shut off head. Three way control valves may be used only with the University's approval.

e. Automatic Dampers:

(1) Performance: Test in accordance with AMCA 500.

(2) Type: Opposed blade.

(3) Frames: Aluminum riveted, with corner reinforcement.

(4) Blades: Aluminum, maximum blade size 6 inches wide, 48 inches long, attached to minimum 1/2 inch shafts with set screws.

(5) Blade Seals: Neoprene mechanically attached, field replaceable.

(6) Jamb Seals: Flexible metal.

(7) Shaft Bearings: Oil impregnated sintered bronze or graphite impregnated nylon sleeve, with thrust washers at bearings.

(8) Linkage Bearings: Oil impregnated sintered bronze or graphite impregnated nylon.

(9) Leakage: Less than 6 CFM per square foot of damper area at 1.0 inches w.g. static pressure.

(10) Maximum Pressure Differential: 4 inches w.g.

(11) Temperature Limits: -40 to 200 degrees F.

(12) Electric Damper Operators: The automatic control damper actuators shall be oil immersed gear train type with a metal housing for all dampers that are 8 square feet area or more. Provide solid state positioning relays for all modulating actuators. Spring return models shall have a minimum of 90 pound inches of torque and non-spring return shall have a minimum of 220 pound inches of torque. Direct mount actuators shall be gear train type and shall be limited to dampers that are less than 8 square feet. Direct mount actuators shall have a minimum of 90 pound inch of torque. The actuators shall be spring return types for all outside air and relief air applications.

(13) Pneumatic Damper Actuators: Provide proportional control with sufficient power for air velocities 20 percent greater then maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation. Type shall be rolling diaphragm piston with adjustable stops. (These shall be used in very limited applications.)

f. Air Compressor and Air Dryer

(1) Provide duplex belt driven air compressor and tank unit with belt guard, silencers, flexible connections and filters. Limit compressor to 30 percent running time.

(2) All air compressors shall be provided with a filter/dryer.

(a) Air dryer shall be self-contained, refrigerated, compressed air dryer complete with heat exchanger, moisture separator and bypass piping.

(3) The air compressor and the dryer shall be connected to the emergency power.

g. Control Transformers

(1) All control transformers will be sized appropriately and supplied with circuit breakers on the secondary side of the transformer.

h. Apparatus Control Panels (ACP)

(1) All electrical, electronic or pneumatic equipment shall be installed in suitable panels or enclosures to protect the equipment from environment, dirt, rain, vandalism, and accidental damage.

(2) All ACPs shall be fully enclosed cabinets, all-steel construction and shall meet the NEMA requirements for the location installed. All ACPs shall have hinged doors and a locking latch. ACP enclosures shall be NEMA 1 for indoor application, ACP enclosure for outdoor application shall be NEMA 4 or NEMA 3. ACP enclosures for a parking garage, dish wash room or loading dock shall be NEMA 4x (stainless steel or fiberglass).

(3) All ACPs shall be keyed alike. A means of storing control system instructions and drawings shall be provided inside cabinet for future reference. Cabinet and door shall be finished with two (2) coats of paint.

(4) Pre-wired apparatus control panels shall be provided for each HVAC unit and each system by the DDC system supplier. ACPs shall include all electronic control chassis, relays, switches, transformers, time clocks, interval timers, pilot lights, set point adjustments, and temperature indication meters. All controls requiring adjustment shall be located in ACPs.

(5) The 120VAC power supplying the control panel shall be filtered via an electronic line filter. The line filter shall be sized appropriately and be rated for industrial use.

(6) Each ACP shall be provided with an isolation valve exterior of the panel to disconnect the ACP from its main instrument air supply and a fused disconnect switch to isolate the line side of all electric circuits within the ACP.

(7) Instrumentation and control (I&C) diagrams for ACPS shall be provided. Drawings shall show complete I&C diagrams and the location of each piece of equipment with in the panel for all equipment furnished and shall be posted in the control panel. Condensed operating instructions explaining preventative maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system manually shall be prepared in typed form.

(8) All ACPs shall be provided with laminated nameplates located on the exterior of the panel.

(9) All equipment within the panel shall be labeled.

(10) All wires and pneumatic tubing within the panel shall be numbered and labeled on both ends of their terminations. All wire and pneumatic tubing shall be run in wire channel or neatly run in vertical and horizontal lines using

wire ties and wire tie mounts.

i. New installations of steam, electric and chilled water meters (Oakland Campus).

(1) All projects including the new installation of steam, electric and/or chilled water meters must be tied into the existing Automated Logic campus meter network via BACnet level 4 interoperability.

(2) The facilities operators will interface to the system via the existing Automated Logic front-end graphic system. The proposed system will include any hardware and software required to program the controllers to seamlessly integrate to the existing Automated Logic System. All new meters shall be incorporated into the existing reporting packages.

(3) Automated Logic, the campus wide EMS contractor shall include all work required to create the necessary reports, graphics, trends, and alarms. Automated Logic shall include a detailed points list containing proper points, names and addressing that will allow the campus wide EMS to read and write all required information between the two systems.

j. Miscellaneous:

(1) Current Sensing Relays: All fans and pumps shall be provided with a current sensing relays for the purpose of remote status reporting.

(2) Current Sensing Relay (VFD): For fans and pumps with VFDs the setpoint for the current switch shall be microprocessor controlled. Manually adjusted set points are not acceptable. Provide a solid state sensor with normally open contacts with an output rating of .5A at 24VAC/DC. Unit shall be rated for NEMA 1, 12, or 13. Sensor shall include output status LED.

k. Gauges: All gauges shall be provided with snubbers.

5. Demolition

a. All existing obsolete controllers, thermostats, wire, tubing, etc shall be removed. Any pneumatic tubing that is not, or can not be removed shall be plugged with the proper pneumatic fitting.

b. Where thermostats, wall sensors, etc have been removed, the walls shall be patched or a blank cover plate shall be provided in place of the removed sensor.

c. Any equipment that is removed shall be returned to the University.

6. General Installation

a. Mount outdoor reset thermostats and outdoor sensing transmitters indoors, with sensing elements outdoors. Provide sun shield for sensing element.

b. Provide guards on thermostats in entrance hallways and other public areas.

7. Wiring Installation

a. **Run all line voltage control wiring in conduit**. Installation shall be in accordance with the National Electric Code and the requirements specified in Division 16. Conduit shall be run in a neat and workmanlike manner and run parallel and perpendicular to building surfaces and lines.

d. All low voltage power wiring shall be as described below:

(1) **Run low voltage wiring in conduit**.
(a) Minimum conduit size shall be ¾"
(b) Minimum control wire size shall be #18 AWG.

(2) All control wiring shall be separated from any power wiring. **No** control wiring 24 vdc or less shall be run with 120 vac or above.

(3) All communication wiring shall be run in separate conduit from control or power wiring.

(4) All wire shall be numbered or labeled on both ends of its terminations.

8. Pneumatic Installation

a. All pneumatic control air piping shall be as described below:

(1) Copper Tubing: ASTM B280, Type L, seamless, hard drawn or annealed.
(a) Fittings: ANSI/ASME B16.22, wrought copper.
(b) Joints: ANSI/ASTM B32 95-5 tin antimony.

(2) Polyethylene Tubing: Black, flame retardant, virgin polyethylene, conforming to modified ASTM D1693 test.
(a) Fittings: UL approved rod or forged brass rated to 200 psig at 100 degrees F.
(b) Joints: Compression or barbed type.

b. Mount compressor and tank unit on vibration isolation consisting of springs with minimum one inch deflection and one inch clearance to floor.

c. Supply instrument air from compressor units through filter, pressure reducing valve, pressure relief valve, with pressure gages and shut off and bypass valves.

d. Use copper tubing in mechanical rooms, where subject to damage or temperatures in excess of 200 degrees F, where adjacent to heating pipes passing through common sleeve and where not accessible. In mechanical rooms, bundled plastic tubing in conduit may be used. Plastic tubing without conduit may be used where tubing is concealed and accessible.

e. All tubing shall be numbered or labeled on both ends of its terminations.

f. Tubing shall be installed in neat and workmanlike manner and run in parallel and perpendicular lines to building surfaces and lines.

9. Training

a. The ATC Contractor shall provide competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed rather than a general training course. All information and documentation necessary to do this work must be provided.

(1) For new buildings and buildings with new systems, provide 40 hours training for Owner's operating personnel.

(2) For additions to existing control systems, provide 16 hours of training for the current project.

(3) Training sessions shall be coordinated with University Maintenance Personnel a minimum of five (5) working days prior to the training session.

b. Training shall be during multiple sessions. Campus Facilities Personnel shall participate in the DDC system check-out performed by the ATC Contractor's field technicians. Campus Facilities Personnel shall verify wiring terminations and accuracy of each analog and binary I/O point. All Contractor written or custom programming will be displayed and demonstrated to Campus Facilities Personnel. The ATC Contractor shall detail warranty requirements and length, identify components replaceable by Campus Facilities Personnel and troubleshooting procedures for those components, and pricing and availability including sources for each component upon expiration of the warranty. Approximately half the formal training shall be conducted prior to final checkout. The other half of the training shall be completed after project completion. The formal training shall include:

(1) Explanation of drawings, operations and maintenance manuals.

(2) Walk-through of the job to locate control components.

(3) Comprehensive DDC controller and ASC operation/function training both hardware and software.

(4) Demonstration and hands-on operation of Operator workstation and peripherals.

(5) Operator control functions including graphic generation and field panel programming.

(6) Operation of portable operator's terminal.

(7) Explanation of adjustment, calibration and replacement procedures.

10. Submittals

a. Provide six (6) copies of submittals for the University’s use plus whatever is required by the Architect/Engineer and Contractor. One set will be given directly to the University’s Energy Management Coordinator for review. Installation shall not begin until the submittals have been approved by the University EMS Coordinator and the consulting engineer. Submittal information will include:

(1) Manufacturer’s data sheets indicating model number, pressure/temperature ratings, capacity, methods and materials of construction, installation instructions, and recommended maintenance. General catalog sheets

showing a series of the same device is not acceptable unless the specific model is clearly marked.

(2) Schematic flow diagrams of systems showing fans, pumps, coils, dampers, valves, and other control devices. Label each device with setting or adjustable range of control. Indicate all wiring, clearly, differentiating between factory and field installed wiring. All cables from the panel field devices shall be numbered or labeled uniquely and shall be reflected on the control drawings.

(3) Flow diagrams for all application programs.

(4) Details of construction, layout, and location of each control panel, including instruments location in panel and labeling.

(5) Schedule of control dampers indicating size, leakage rating, arrangements, pressure drop at design airflow, and number and size of operators required.

(6) Schedule of control valves indicating system in which the device is to be used, rated capacity, flow coefficient, flow required by device served, actual pressure drop at design flow, size of operator required, and locations where valves are to be installed.

(7) A complete description of each control sequence.

(8) Calculations completed to determine size of control air compressor(s) and dryer (s).

(9) Installing contractor must be a manufacturer's branch office or an authorized representative of the control equipment manufacturer that provides engineering and commissioning of the manufacturers control equipment, submit written confirmation of such authorization from the manufacturer. Indicate in letter of authorization that installing contractor has successfully completed all necessary training required for engineering, installation, and commissioning of equipment and systems to be provided for the project, and that such authorization has been in effect for a period of not less than three years.

(10) Prior to request for final payment, submit record documents which accurately record actual location of control components including panels, thermostats, wiring, and sensors. Incorporate changes required during installation and start-up.

11. Operating and Maintenance Manuals

a. Furnish six (6) bound operating and maintenance manuals for review and approval prior to substantial completion, performance testing, and training. One set, which will include the drawings in AutoCAD or Visio format, will be given directly to the University’s Energy Management Systems Coordinator. Manuals to include the following:

(1) A complete set of record control drawings and sequences of operation including setpoints, control settings and adjustments. Schematic flow diagrams of systems showing fans, pumps, coils, dampers, valves, and other control devices. Label each device with setting or adjustable range of control. Indicate all wiring, clearly, differentiating between factory and field installed wiring. All cables from the panel field devices shall be numbered or labeled uniquely and shall be reflected on the control drawings.

(2) Details of construction via a floor plan layout including the location of each control panel, controller, control transformer, breakers, low voltage power wiring path, communication wiring path, etc.

(3) A description of recommended replacement parts and materials which the owner should stock.

(4) A summary of equipment vendors, or location where replacement parts can be purchased.

(5) Manufacturer's literature indicating features, materials of construction, and operating limits of installed equipment. (Brochures giving brief descriptions of multiple pieces of control apparatus are not acceptable.)

(6) A complete set of as-built control drawings in AutoCAD or Visio format.

(7) A system checkout (commissioning) report that will include all hardware points, software points, trends, alarms, reports and programs. The technician shall initial and date each point after they have been verified.

b. The ATC sub-contractor shall provide a complete laminated set of as-built drawings which will be placed in the main apparatus control panel (ACP) for the project.

12. Warranty

a. All devices and components shall be warranted for a period of two (2) years following the date of final acceptance by the owner. Warranty shall not start until all systems under project are accepted by the owner. No partial warranty shall be permitted.

b. All system consoles, operator interfaces, DDC controllers, ASCs, ACPs and software shall be warranted for a period of five (5) years following the date of final acceptance by the owner.

c. This warranty shall include labor and material. Any defects arising during the warranty period shall be corrected without cost to the owner. During the warranty period, the contractor’s service personnel shall be available to be physically present at the facility within twenty-four (24) hours for emergency repairs.

d. The contractor shall consider the possibility of allowing owner’s trained maintenance personnel to affect repairs of extremely critical nature, even before the service representative arrives at the site. For this purpose, a stock of necessary spare parts shall be maintained at the facility. If the owner’s stock of spare parts is used for in-

warranty repair, such stock shall be replenished within ten (10) working days.

e. All fiber optics shall have a fifteen (15) year parts and labor warranty from the date of final acceptance.

13. Owner Demonstration

a. The ATC Contractor shall demonstrate each system completely to the University's EMS Coordinator that the systems installed comply with the design concept, shop drawings and sequence of control. The ATC Contractor shall submit, by system, a performance test method and format that indicate the system, the point descriptors for all systems, field values, BAS values, occurrence values, manual automatic controls, status values, etc., for approval to the University's EMS Coordinator. The ATC contractor shall coordinate the acceptance test directly with the University's EMS coordinator.

14. Final Acceptance

a. Final acceptance shall be determined only after the operation of the complete DDC system for the entire project has been verified by the University EMS Coordinator, the owners operating personnel have received training as specified herein and the final acceptance documents (provided by owner) have been signed by both the contractor and the owner.

15. System Monitoring

a. Building Central Systems
   (1) Chillers
      (a) 5 tons or larger
         (i) Status
         (ii) Run time
         (iii) CWS temp
         (iv) CWR temp
         (v) Start stop and alarm
         (vi) Condenser WS temp (if available)
         (vii) Condenser WR temp (if available)
      (b) 1,000 tons or larger
         (i) All of the above
         (ii) CWS flow
         (iii) Condenser WS flow
         (iv) Evaporator liquor temperature
         (v) Evaporator pressure and condenser pressure
         (vi) Running amps
         (vii) Bearing temperatures
         (viii) Any other requirements of the Senior Mechanical Engineer

   (2) Boilers, Water
      (a) 500,000 Btu/Hr or larger
         (i) HW supply temp
         (ii) HW return temp
         (iii) Start stop and alarm
         (iv) Lead/lag (if available)
         (v) BTU usage - instantaneous and cumulative

(3) Boilers, Steam
- (a) 500,000 Btu/Hr or larger
  - (i) Pressure
  - (ii) Start stop and alarm
  - (iii) Lead/lag (if available)
  - (iv) BTU usage – instantaneous and cumulative

(4) HW and CW Pumps
- (a) 3 HP or larger
  - (i) Status
  - (ii) Run time
  - (iii) Start stop and alarm
- (b) 25 HP or larger
  - (i) All of the above
  - (ii) Running amps
  - (iii) Lead/lag (if available)
- (c) 100 HP or larger
  - (i) All of the above
  - (ii) Winding temperatures (if available)

(5) Control Air Pressure
- (a) Alarm on loss

(6) Smoke
- (a) Duct detectors shall be hardwired into the fan starter circuit with a local alarm signal to the BAS and tied into the central fire alarm system (as required by code).

(7) Air Handling Units
- (a) Less than 1500 CFM
  - (i) No monitoring unless requested
- (b) 1500 CFM or more
  - (i) Freeze status alarm
  - (ii) Start Stop and alarm
  - (iii) Run time
  - (iv) Supply air temperature
  - (v) Outside air temp
  - (vi) Return air temperature
  - (vii) Duct detector (monitor only)
  - (viii) Supply air temperature remote reset
  - (ix) Mixed air temperature
  - (x) Mixed air temperature reset
- (c) 10,000 CFM
  - (i) All of the above
  - (ii) Supply air flow
  - (iii) Supply air static pressure
  - (iv) Cooling coil supply air temperature reset
  - (v) Heating coil supply air temperature reset
- (d) 50,000 CFM or larger

(i) All of the above
(ii) Running amps

(8) Fume Hoods
(a) Face velocity
(b) CFM
(c) Sash position
(d) Hood usage sensor
(e) Alarms
(f) Any other parameters deemed necessary by the Senior Mechanical Engineer

(9) Environmental Rooms
(a) Rooms temperatures
(b) CFM (supply and exhaust)
(c) Pressurization
(d) Alarms
(e) Any other parameters deemed necessary by the Senior Mechanical Engineer

(10) Steam metering – see section on Steam metering

(11) Chilled water metering – see section on Chilled water metering

(12) Variable volume box
(a) Damper position
(b) Temperature
(c) CFM
(d) Any other parameters deemed necessary by the Senior Mechanical Engineer

16. Alarms - The following Alarms shall be generated where applicable
(a) Air Handling Units
(1) Supply Fan Failure
(2) Return Fan Failure
(3) Mixed Air Low Limit
(4) Freeze
(5) Smoke
(6) Filter
(7) High Discharge Static Pressure
(8) High Discharge Air Temperature
(9) Low Discharge Air Temperature
(10) VFD Fault
(b) Chillers
(1) Low chilled water temperature
(2) Low evaporator temperature or pressure
(3) High condenser refrigerant pressure
(4) Evaporator water flow failure
(5) Condenser water flow failure
(6) Low oil pressure
(7) Low oil temperature
(8) High oil temperature
(9) High motor winding temperatures
(10) Sensor faults

(11) Proper operation of unit controls

END OF SECTION

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DIVISION K
ELECTRICAL STANDARDS

K.1 GENERAL

The Professional shall meet with the University's Project Manager to develop and prepare a Project Program in accordance with the Facilities Management requirements for new buildings and/or renovations. The Professional shall be required to visit the site to verify existing conditions and to survey the area of work.

K.2 ELECTRICAL DESIGN CRITERIA

A. The electrical design criteria shall include but is not limited to the following:

1. Power distribution systems
2. Grounding systems
3. Emergency, legally-required, and optional standby systems
4. Lightning protection
5. Lighting systems
6. Fire alarm systems
7. Teledata
8. Security systems
9. Instructional Equipment.

B. The building under design may only require some of these criteria, and the Professional shall identify with the University's Project Manager the implementation of those systems that apply.

C. Lighting systems shall be designed to be energy conserving and in accordance with IBC, IECC, and ASHRA/IES Standard 90.1.

K.3 PRIMARY POWER DISTRIBUTION

A. Research and laboratory buildings shall be provided with a two source primary, secondary selective unit substations with transformers furnished with fan-cooling and/or lower than normal temperature rise such that under emergency conditions they can carry continuously the maximum load of both sides. Classroom/office buildings and other similar structures shall be provided with a primary selector load break switch only when medium voltage is supplied to the building.

B. Selector switches shall be fused using current-limiting fuses. Large, gasketed, high-impact viewing windows shall be provided in the switch enclosure that permit full view of the position of all three switch blades, blown fuse indicators, and cable terminations from outside the enclosure.

C. **Oakland Campus**:

1. Primary power distribution is 4160 volts from one of six Duquesne Light Company (DLCO) substations located on the main campus as follows:

Substation	Xfmr Quantity	Xfmr OA/FA Ratings	Xfmr Voltage
BST	3	10MVA ONAF	23kV-4.16kV

Chevron	2	5MVA (1ONAF)	23kV-4.16kV
Clapp	1	3.75MVA	23kV-4.16kV
Panther	2	10MVA (Future ONAF)	23kV-4.16kV
Posvar	3	7.5MVA ONAF	23kV-4.16kV
Scaife	2	10MVA ONAF	23kV-4.16kV

2. Each of these substations, except Clapp, has main-tie-main auto-throwover control. Each feeder originating from the substation shall be protected by a draw-out vacuum breaker with overcurrent protective relaying fully coordinated with upstream and downstream devices.
3. Each building's main unit substation shall be provided with two 4160V feeders from two different DLCO transformers (i.e., a primary selective system).
4. 500kCMIL copper conductors shall be used for all primary power distribution medium voltage feeders.
5. All underground medium voltage conduits shall be encased in concrete. The minimum size medium voltage conduit to be used underground shall be 5".
6. Precast manholes shall be waterproof coated. All wall penetrations shall be core drilled for conduit entrance. They shall also include a sleeve for ground rod, pulling irons, and sump with grate. All hardware for mounting cable racks, ground bars, etc. shall be stainless steel. All penetrations shall be sealed with hydrophilic grout. Manhole covers shall be cast iron, 36" in diameter with cast-in legend as follows and shall include the University-assigned alphanumeric manhole designation:

   (a) "UNIVERSITY OF PITTSBURGH ELECTRIC" "MH-XXX) (with XXX being the designated manhole number) for power distribution.
   (b) "UNIVERSITY OF PITTSBURGH TELECOMMUNICATIONS" for communications, data, and telephone systems. Refer to Division L CSSD Specifications.

   Precast manholes shall be by A.C. Miller Concrete Products Inc. or University-approved equal.

E. **Bradford Campus**:

Primary power distribution is 12,470 volts from First Energy Corporation, Pennsylvania Electric Company (Penelec).

F. **Greensburg Campus**:

Primary power distribution is provided by First Energy Corporation, Allegheny Power at normal service entrance voltage.

G. **Johnstown Campus:**

Primary power distribution is provided by First Energy Corporation, Pennsylvania Electric Company (Penelec) via a 480-volt network or normal service entrance voltage.

H. **Titusville Campus:**

Primary power distribution is provided by First Energy Corporation, Pennsylvania Electric Company (Penelec) at normal service entrance voltage.

K.4 GROUNDING

A. A grounding system meeting or exceeding the requirements of the NEC and IEEE Standard 142 shall be designed for each University building. The neutral point of all 4160V, 208Y/120V, and 480Y/277V systems shall be single-point, solidly grounded. The neutral (grounded conductor), equipment grounding conductor, and isolated ground conductor, where used, shall be bonded to the grounding electrode conductor at the service equipment only (single-point). All electrical equipment shall be connected to the grounding system. All separately derived electrical systems (e.g., transformers, generators, and UPSs) shall be grounded per code requirements including a separate grounding electrode conductor to a building grounding electrode.

B. The grounding electrode shall be protected by rigid aluminum or fiberglass conduit where exposed.

C. The grounding electrode system shall have a measured resistance to ground of 5 ohms or less.

D. All metallic raceways, cable trays, and metallic sheaths of MC cable shall be properly grounded and bonded. In addition, separate, code-sized, insulated equipment grounding conductors shall be contained within the same raceway, cable, or otherwise run with the circuit conductors.

E. Bare ground conductors shall not be installed unless approved by the University's Senior Electrical Engineer.

F. All high press lugs used in the building system shall be rated copper only. All mechanical lugs can be cu-al rated lugs.

G. All raceways used to contain single or multiple branch circuits shall include a green insulated ground conductor. Circuits used for isolated ground outlets shall have, in addition to the green insulated equipment ground conductor, a separate green-with-yellow-stripe insulated ground conductor installed and tagged for identification at all outlet and junction boxes.

H. A 600V ground wire shall be run with all medium voltage feeders in all types of conduit (PVC, Fiberglass, RMC and Aluminum).

I. Feeders

1. All raceways used to contain 480 volt feeders shall include a green insulated ground conductor.
2. All raceways used to contain 208 volt feeders shall include insulated ground conductor(s) as follows:
   (a) Common ground: one green insulated equipment ground conductor that is intended to supplement the conduit grounding system shall be installed with all feeders. This conductor shall be connected to the bonded ground bus of the panelboard or switchboard at each end.
   (b) Isolated ground: one green-with-yellow-stripe insulated isolated ground conductor that is intended to provide an isolated ground system for sensitive equipment shall be installed with feeders to panelboards serving research areas and teledata equipment. Panelboards serving research areas and teledata equipment shall include an insulated ground bus. The isolated ground conductor shall be connected to this insulated ground bus.

J. Panelboards and Switchboards

1. All 480 volt and 208 volt panelboards and switchboards shall include a bonded ground bus.
2. All 208 volt panelboards that serve research areas and teledata equipment shall include both a bonded ground bus and an insulated ground bus. The insulated ground bus is intended to provide an isolated ground system for sensitive equipment.

K. Manholes

1. Provide one copper ground bus in each manhole sized to accommodate all required grounds. Minimum bus size shall be 12" x 2" x 1/4" thick, mounted with standoff brackets to side of manhole.
2. Provide one ¾" x 10' copper-clad ground rod and connect to ground bus with #2 AWG. Connection to ground rod shall be by exothermic weld. Hydrophilic grout shall be used to seal ground rod penetration.
3. Terminate all equipment ground conductors run with feeders and any ductbank grounds onto ground bus.
4. Terminate all 5kV cable shields from splices and t-taps onto ground bus with #10 AWG.
5. Bond all metal manhole components, including manhole lid rings, ladders, pulling irons, cable racks, sump frames, and door frames, to ground bus with #6 AWG.
6. Make ground connections inside manholes with exothermic welded connections, approved pure-wrought-copper compression connectors, or approved high-strength, high-conductivity, cast-copper-alloy connectors with silicon bronze nuts, lock washers, and bolts.
7. Ground conductors shall be stranded copper.

K.5 ELECTRICAL EQUIPMENT ROOMS

Access shall be provided for replacement of the largest piece of equipment without cutting the equipment or removing walls. The rooms shall be adequately ventilated under automatic control and shall have a floor drain with a trap primer. The mechanical and electrical rooms shall not be adjacent to areas where vibration and/or noise would be objectionable. Mechanical and electrical rooms shall be separate and physically isolated rooms. Mechanical piping and ductwork shall not be routed through electrical equipment rooms except when servicing the room. Telecommunications, data and security wiring shall not be routed through or terminated in electrical equipment rooms except when servicing the room. Doors for electrical rooms shall open out and have a panic bar opener.

K.6 SALVAGED ELECTRICAL MATERIALS

A. The Professional shall review salvaged materials and equipment items with the University's Senior Electrical Engineer and define these items in the bid documents.

B. The University shall have the right of first refusal for any existing equipment removed by the Contractor. The Professional shall specify that the Contractor shall be required to return to the University any piece of equipment in operational or "as found" condition as requested by the University. The Contractor shall be responsible for placing this equipment in a location designated by the University. Distribution and other equipment items to be returned include but are not limited to the following:

1. Transformers

2. Medium voltage and low voltage switchgear
3. Switchboards and panelboards
4. Relays (electronic and mechanical)
5. Disconnect switches, circuit breakers, motor starters, and VFDs
6. Bus duct, plug-in breakers and switches
7. Electric meters and components
8. Building management systems
9. Fire alarm systems
10. Generators
11. Luminaires, light poles, and lighting controls, including occupancy and vacancy sensors
12. Automatic Transfer Switches.

C. Receipts shall be provided to the University for all recycled materials.

K.7 SHUTDOWNS OF UTILITIES

A. The Professional shall specify that Contractors shall submit for approval from the University, at least twenty-one (21) days in advance, a request for the shutdown of utilities. The University must issue an outage notice at least ten (10) working days in advance unless it is an emergency. Utility shutdowns must be scheduled so as not to interfere with the University's daily functions.

B. Professionals shall be responsible for identifying major shutdowns that shall occur during nighttime or weekend hours. These shutdowns are to be specifically described in this Division of the Specifications. The Professional shall submit to the University all options regarding shutdown work including time and cost for each option.

C. Where shutdowns are unavoidable because of introducing additional or increased hazards or of infeasibility due to equipment design or operational limitations as permitted per NFPA 70E, a justification for work and energized electrical work permit shall be filed with the University's project manager in accordance with NFPA 70E. The Electrical Contractor shall inform the University about the Contractor's electrical safety program.

K.8 "AS-BUILT" DRAWINGS, TRAINING, AND O&M MANUALS

A. The Professional shall specify that, during the course of the work, the Contractor shall record all changes in the work on a set of the contract documents (in electronic format) to include one (1) set of corrected specifications. The Professional shall revise the original documents and provide the "As-Built" information in computer file form (PDF and DWG) to the University. This applies to all Trades involved with the work.

B. The Professional shall specify that training sessions for each piece of electrical equipment or each electrical system shall be a minimum of eight hours each. Training shall not be held until the start-up and commissioning of the subject electrical equipment or system is complete.

C. The date of substantial completion of the construction contract takes effect on the date when both the required training and O&M manuals have been fully received.

D. All major electrical equipment (including but not limited to switchgear, switchboards, transformers, generators, ATSs, UPSs, and VFDs) shall have a warranty label placed in a conspicuous place. Label shall indicate start and end date of the warranty period. The start date shall be the date of final acceptance by the University.

K.9 ACCESS AND PROTECTION

A. Access panels shall be provided for accessibility to devices and controls requiring service by the University that will not be readily accessible after completion of the project.

B. Where existing mechanical equipment or pipes are located above electrical equipment not covered by the NEC (i.e. VFDs, starters, control panels, etc.), secondary drip pans shall be provided. Drain lines shall be provided and shall be daylighted to a service sink, floor drain or corridor, as approved by the University, where leaks will be noticeable by maintenance personnel.

K.10 REGULATIONS AND PERMITS

A. All electrical work, equipment and materials furnished and installed shall conform to the requirements of the latest editions of the following: the National Electrical Code (NEC), the National Fire Protection Association (NFPA), the Department of Labor and Industry, Occupational Safety and Health Association (OSHA), United States Department of Health and Human Services (as applicable), Federal Specifications (as applicable), International Building Code (IBC), International Energy Conservation Code (IECC), American National Standards Institute (ANSI), Illuminating Engineering Society (IES), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ANSI/ASHRAE/IESNA Standard 90.1), Institute of Electrical and Electronics Engineers (IEEE), National Electrical Manufacturers' Association (NEMA), Factory Mutual (FM), and any other governmental or local authorities having jurisdiction.

B. The University shall procure the necessary permits, from the Department of Labor and Industry. The Professional shall complete the paperwork for the submission for the University. The University will determine the level of permit needed. If applicable, the Contractor will be responsible for maintaining the permit set on the construction site. Notify the inspection agency in sufficient time prior to concealment of work so that a complete rough-in inspection may be made.

C. Any and all standards and regulations listed in this document shall be included in the specifications as applicable, shall take precedent over the specifications, and shall be satisfied by the Contractor at no additional expense to the University.

K.11 STANDARDS

A. All material and equipment shall be listed, labeled or certified by a nationally recognized independent testing laboratory where such standards have been established. Equipment of a class which no nationally recognized testing laboratory accepts, certifies, lists, labels or determines to be safe shall be considered, if inspected or tested in accordance with a national industrial standard, such as the American National Standards Institute (ANSI), National Electrical Manufacturers' Association (NEMA), or Insulated Cable Engineers Association (ICEA).

K.12 WORKMANSHIP

A. The Professional shall specify that Electrical Contractors shall be responsible for the repair of damages caused by the EC to other Contractors work and/or existing work area and to repair said damages to original conditions to the satisfaction of the University.

B. The University's Project Manager reserves the right to direct the removal of any item which

does not comply with the contract drawings or specifications, or does not present a neat, orderly, and workmanlike appearance.

K.13 CALCULATIONS

A. The Professional shall perform all required electrical calculations, including but not limited to voltage drop, load (connected, demand, and design), power factor correction sizing (for new services or large motor installations), generator sizing, motor starting, lighting levels, and lighting power density with ComCHECK results and submit them to the University's Electrical Engineer.

B. When new equipment required to be labeled by NFPA 70E is involved or if the short circuit currents or upstream overcurrent protective device characteristics change for existing equipment, the Professional shall provide power system studies, including short circuit (with equipment kAIC evaluation), overcurrent protective device coordination, and arc flash risk assessment. The Professional will perform a preliminary study to determine short circuit design criteria and minimize potential arc flash risks. Before equipment submittals are approved, studies shall be completed based on the submittals to confirm the equipment ratings and overcurrent protection characteristics. Any equipment location found to be in excess of PPE (Personal Protection Equipment) Category 2 as defined by NFPA 70E-2016 Table 130.7 (C)(16) shall be identified to the Senior Electrical Engineer immediately so that solutions and products that will mitigate the arc flash risk and reduce the PPE Category may be further evaluated before proceeding with full release of equipment on order. Before startup and commissioning, studies shall be finalized using approved equipment data. Labels shall be provided and installed by the Professional for all equipment as required by NFPA 70E, including the following parameters:

1. Equipment Name and Date
2. Flash protection boundary
3. Incident energy at 18" expressed in cal/cm^2 (for LV equipment) or
4. Incident energy at 36" expressed in cal/cm^2 (for MV equipment)
5. PPE Category
6. PPE required
7. Voltage shock hazard
8. Limited shock approach boundary
9. Restricted shock approach boundary
10. Prohibited shock approach boundary.
11. kAIC rating of equipment

C. For short circuit studies, the utility contribution data will be provided by the University's Electrical Engineer.

D. Adjustable overcurrent protective device settings shall be confirmed by the Professional before installing the labels.

E. OTI ETAP PowerStation (preferred) or SKM Systems Analysis Power*Tools or EasyPower software shall be used for all power system studies. The Professional shall have a minimum of five years proven experience performing all required power system studies; otherwise, one of the following preferred, local engineering firms or a University-approved equal shall be subcontracted:

1. Tower Engineering
2. HF Lenz

3. Qual-Tech Engineers.

The manufacturer or supplier of the new electrical equipment being studied shall not be used to perform the power system studies.

K. 14 RACEWAYS

A. Unless otherwise specifically approved by the University's Senior Electrical Engineer, all new wiring in existing and new buildings shall be concealed.

B. The minimum conduit size aboveground shall be ¾ inch; underground shall be 1 inch.

C. Aboveground, low-voltage conductors shall be installed indoors in electrical metallic tubing (EMT) and outdoors in rigid aluminum conduit except where otherwise required.

D. Aboveground, medium-voltage conductors shall be installed indoors in rigid galvanized steel conduit (RGS) and outdoors in rigid aluminum conduit except where otherwise required.

E. Medium-voltage pull and junction box covers shall have white lettering on red background tags reading "Danger Medium Voltage __Volts Keep Out." Fill in voltage as 4160 for Oakland Campus or 12,470 for Bradford Campus.

F. Underground, low-voltage and medium-voltage conductors shall be run in Schedule 40 PVC conduit except under roadways where conduit shall be Schedule 80 PVC. Underground conduit for site lighting shall be direct buried; all other applications shall be in concrete encased ductbanks. Provide a minimum of one spare conduit per ductbank, equal to or larger than the largest specified size.

G. Compression fittings shall be used for EMT up to and including two (2) inches. On EMT conduits larger than two (2) inches, compression fittings or steel-sleeve set screw fittings shall be used. Die-cast fittings are not permitted.

H. Rigid conduit fittings shall be of the threaded type only.

I. Concrete-encased ductbanks shall have a minimum 5" envelope. All ductbanks, regardless of voltage, shall be provided with a minimum 36" cover and a permanent, magnetically detectable underground warning tape above the buried conduit 6"-8" below finished grade. The tape shall be not less than 6 " wide by 4 mils thick and read "Caution buried electric line below" in black lettering on a red background. Top of manholes shall be 12"-24" below grade. Provide pre-cast collars to place top of manhole cover at grade. Where ductbanks cross roads, 2" diameter round brass tags center stamped "ELECTRIC" with the manhole designations stamped above and below shall be permanently embedded into the face of the curbs at each end of the crossing directly above the centerline of the ductbank. Manhole designations shall be oriented in the direction of the manholes. Brass tag lettering shall be 3/16" high.

J. With approval of the University's Senior Electrical Engineer, low-voltage cable marked "For CT Use" installed in cable tray may be used in electrical rooms or switchyards accessible to qualified personnel only.

K. The use of BX Cable is prohibited.

L. In existing structures "MC" cable may be used in inaccessible ceiling and wall spaces. In new construction lengths shall be limited to 6'-0" maximum to ceiling-mounted luminaires and

wiring devices and 20'-0" maximum to wall-mounted. All conductors from the panelboard to an existing space shall be run in EMT to a junction box in the space where "MC" cable is to be used. All installations of "MC" cable shall be inspected by the University's Senior Electrical Engineer prior to covering the work with walls, ceilings, etc. The Professional shall verify all other uses of "MC" cable with the University's Senior Electrical Engineer. "MC" cable can be solid wire.

M. As permitted by the NFPA and local codes, plenum-rated, riser-rated, and general purpose cable with 300 volt insulation or less may be installed without raceway or in cable tray when used for teledata system wiring only. All other 300 volt and less wiring shall be run in raceway or as "MC" cable as required elsewhere in this standard.

N. The use of electrical non-metallic tubing (ENT) shall not be permitted without the written approval of the University's Senior Electrical Engineer.

O. Insofar as possible, use existing conduits for wiring. However, do not reuse existing wiring. The Professional shall indicate that exposed raceways, luminaires, panel boards, and other electrical equipment that are no longer a functioning part of the electrical system shall be de-energized, disconnected and removed and all ceiling, wall or floor openings left by this removal shall be patched (fire sealed, if applicable) and painted to match corner to corner.

P. In existing, inaccessible, finished areas where concealment is impractical, Wiremold, Hubbell, or University-approved equal surface metal raceway shall be used with approval by the University's Project Manager.

Q. All raceways shall be supported on a minimum of 8'-0" centers and within 3'-0" of outlet box. "MC" cable shall be supported on 6'-0" centers and within 1'-0" of outlet box.

R. Junction and pull boxes shall be installed such that covers are readily accessible and adequate working clearance is maintained (0'-6" minimum) after completion of the installation.

K.15 CONDUCTORS

A. Reuse of existing conductors over 25 years old is prohibited.

B. All low-voltage building power wire shall be type THHN/THWN 90 degrees C dry/ 75 degrees C wet, 600 volt, insulated stranded copper. Minimum wire size shall be #12 AWG. Solid wire shall not be used, except in "MC" cable (see item K.14 L). 300 volt insulation can be used for teledata and building management system wiring.

C. All electrical wiring passing through an environmental air plenum space shall be approved for such use or shall be installed in metal conduit.

D. Low-voltage conductor ampacities in above-grade raceway shall be as stated in NEC Table 310-16 under the applicable column, 60°C or 75°C and shall be derated as necessary per NEC for ambient temperatures and quantity of current carrying conductors.

E. Low-voltage conductor ampacities in underground electrical ductbanks shall be calculated using NEC Annex B application information.

F. Branch circuit wiring shall be color-coded. Black (phase A), red (phase B), blue (phase C), and white (neutral—grounded conductor) shall be used for 208Y/120V systems. Brown (phase A), orange (phase B), yellow (phase C), and gray (neutral—grounded conductor)

shall be used for circuits of 4160Y/2400V and 480Y/277 volts. Green shall be used for equipment grounding conductors only. Green with yellow stripe shall be used for isolated ground conductors. For three-way or four-way switches use a color other than those listed for the traveler circuits.

G. Push in wire connectors are prohibited (except in luminaire disconnects).

H. All medium-voltage power cable shall be 5kV, UL-listed Type MV-105, 105°C, single-conductor, 133% insulation level, copper-tape shielded with the following:

1. Compact stranded, annealed bare copper conductor with an extruded, semiconducting, ethylene propylene rubber (EPR) compound strand screen
2. EPR insulation with a minimum thickness not less than 90% of that specified in ICEA
3. Helically applied bare copper tape over extruded, semiconducting, EPR layer insulation screen
4. Sunlight resistant, black polyvinyl chloride (PVC) overall jacket.

The cable shall be Okonite Okoguard-Okoseal Type MV-105 or equal by Aetna, American Insulated Wire, General, Prysmian, or Southwire.

I. All medium voltage separable cable splices shall be Elastimold Series 600 Deadbreak separable connectors or equal by Cooper Power Systems. In manholes, each set of connectors shall be supported with cable support arms.

J. All 5kV stress cones shall be 3M Company Cold-shrink QT-III or approved equal of Elastimold or Cooper Power Systems.

K. All medium voltage non-separable cable splices shall be 3M Company Cold-shrink QS-III or approved equal of Elastimold or Cooper Power Systems.

L. After installation, all medium-voltage cable circuits shall be properly identified by a durable nonmetallic engraved tag at every point of access and at both ingress and egress points of manholes and junction boxes. Tags shall be white with black lettering, ¼" in junction boxes and ½" in manholes. Tags shall bear the following information:

1. Circuit voltage; i.e., 4160V
2. Points of origin and termination; e.g., PANTHER HALL SWITCH #390 TO PA HALL SWITCH #336
3. Size and number of conductors, including equipment ground; e.g., (3) 500KCMIL + #4GRD
4. Class of insulation; i.e., 5kV, 133%
5. Date of installation; e.g., INSTALLED JULY 2006.

M. All medium voltage cables in pullboxes and manholes shall be arc-proofed and fireproofed using a flexible flame and high electric arc-resistant type of tape manufactured for the purpose applied to cables and splice areas. Tape shall be installed in a ½ lap wrap fashion and securely held in place by a random wrapped silicone cloth adhesive tape.

N. A full loop of spare cable length shall be provided around the perimeter of all manholes for each cable passing through. Heavy duty nonmetallic cable racks with a minimum of four cable support arms on each stanchion shall be installed every 3'-0". Stanchions shall reach from 0'-6" above the manhole floor to within 1'-0" below the ceiling. Stanchions shall be Underground Devices Inc. Type CR and arms shall be Underground Devices

Inc. Type RA or University-approved equal.

K.16 PANELBOARDS

A. Normal lighting and appliance panelboards shall be a minimum of 42-circuit.

B. Emergency lighting and appliance panelboards shall be a minimum of 24-circuit.

C. Normal lighting and appliance panelboards shall have all of their branch circuits on the same floor as the panelboard location.

D. Emergency lighting and appliance panelboards may located every third floor, depending on panel loading.

E. The number of overcurrent protective devices in power distribution panelboards shall be restricted only to practical physical limitations such as standard box heights and widths.

F. The operating handles of the topmost-mounted devices in all panelboards shall not exceed 6'-6" above the finished floor.

G. For labs, a separate panelboard shall be located in each lab.

H. Panelboards shall have panel schedules on the drawings as well as matching, typed directories in each panel.

I. Panelboards shall be door-in-door construction with hinged front panels and hinged doors. Provide common keying for all panels.

J. Circuit breakers shall be bolt-on type and for lighting branch circuits shall be rated 'SWD'.

K. The preferred manufacturers for panelboards are Eaton, Square D, and Siemens.

L. Panelboards shall have copper bus.

M. Provide at least 20% spare breakers and/or spaces in all new panels.

K.17 WIRING DEVICES

A. Convenience receptacles shall be light industrial specification grade, 20 amps, NEMA rated, grounding type, Hubbell, Cooper, Pass & Seymour, Bryant, Leviton or approved equal #5362.

B. Ground-fault circuit-interrupter (GFCI) receptacles shall be used in bathrooms; kitchens; outdoors (including rooftops); within six (6) feet of laundry, lab, or utility sinks; and all other locations required by NEC. GFCI receptacles shall be light industrial specification grade, 20 amps, NEMA rated, grounding type, Hubbell, Cooper, Pass & Seymour, Bryant, Leviton or approved equal #GF5362.

C. Combination USB charger shall be commercial specification grade, 20 amps, NEMA rated, grounding type AC duplex receptacle with two USB charging ports rated at 2.1 amps and 5 volts DC, Cooper #TR7746 or approved equal.

D. Switches shall be Hubbell, Cooper, Pass & Seymour, Bryant, Leviton or approved equal Specification Grade #1221, 1223, and 1224.

E. Cover plates for wiring devices shall be stainless steel finish, unless otherwise approved by the University. Where wall surfaces are to receive wall coverings, the cover plates shall be high-impact nylon with color as selected by the Architect.

F. Duplex receptacles shall be mounted to centerline at 18" A.F.F. with ground terminal up and switches at 46" A.F.F. If receptacle is vertical, grounding pole shall be at the top; if horizontal, the neutral blade shall be at the top.

G. All existing device locations which are to be reused shall receive new devices and cover plates.

H. While-in-use weatherproof receptacle covers shall be used as required by NEC for wet locations, which include but are not limited to outdoor areas and all indoor areas that could be subjected to hose spray.

I. Stranded conductors shall be attached to all wiring device ground terminals with approved crimp-on, insulated fork terminal connectors.

J. Cover-plate receptacle labels and cover-plate switch labels shall indicate panel and circuit identification for all receptacles and switches. Durable wire markers or tags shall be used inside outlet boxes and cover-plate for switches.

K. Legally-required standby or optional standby receptacles shall be red and isolated ground receptacles shall be orange.

K.18 ENGINE-GENERATOR SETS

A. All genset electrical equipment, piping, and ductwork shall be mounted on vibration isolators to minimize transmission of vibration and noise to building structures or spaces.

B. All rotating equipment shall be balanced both statically and dynamically. The equipment supporting structure shall not have any natural frequencies within ±20% of the operating speeds. The equipment while operating shall not exceed self-excited radial vibration velocity of 0.10 inches per second or an axial vibration velocity of 0.05 inches per second when measured with a vibration meter.

C. Alarm signals shall be sent to the Campus-wide Building Management System to indicate genset run status, fuel tank low status, and genset trouble alarm. These signals shall be from the generator.

D. Genset design shall include an integral double-walled fuel tank and associated leak detection, venting, piping, and remote filling (if necessary) as well as engine exhaust and cooling/combustion air ventilation systems. Remote fuel fill stations shall be mounted no higher than 4'-0" above finished grade, shall have cam lock couplings to match the University's fuel supplier's hoses, shall include means for locking and have an exterior fill alarm. Fuel gauges shall be provided on all fuel tanks. Readout shall be in gallons. Exhaust and vent stacks shall terminate a minimum of 12'-0" above finished grade. All indoor mufflers and exhaust piping shall be insulated.

E. Outdoor generators shall have a sound attenuating enclosure that reduces the sound level to not more than 60 dB at the property line.

F. The Professional shall provide a listing of all equipment fed by the emergency generator and

all calculations used to size the generator and the fuel tank. The fuel tank capacity shall support running the genset at 100% load for 24 hours minimum.

G. A full-load field test shall be performed after the genset installation is 100% complete. Test shall be run by a factory-authorized service company for a minimum of four hours. Provide a load bank as necessary for the testing.

H. Make provisions for the contractor to refill the fuel tank following the load test, before turn over to the University. Also, make provisions for the contractor to refill all generator tanks if existing generators were used to support an extended outage for the contractor.

I. On the Oakland Campus only, the emergency genset fuel shall be diesel only. Natural gas may be used for optional standby gensets.

J. Generators shall be separately excited permanent magnet generator type. The automatic voltage regulator shall be full wave rectified pulse width modulated output type. The governor shall be an electronic isochronous type.

K. Any fuel tanks over 1400 gals. are required to be tested and certified during installation.

L. Acceptable manufacturers of generators are Caterpillar, Cummins and Kohler.

K.19 AUTOMATIC TRANSFER EQUIPMENT

A. The emergency system shall either be 208Y/120 or 480Y/277 volt, three phase, four wire. It shall have one or more open-transition, four-pole, switched-neutral automatic transfer switches (ATSs). A separate ATS shall be provided for legally-required and optional standby loads per NEC. Legally-required and optional standby loads (e.g., research loads, computer labs, server rooms, environmental rooms, prime hood exhaust fans, hot water pumps, building management panels, security panels, elevators, fire pumps, smoke control systems, and teledata) shall not be connected to the life-safety emergency system ATS.

B. The transfer switches shall have 3-cycle or 30-cycle short circuit withstand ratings that exceed the available system fault current, as determined by the overcurrent protective device coordination study.

C. ATSs shall be contactor type. Circuit breaker type ATSs are not permitted.

D. All life safety transfer switches shall have a maintenance by-pass.

E. If elevators, MG sets, transformers or other large motors are connected to the generator, the ATS supplying them shall include an in-phase monitor to minimize voltage transients and system stresses and avoid nuisance tripping of the feeder breaker.

F. Alarm signals shall be sent to the Campus-wide Building Management System to indicate ATS in the emergency position.

G. Loss of normal power, pre-transfer, or other signals required by the elevator controllers for smooth transition between normal and emergency sources shall be provided in the ATS and wired to the elevator controllers.

H. The preferred manufacturers of automatic transfer switches are Russelectric, Cummins, ASCO and Caterpillar.

K.20 EMERGENCY POWER LOADS

A. New construction projects shall have emergency loads connected to the emergency power system through a dedicated ATS as required by the governing codes. The following equipment in new structures shall also be provided with emergency power whether required or not: fire alarm system, emergency lighting, exit signs, and emergency lighting in electrical and mechanical rooms. A separate ATS shall be provided for the legally-required standby and optional standby loads.

B. Existing buildings shall only have loads connected to the emergency power system through a dedicated ATS as required by the governing codes or as approved by the University's Senior Electrical Engineer. Load data on existing emergency generators shall be obtained from the University's Senior Electrical Engineer by the Professional. A separate ATS shall be provided for the legally-required standby and optional standby loads.

C. The following optional-standby loads can only be added with written permission from the University's Senior Electrical Engineer and must be on a separate ATS if capacity on the generator permits: research loads, computer labs, server rooms, environmental rooms, prime hood exhaust fans, hot water pumps, and teledata.

D. The following legally-required standby and optional-standby loads shall be connected to the generator via a separate ATS even if not required by the governing codes: building management panels, security panels, elevators, smoke control systems, and fire pumps.

K.21 MEDIUM VOLTAGE SUBSTATION/SWITCHGEAR

A. Medium-voltage (i.e., 5kV or 15kV) circuit breakers shall be of vacuum draw out type in metal-clad switchgear. AC control with capacitor trip devices shall be used. DC control is not acceptable.

B. Multi-ratio phase current transformers shall be provided in each breaker compartment. In addition, multi-ratio zero sequence current transformers shall be provided in each feeder breaker compartment. All taps shall be wired to a terminal block accessible in the breaker control compartment. Current transformers and voltage transformers shall be wired to separate test switches with shorting blocks and voltage disconnects for each meter. Protective relays shall be draw out type or have quick disconnect connectors with integral shorting contacts. Cause-of-trip indicators shall be provided on each protective relay.

C. Three potential transformers connected line-to-ground shall be used. Two voltage transformers connected line-to-line is not acceptable.

D. All breaker statuses shall be hardwired to a terminal strip to be individually wired to the campus-wide Electric Metering system.

E. Each breaker shall have a corresponding electric meter. See section K.24 for meter details. Each meter shall be individually wired to the campus-wide Electric Metering system via cat5E Ethernet cable.

F. The preferred manufacturers for medium voltage switchgear are Eaton, Square D, Siemens, and ABB.

G. All protective relays shall be independently powered from an external normal/emergency circuit and a UPS. UPS status shall be hardwired back to the campus-wide Electric Metering system. Relays shall be Square D Sepam or equal from ABB, Eaton or Siemens.

K.22 TRANSFORMERS

A. Transformers shall be mounted on isolators to minimize transmission of vibration noise to the building structure.

B. All indoor transformers with a medium-voltage primary shall be dry type, unless there is a space constraint that would dictate a smaller footprint with an oil-filled transformer. All outdoor transformers with a medium-voltage primary shall be oil-filled.

C. All oil-filled transformers shall be FM Approved Code Listed and Labeled, designed in accordance with the requirements of ANSI/IEEE C57.12.00 and labeled by Factory Mutual Research Corporation as meeting the requirements of FMRC Approval Standard Class 3990, insulated with FM Approved less-flammable fluid all in compliance with NEC Sections 110-3 and 450-23, and shall be as follows:

1. Liquid-filled type design
2. Temperature rise of 65 degrees C
3. Primary insulation of 60kV BIL
4. Secondary insulation of 30kV BIL
5. Copper windings
6. Self cooled, KNAN/Future KNAF
7. Bussed connection to low voltage switchboard where applicable
8. Distribution class lightning arresters
9. Temperature sensors on windings with external alarms tied to the campus BAS
10. Containment pan sized and provided by the manufacturer for indoor transformers. Containment pans cannot be more that 12" from the base surface of the transformer.
11. Pressure sensors with an external alarm tied into the campus BAS.

D. The dielectric coolant shall be a listed less-flammable fluid meeting the requirements of NEC 450-23 and the requirements of IEEE C2-1997, Section 15. The fluid shall be non-toxic, non-bioaccumulating, and be readily and completely biodegradable per EPA OPPTS 835.3100. It shall be comprised of edible oils and food grade performance enhancing additives. It shall not require oils derived from genetically altered seeds. It shall be FM Approved and UL Classified, Envirotemp FR3 or University-approved equal. It shall have a minimum open cup flash point of $\geq$ 325^{o}C and a fire point of $\geq$ 350^{o}C per ASTM D92.

E. Dry-type transformers shall be ventilated dry type design and shall be as follows:

1. Ventilated dry type design
2. Insulation temperature of 220 degrees C
3. Temperature rise of 80 degrees C
4. Primary insulation of 60kV BIL for 4160V and 10kV for 480V or 208V
5. Secondary insulation of 10kV BIL
6. Copper windings
7. Self cooled, AA/FFA
8. Bussed connection to low voltage switchboard where applicable
9. Distribution class lightning arresters
10. Temperature sensors on windings with external alarms.

F. Outdoor transformers may be installed only as approved by the University's Senior Electrical Engineer.

G. Transformers shall be furnished with full capacity high-voltage taps. The taps shall be 2 - 2½% above and below nominal voltage.

H. Fan-assisted convection cooling (NEMA AFA) to achieve base ratings such as that used by GE TransforMore transformers shall not be used.

K.23 INSTALLATION

All floor-mounted equipment shall be installed on housekeeping pads unless otherwise directed by the University's Senior Electrical Engineer.

K.24 SERVICE, DISCONNECT, METERING

A. Generally, electrical distribution systems shall be 480Y/277 volt, 3 phase, 4 wire for lighting and mechanical loads and a 208Y/120 V, 3-phase, 4-wire for small power loads.

B. The Main Distribution Panel (MDP) shall have a power meter that monitors current, voltage, power, energy, frequency, power factor, current and voltage harmonics, and total harmonic distortion. The MDP meters shall be Square D Powerlogic or equal by Siemens or Eaton, compatible with the campus-wide Electric Metering system and as approved by the University's Senior Electrical Engineer. Each meter shall be individually connected to the campus-wide Electric Metering System via an Ethernet cable. UPS control power shall be provided to all meters on main switchgear/switchboards and shall be fed from an external normal/emergency circuit. A status point from the UPS shall be hardwired to the campus-wide Electric Metering system. Each meter shall have separate shorting blocks for the CT inputs and disconnects for the PT or voltage inputs. Meter types shall be as follows:

1. Utility Mains
   (a) Sq D PowerLogic CM-4000T
   (b) Eaton Power Xpert PXM8000
   (c) Siemens 9610.

2. Building Mains
   (a) Sq D PowerLogic PM-8240
   (b) Eaton Power Xpert PXM4000
   (c) Siemens 9360.

3. All Other Applications
   (a) Sq D PowerLogic PM-5560
   (b) Eaton Power Xpert PXM2260
   (c) Siemens 9340.

C. The MDPs shall contain a main circuit breaker and the required branch feeder breakers. Space for future 25% minimum load growth shall be included in all MDPs. The main circuit breaker shall have ground-fault protection only where required by NEC. The main ground-fault protection shall be set at the maximum pickup and time-delay settings permitted by NEC. When main ground-fault protection is required, all feeder breakers shall have ground-fault protection set for proper selective overcurrent protection coordination.

D. 1600 amperes or greater circuit breaker frame sizes shall be of the metal-enclosed, draw out, low-voltage power circuit breaker type designed to ANSI C37.13, C37.16, and C37.17 and shall incorporate electronic trip units with functions as determined by the coordination study and as required by NEC with cause of trip indicator targets.

E. The main circuit breaker fed from a transformer shall have a separation barrier to protect the rest of the gear from arc flash concerns.

F. The Professional shall submit load calculations for MDPs with demand and diversity factors. All calculations shall be as according to NEC guidelines.

G. The preferred manufacturers for low-voltage switchgear, switchboards, panelboards, busway, transformers, and disconnect switches are Eaton, Square D, and Siemens.

H. All panelboards, disconnect switches, motor starters, and transformers shall be labeled indicating source of power, voltage, and load.

I. For buildings with direct utility company service, power factor shall be targeted for .95 lagging average minimum without going leading and shall be accomplished with central static or distributed static PF correction capacitors. A harmonic resonance calculation shall be performed and mitigating measures shall be taken if required.

K.25 FEEDER CIRCUIT/BRANCH CIRCUITS

A. Low-voltage distribution overcurrent protection devices shall be molded case circuit breakers. 400 amperes and larger frame sizes shall incorporate electronic trip units with functions as determined by the coordination study and as required by NEC with cause-of trip indicator targets. Electronic trip units shall only be used on smaller frame sizes where indicated by the coordination study for proper selectivity. All trip functions shall be adjustable from the face of the breaker. Trip units that require an external device to program or change are not acceptable.

B. Circuit breakers shall be fully rated; series rating circuit breakers is not permitted.

C. Branch circuit wiring shall include the home run number. When a renovation is occurring, all wire that is over 25 years old shall be replaced unless otherwise approved by the University's Senior Electrical Engineer.

D. Each branch circuit shall have a separate neutral.

E. A separate ground wire shall be provided for every A, B, C phase configuration.

F. Branch/feeder arc-fault circuit interrupters (AFCI), combination type, shall be provided to protect all 120V branch circuits supplying outlets installed in dwelling units except those required to be protected by GFCI.

K.26 MOTORS AND MOTOR CONTROLS

A. Motors 1 through 500 HP shall be NEMA premium efficiency type. Refer to mechanical standards for details.

B. If 480V is available in the building, all motors and mechanical equipment shall be fed from the 480V distribution system.

C. Fused switches shall not be utilized for motor overcurrent protection. Instead, circuit breaker combination type motor starters shall be used for motors up to 40 HP (magnetic-only motor circuit protectors on motors 10 HP and above). Motors over 40 HP shall utilize magnetic reduced-voltage autotransformer type starters. All combination motor starters shall include

hand/off/auto selector switches. Start/stop momentary pushbuttons shall not be used. Refer to mechanical standards for details.

D. Variable frequency drives (VFDs) shall be used for all fan and pump applications. Refer to mechanical standards for details.

K.27 SOUND PRESSURE LEVELS

The sound pressure levels in electrical equipment rooms (motors, elevators, transformers, etc.) in the equipment spaces shall not exceed 85 DBA on the A scale at any point three (3) feet from the equipment, with all equipment in the room operating in the range of each piece of equipment.

K.28 SURGE SUPPRESSION

A. Provide a UL 1449 3rd Edition, latest revision, “Master Plan” surge-protective and filter system for the protection of AC electrical circuits and equipment from the effects of lightning induced currents, substation switching transients, and internally generated transients resulting from inductive and/or capacitive load switching and other electronic equipment.

B. The surge suppression system shall be comprised of distribution class arresters at the utility equipment; an ANSI/IEEE C62.41 Category "C" surge-protective device (SPD) at the building service entrance; ANSI/IEEE C62.41 Category "B" SPD's at critical distribution panels serving sensitive electronic equipment including computer labs, laboratory instrumentation, and optional standby systems; and ANSI/IEEE C62.41 Category "A" SPD receptacles in telecommunications MDF and IDF rooms and in areas as directed by the University’s Project Manager.

C. All SPD devices shall be integral to the switchgear, switchboards, and panelboards to which they are connected.

D. Distribution Class Arresters.

1. Equipment shall comply with ANSI/IEEE C62.11, metal oxide varistor distribution surge arrester requirements.

2. Equipment shall employ metal oxide varistor technology, mounted in polymer housing. Equipment shall be rated 6kV on a 4.16kV distribution system and 15kV on 12.47kV. Equipment shall provide line-to-ground protection. Equipment shall be Cooper Power Systems VariSTAR or University approved equal.

3. Equipment for pad mounted applications shall employ metal oxide varistor technology mounted in pre-molded rubber elbows. Equipment shall be rated 6kV on 4.16kV distribution system and 15kV on 12.47kV. Equipment shall provide line-to-ground protection. Equipment shall be Cooper Power Systems M.O.V.E. Elbow or University-approved equal.

4. Preferred manufacturers are Cooper Power Systems and McGraw-Edison.

E. Category "C" SPD

1. Equipment shall comply with ANSI/IEEE C62.41 (IEEE 587), Category "C" requirements, tested to ANSI C62.45, listed to UL 1449 Second Edition, latest revision, and bear the UL label.

2. Preferred manufacturers are Eaton, Square D, and Siemens.

F. Category "B" SPD

1. Equipment shall comply with ANSI/IEEE C62.41 (IEEE 587), Category "B" requirements, tested to ANSI C62.45, listed to UL 1449 Second Edition, and bear the UL label.

2. Preferred manufacturers are Eaton, Square D, and Siemens.

G. Category "A" SPD

1. Equipment shall comply with ANSI/IEEE C62.41 (IEEE 587), Category "A" requirements, tested to ANSI C62.45, listed to UL 1449 Second Edition, and bear the UL label.

2. Equipment shall be duplex type receptacle, NEMA 5-20R, and shall protect against line-to-line, line-to-neutral, line-to-ground, and neutral-to-ground voltage transients. Receptacles shall have a minimum of two, 130V, 20mm metal oxide varistors (MOV), visible and audible surge status indicators, thermoplastic base, and ivory face. Devices shall not be used to provide "down-stream" protection of other receptacles.

3. Preferred manufacturers are Hubbell, Pass and Seymour, and Leviton.

K.29 LIGHTNING PROTECTION SYSTEMS

A. Provide lightning protection system for the protection of University structures from direct lightning strikes.

B. This is an optional system that should be evaluated for inclusion in new construction projects. Evaluation shall be made in accordance with guidelines set forth in NFPA 780, Lightning Protection systems, Appendix H, Risk Assessment Guide. Submit copies of the evaluation for review by the Senior Electrical Engineer.

C. The lightning protection system shall be comprised of air terminals, conductors, ground terminals, counterpoised ground conductor, interconnecting conductors, arresters and other connectors or fittings required to complete the system. All conductors shall be tinned, stranded copper. The lightning protection ground components shall be connected to the electrical service ground. System design shall be in accordance with NFPA 70, National Electrical Code, NFPA 780, Lightning Protection Systems and the LPI-175, Lightning Protection Institute, Standard of Practice. The system shall be LPI certified.

K.30 OAKLAND CAMPUS - OUTDOOR LIGHTING STANDARDS

A. Exterior Fixtures shall comply with the Title 24, Part 6; Dark Skies Requirements.

B. Traditional pole foundations shall be 48” to 60” deep, 20” diameter with a 1” chamfered edge. Bollards shall be 36” to 48” deep, 20” diameter with a 1” chamfered edge.

TYPE SA-H Site lighting within Historical District shall be a horizontal 150-watt pulse-start, clear metal halide, ED 17 bulb, medium base, pole-mounted traditional luminaires with house shields, photocells, and fuses as manufactured by Lumec or Heritage Casting and Ironworks (HCI) as follows:

Lumec (LMS7052x) – Horizontal Lamp
Luminaire Cat # L60-150MH-GLBG-C-SGFM-QTA/208-HE-SF60-PH7-BKTX-LMS7052x
Pole Cat # R80-11.5-FS2-TBC1-BKTX-LMS7052x
Banner Arms Cat # BAS24(2)-BKTX

Heritage Castings & Ironworks – Horizontal Lamp
Luminaire Cat # F146L-CTG-SR5-150PMH-208QT-PCB-RAL9011 TXT
Pole Cat # P440-BC-RAL9011 TXT
Banner Arms Cat # BA1-CMx2-RAL9011 TXT

TYPE SB-L Bollards within Historical District shall be 50-watt pulse-start, clear metal halide, ED 17 bulb, medium base, as manufactured by Lumec or Heritage Casting and Ironworks (HCI) as follows:

Lumec (LMS7052x)
Type A: BOR80-50MH-GL-O-120-BCH2-TBC1-BKTX
Type B: BOR80-50MH-GL-O-120-TBC1-BKTX

HCI
Type A: B833-L2-CPC-50MH-120V-___-EB2-RAL9011 TXT
Type B: B833-L2-CPC-50MH-120V-___-RAL9011 TXT

TYPE SB-NL Bollards within Historical District non-lighted as manufactured by Lumec or Heritage Casting and Ironworks (HCI) as follows:

Lumec (LMS7052x)
Type C: BOR80-DSH-BCH2-TBC1-BKTX
Type D: BOR80-DSH-TBC1-BKTX

HCI
Type C: B633-B-EB2-RAL9011 TXT
Type D: B633-B-RAL9011 TXT

C. LED replacements should be evaluated for replacements in existing luminaires, provided by Lumec or Heritage Castings and Ironworks. All new outdoor lighting shall be LED.

D. In-ground lighting is not acceptable for any application.

K.31 BRADFORD/TITUSVILLE CAMPUSES - OUTDOOR LIGHTING STANDARDS

A. Walkway Lighting

1. Luminaire Cat # Lithonia KAD-LED 40C 700 40K R3 277 RPUMBAK__04 HS DDBXD
2. Pole Cat # SSA12D4-4R00-BM

B. Parking/Roadway Lighting

1. Luminaire Cat # KAD-320-R4-TB-SPD04-SCWA-DF-LPI DARK BRONZE

2. Pole Cat # SSA20__-4R00-BM or SSA16__-4R00-BM (depending on photometrics).
3. SSA25__-4R00-BM (for the main road).
4. Minimum of 1fc from curb-to-curb.

C. In-ground lighting is not acceptable for any application.

K.32 GREENSBURG CAMPUS - OUTDOOR LIGHTING STANDARDS

A. Walkway Lighting

1. Luminaire: Cooper McGraw-Edison GSM-AM-150-MP-MT-3F-FG-BZ, 150-watt pulse start Metal Halide.
2. Pole: Cooper SSA4T12WFM1, straight aluminum, 12 foot height, 4” square shaft, standard grounding lug and dark bronze polyester powder coat finish machined for one CA40 direct arm.
3. Mounting Bracket: MA1006-BZ

B. Parking/Roadway Lighting

1. Luminaire: Cooper McGraw-Edison GSM-AM-320-MP-MT-3F-FG-BZ, 320-watt pulse start Metal Halide.
2. Pole: Copper SSA5T25WFM1, straight aluminum, 25 foot heights, 5” square shaft, standard grounding lug and dark bronze polyester powder coat finish machined for one CA40 direct arm.

C. In-ground lighting is not acceptable for any application.

K.33 JOHNSTOWN CAMPUS - OUTDOOR LIGHTING STANDARDS

A. Walkway Lighting

1. Luminaire: Eaton Streetworks MPW-AC-LED-E-U-SYM-BZ
2. Pole: Valmont 0908-30504TPP2-SBF

B. In-ground lighting is not acceptable for any application.

K.34 LAMPS

A. Incandescent lighting shall not be used unless there is a specific programmatic need; e.g., research. Any applications shall be reviewed and approved by the University’s Senior Electrical Engineer. All incandescent lamps shall be of the energy savings type, rated for 130V.

B. The Professional shall consider maintenance items such as lamp life, lumen deprecation, existing lamp types, accumulation of dirt on lens, lower reflectances of ceiling and walls. Consideration should be given to ease of lamp replacement and overheating of ballasts caused by poor ballast location.

C. Linear fluorescent luminaires shall include a highly visible label within the housing reading “T8 Lamps Only.”

	General Electric	Philips	Osram/Sylvania
4 foot	# 73095 F32T8/SXL/SPX41/ECO	# 43406-8 F32T8/TL841/2XL/ALTO	# 21577 FO32/841/XP/XL/ECO3
3 foot	# 15491 F25T8/XL/SPX41/ECO	# 20495-8 F25T8/ADV841/ALTO	# 22155 FO25/841/XPS/ECO
2 foot	# 15484 F17T8/XL/SPX41/ECO	# 20485-9 F17T8/ADV841/ALTO	# 22152 FO17/841/XPS/ECO

D. Metal Halide and high pressure sodium luminaires shall not be used in any application.

E. Exit signs shall use LED lamps, not exceeding 3 watts total per luminaire. Edge-lit LED exit signs and self-contained exit signs powered by a radioactive source shall not be used.

F. All similar lamp types shall be obtained through one source from a single manufacturer.

G. Architectural accent lighting shall be minimized and shall only be used where approved by the University's Senior Electrical Engineer. All accent lighting shall use LED lamps.

H. Approved lamp manufacturers are General Electric, Philips or Osram/Sylvania.

I. All fluorescent lamps shall have a minimum color rendering index (CRI) of 82 and shall have the longest commercially available life.

J. 26W Triple Biax Compact Fluorescent lamps are prohibited. Utilize the 32W Triple Biax or a 26W Double Biax if necessary.

K.35 BALLASTS AND DRIVERS

A. All fluorescent lighting shall utilize high-efficiency, programmed rapid start, and parallel wired, electronic, universal-voltage (120-277V) ballasts with less than 10% total harmonic distortion. Ballast factor shall be selected to match the application to better minimize energy use by "tuning" the lighting levels in the space.

B. Luminaires that utilize double-ended lamps and contain ballast(s) that can be serviced in place shall have a disconnecting means that satisfies the requirements of NEC Article 410.

C. Approved fluorescent ballast manufacturers are General Electric, Advance, Universal or Osram/Sylvania.

D. The driver or power supply for the luminaire shall be modular and replaceable.

E. The rated life of the driver shall match the rated life of the LEDs and luminaire.

F. In general, the drive current rating of the driver shall be minimized, while still maintaining the required lumen output, to improve luminaire efficiency and life.

G. The driver shall meet the emission standards of IEC EN-61000-6-3 at a minimum. For healthcare and other applications with EMI sensitive equipment, provide drivers that meet more stringent standards as required.

H. The LED luminaire shall have a power factor of 0.90% or greater at all standard operating

voltages.

I. The Total Harmonic Distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 20% at any standard input voltage for an LED Luminaire. The LED luminaire shall comply with ANSI C82.11, or equivalent ANSI LED Standard.

J. The LED Luminaire shall include surge protection to withstand high repetition noise and other interference:
   1. The surge protection which may reside within the driver shall protect the luminaire from damage and failure for transient voltages and currents as defined in ANSI/IEEE C64.41 for Location Category A-Low where failure does not mean a momentary loss of light during the transient event.
   2. Surge protection performance shall be tested per the procedures in ANSI/IEEE C62.45 based on ANSI/IEEE C62.41 definitions for standard and optional waveforms for Location Category A-Low.

K.36 LIGHTING CONTROLS

A. All outdoor lighting shall be controlled by photocells. Photocells shall be placed to provide the optimum “turn on time” for security consideration. One (1) photocell shall be provided for each luminaire and each luminaire shall be individually fused. All photocells shall fail “ON”.

B. Multi-levels of switching shall be provided, as necessary in computer room, classroom and conference room applications.

C. Acceptable manufacturers of lighting controls shall be Sensorswitch, Wattstopper, and Cooper-Greengate.

D. All restrooms, mechanical room, pass through spaces and hallway lighting, including emergency egress lighting, shall be controlled with occupancy sensors or timeclocks. All classrooms, offices, utility spaces and conference rooms shall be controlled with vacancy sensors. (Timeclocks shall be used only with approval from the University’s Senior Electrical Engineer.) Adjustable timer switches, with flicker warning, may be used in mechanical rooms where air or equipment movement or obstructions make occupancy sensors impractical. Any renovation work that addresses any of these areas shall install automatic control. Main electrical vault lighting shall be on the normal/emergency system and shall be controlled manually.

E. The Professional shall provide a control matrix on the drawings for all of the lighting control setups.

F. Occupancy/Vacancy Sensor coverages shall be shown on a floor plan and submitted for review by the University Electrical Engineers. Occupancy/Vacancy Sensors shall be placed appropriately to eliminate false ons and be suitable for the application or space. Occupancy/Vacancy Sensors shall be ceiling mounted or wall mounted as a wall switch combination device. Occupancy/Vacancy Sensor should not have a pivot-able mounting bracket.

G. Emergency egress lighting controls shall include automatic bypass devices that turn lights on automatically upon loss of normal power. Automatic bypass devices shall be UL-listed for this purpose and shall be Bodine GTD Generator Transfer Devices, Wattstopper ELCU, or University-approved equal. Battery type emergency luminaires and exit signs shall not be used except where required by code; e.g., in emergency genset rooms.

H. Single fluorescent ballast dimming is not permitted. Dimming, where required by codes or special applications as approved by the University's Senior Electrical Engineer, shall be by dimmable LED Drivers using 0-10V control. Dimming can also be achieved by switching multiple fluorescent ballasts.

I. Include setup (i.e. sensitivity settings, delay settings, etc.), commissioning and startup of all lighting controls in the specifications.

J. Dimming: where dimming is specified, the luminaire shall be capable of continuous dimming without perceivable flicker over the range of 100% to 5% of rated lumen output. Dimming shall be controlled by a 0-10V signal, unless otherwise noted or specified.
   1. Dimming switches and other control system components shall be compatible with the LED driver type – constant current reduction (CCR) or pulse-width modulation (PWM). The device(s) shall be rated to accommodate full load, as well as inrush current and repetitive peak currents.
   2. The Luminaire and dimming controls shall produce a smooth change in lumen output, without any visible flicker.
   3. The luminaire shall be capable of dimming without any visible change in CCT and color rendition.

K. Lumen Output and Performance:
   1. The luminaire shall maintain the lumen output specified on the lighting fixture schedule and drawings, or that of the basis of design luminaire if no minimum lumen output is specifically listed.
   2. The lumen output shall be maintained regardless of ambient temperature fluctuations, within the rated temperature range. The luminaire data sheets shall specify any effect or variation on lumen output from temperature.
   3. The luminaire shall be capable of continuously monitoring system performance to allow for constant lumen management/compensation, if specified in lighting fixture schedule, drawings or basis of design luminaire.
   4. The luminaire shall provide a total system efficacy that meets or exceeds that of the basis of design luminaire listed on the light fixture schedule and drawings.

K.37 OPTICS

A. Prismatic shielding in fluorescent troffers shall be 0.125" minimum thickness, Pattern #12, lens.

B. Parabolic louvers shall not be used.

C. Direct/indirect luminaires shall only be used in special applications with the approval of the Senior Electrical Engineer. Direct/indirect optics shall be 80% down light minimum.

D. Volumetric luminaires shall have a full door (hinged); physical baskets are not permitted.

E. All luminaires shall be painted after fabrication.

F. Luminaires shall not utilize snap in lenses.

G. The optical assembly of the LED luminaire shall be constructed so that individual LED images shall not be visible to the occupant.

K.38 LUMINAIRES AND MANUFACTURERS

A. Every luminaire, ballast, lamp, and occupancy sensor type shall have three manufacturers and model numbers, each from a different manufacturer's representative, specified. The luminaire line for each manufacturer's representative used shall include every luminaire type specified. Preferred manufacturer's representatives are as follows:

1. Architectural Lighting Sales, Inc
2. Gormley Farrington, Inc
3. LaFace & McGovern Associates
4. Paolicelli Associates – One Source
5. Repco II

B. Proprietary luminaires, lamps, ballasts and occupancy/vacancy sensors are not acceptable unless approved by the University's Senior Electrical Engineer.

C. All metal parts to be chemically treated with a rust resistant phosphatized solution, internal components and reflecting surfaces to have a factor of minimum 90%.

D. Provide luminaires, completely factory-assembled and wired and equipped with necessary light sources, drivers, wiring, shielding, reflectors, channels, lenses, etc., and deliver to the job ready for installation.

E. Fluorescent and LED luminaires shall have a hinged frame, either via a piano style or die-formed steel T-hinges along with two positive cam latches.

F. Provide a minimum of two support points for all surface, pendant or recessed mounted luminaires. The supports shall be tied to the building structural system. The support points shall be totally independent of the ceiling system.

K.39 LED LUMINAIRES

A. Each Luminaire shall consist of an assembly that utilizes LEDs as the light source, in addition, a complete Luminaire shall consist of a housing, LED array, and an electronic driver (power supply). Components such as the LED array and driver shall be modular and replaceable without removing the Luminaire.

B. All LED luminaires shall have a CRI of at least 80, an estimated life of at least 50,000 hours at 70% lumen maintenance (L70), and shall include a minimum 5-year warranty on the entire luminaire including the driver. The luminaire and LEDs shall have been tested in accordance with LM-79 and LM-80.

a. The manufacturer shall provide a warranty against loss of performance and defects in materials, finishes, and workmanship for the Luminaires and all components for a minimum of 5 years after acceptance of the Luminaires. Replacement Luminaires shall be provided promptly after receipt of Luminaires that have failed at no cost to the University. All warranty documentation shall be provided to the University prior to random sample testing.

b. Failure of the LED light source shall be defined as failure of negligible output of 10% or more individual LEDs within the LED array, bar, etc.

C. The individual LEDs shall be connected such that a failure of one LED will not result in the loss of the entire luminaire.

D. Each luminaire shall be listed with a nationally recognized testing laboratory (including but

not limited to UL, CSA, ETL) under UL1598, and UL 8750, or an equivalent standard from a recognized testing laboratory.

E. The LEDs shall be manufactured by Cree, Philips, Toshiba, Osram, Samsung, General Electric or Nichia, unless otherwise noted.

F. Electrical connections between normal power, driver and LED boards must be modular utilizing a snap fit connector. All electrical components must be easily accessible after installation from the room side and all electrical components must be able to be replaced without removing the fixture from the ceiling.

G. Each luminaire shall have the manufacturer's name, trademark, model number, serial number, date of manufacturer (month-year), and lot number as identification permanently marked inside each unit and the outside of each packaging box.

H. The following operating characteristics shall be permanently marked inside each unit: rated voltage and rated power in watts and volt-amperes.

I. Before any customer design qualification testing is performed, the sample luminaires shall be energized for a minimum of 24 hours, at 100% on-time duty cycle, at a temperature of +70*F (+21*C).

K.40 QUALITY OF ILLUMINATION

A.

Area	Recommend Average Maintained Foot-Candle Horizontal	Vertical
Conference Rooms/ Offices		
a. Meetings	30	5
b. Video Conferences	50	30
Lobbies, Lounges, Locker-Rooms	10	3
Service Areas, Stairways, Corridors, Storerooms	5	3
Library Stacks	30 @ 30"A.F.F.	
a. Study Carrels	30	
b. Card Files	30	
Laboratory (Science)	70	
Classrooms and lecture halls		
a. Demonstration	100	
b. Art Rooms	50	
c. General		
I. White Boards		5
II. Chalk Boards		50
d. Corridors	5	10
Offices/Classrooms		
a. Intensive VDT	30	5
b. Intermittent VDT	50	5
Computer rooms & drafting rooms	30	10

(VDT terminals)	3	3
Drafting rooms (patch based tasks)	50	30
Mechanical, electrical rooms	20	
Covered parking facilities	5 (min. @5'-0" AFF)	
Walkways	2 (minimum)	

B. Visual comfort probability (VCP) in offices/classrooms shall be 80 or greater.

C. In offices and classrooms the maximum to minimum ratio shall never be greater than two to one.

D. Maximum Luminance Ratios for Offices Containing VDT's*:

1.	Between paper-based visual tasks and an adjacent VDT screen	3 to 1
2.	Between a visual task (paper or VDT) and adjacent dark surroundings	3 to 1
3.	Between a visual task (paper or VDT) and adjacent light surroundings	1 to 3
4.	Between a visual task (paper or VDT) and more remote dark surfaces	10 to 1
5.	Between a visual task (paper or VDT) and more remote lighter surfaces	1 to 10

*The luminance of the VDT is taken as the average luminance of a character-filled screen.

E. Recommended Preferred and Maximum Average Luminance for Luminaires Used in the Direct Lighting of a VDT Environment.

Angle From: Vertical(deg)	Preferred	Maximum
55	850	---
65	350	850
75	175	350
85	175	175

F. Luminance is measured along the lengthwise, crosswise and 45 degree horizontal planes. All tables and criteria in this standard are reprinted from the IESNA Lighting Handbook, 10th Edition.

K.41 FIRE ALARM SYSTEM

A. The Professional shall provide progress and final drawings to the University's Project Manager for review of fire alarm systems for the University Buildings. The University's Insurance Carrier will review the design and provide written comments for further consideration in the final design document.

B. All renovation projects that require the removal or relocating of fire alarm devices shall replace the smoke detectors (if any) within the scope of work. New smoke detectors shall match existing systems.

C. Fire alarm systems shall be designed in accordance with NFPA 72, Standard for the Installation, Maintenance, and Use of Fire Protective Signaling Systems; NFPA 72-E, Standard on Automatic Fire Detector; NFPA 72-G; Guide for the Installation, Maintenance and Use of Notification Appliances for Protective Signaling Systems, IBC,

IFC, ADA and all local codes.

D. The fire alarm system shall be an addressable type with individual address for each initiating device.

E. The fire alarm systems shall be connected to normal/emergency power. Battery backup shall be provided in the fire alarm control panel in accordance with the NFPA.

F. Minimum wire size for the fire alarm system strobes shall be # 14 AWG, type THHN. Data and speaker cable shall be per the manufacturer's recommendation. A separate ground conductor shall be installed in all conduits. All conductors shall be solid.

G. A consistent color code shall be used for the fire alarm system conductors throughout the installation. When tying into existing systems, the existing color code shall be matched.

H. The control panel shall contain trouble, supervision, and alarm contacts that are input into the Campus-wide Building Management and Security Systems.

I. Control panels shall be of modular design for ease of expansion and contain built-in surge suppressors.

J. Manual pull stations shall not have a glass rod or glass plate which must be broken to activate the system.

K. An annunciator panel shall be installed in a public area acceptable with local authorities so that a visual indication of the activated zone can be easily identified.

L. Audio/visual notification appliances shall consist of a speaker and xenon strobe suitable for mounting in a 4” square back box. In the finished areas, where surface mount devices are necessary, a factory-finished back box shall be used.

M. The control panel shall contain contacts to tie into monitoring systems as follows:

1. Oakland Campus: Guardian Remote Supervising Station using the following DACT components:

    a. (1) Bosch Radionics D7412G Panel, Version 2 (or newer)
    b. (1) Bosch D8109 Fire Enclosure (16” x 16” x 3.5”)
    c. (1) Bosch D8004 Transformer Enclosure (20A 125V Red Duplex req.)
    d. (1) Radionics D928 Dual Phone Line Switcher
    e. (1) Teleular Teleguard Digital TG-7 Radio
    f. (2) Amseco XT-1640 Transformers
    g. (3) 12CE75 Batteries (Powersonic PS-1270, Rechargeable Sealed Lead-Acid)
    h. (1) Battery Harness.

2. Bradford Campus: Simplex Monitoring System located in the campus police station.

3. Greensburg Campus: The monitoring system located in McKenna Hall as well as Integrated Systems, Inc., West Mifflin, PA.

4. Johnstown Campus: The Honeywell monitoring system located in Biddle Hall.

5. Titusville Campus: The monitoring company is Unicom Protection Company.

The system shall transmit alarm, supervision, and trouble conditions to the monitoring station as required by Codes.

N. A certificate of compliance shall be competed for each system in accordance with NFPA 72.

O. The contractor shall test each device in a fire alarm system and document said test in a printout showing compliance with specifications and that each device has been tested. This document shall be provided with the Operation and Maintenance Manual.

P. The fire alarm drawings shall graphically depict the fire alarm zones. All devices shall have their addresses shown on the drawings and clearly marked on the devices in the field.

Q. The fire alarm supplier shall update their construction drawings to reflect the installed conditions (these are NOT the drawings supplied by the professional). These updated drawings shall be part of the Operation & Maintenance Manual supplied for the fire alarm system.

R. Strobe lights shall be provided in spaces as required by the Americans with Disabilities Act Guidelines.

S. As there are many different complexities of occupancies on campus, the styles of initiating device circuits and notifying device circuits shall be recommended by the Professional.

T. Voice alarm systems shall be used (regional campuses may use tone alarm systems at their Facilities Management Department's discretion where not required by code). The Professional shall delineate the speaker placement and wiring requirements to assure correct annunciation of an alarm signal to the affected zone(s). Where horizontal zoning is used, speakers shall be appropriately zoned to allow distribution of multiple messages. Stairwells shall not be included in horizontal zoning, but instead, shall only alarm for "all-building" alarms; e.g., main flow switch. Fire pump running shall not be used as an alarm signal but rather as a trouble signal.

U. For the Oakland Campus, the following mass notification system shall be used.

1. Two intelligent addressable modules (IAMs) shall be provided for inputs from the security system: one for emergency evacuation and one for security lockdown.
2. The emergency evacuation message shall be as follows: TONE 900Hz (Siemens) or 1000Hz (Simplex), two pulses per second with strobe light activation followed by audible message. Runs until manually reset or silenced locally: "May I have your attention please. A security alert has been reported. Please leave the building by the nearest exit. Do not use the elevators."
3. The security lockdown message shall be as follows: CHIME with temporary strobe light activation followed by audible message repeated for 30 seconds (to complete three full loops); then again every hour until manually reset. Audible and strobes will stop after each 30 second notification until repeated: "May I have your attention please. A security emergency has been reported. Remain in the building. Stand by for further instructions."

4. All notification device coverplates shall be blank; i.e., the word “fire” shall not appear.

V. The Professional shall use a computer-based design program or acoustic measurements combined with the knowledge of the specified speakers’ performance characteristics, using mathematical formulas developed for the purpose, to design the audio/visual notification appliance layout.

W. A fire alarm central command station shall be provided for high-rise buildings in accordance with the IFC and NFPA 72. Locating central command station in the lobby requires approval of the authority having jurisdiction.

X. Smoke and heat detection systems (including duct detectors to shut down fans) shall only be used where required by codes. If required, smoke detectors shall be photoelectric type with alarm verification. When required by codes, smoke detectors shall be used in public areas and heat detectors shall be used in areas such as mechanical rooms, kitchens, and storage rooms where dust or smoke can be present under normal working conditions. Combination smoke/heat detectors shall not be used. The Professional shall include smoke and heat detector coverage circles or other spacing criteria on the plans to demonstrate complete coverage. If duct detectors are required, provide remote indication in a location close to the detector and visible from floor.

Y. Fire alarm systems shall include elevator recall even where the elevator controllers in existing buildings do not have recall capabilities. In that case, provisions shall be made to connect the fire alarm recall to a future upgraded elevator controller.

Z. The Professional shall include a sequence of operations presented on the drawings as an input/output matrix per NFPA 72, Annex A.

AA. Fire alarm systems shall be Pyrotronics, Simplex, or Edwards. Fire alarm system vendors who materially participate in the fire alarm system design shall not be eligible to bid on the construction contract.

BB. The University Office of Risk Management, Environmental Health and Safety, and FM Global, the University’s insurance carrier, will review and comment on all fire alarm progress design documents and shop drawings. The University Project Manager will direct the Professional as to the incorporation of these comments.

CC. Tamper and Flow switches shall each have their own individually addressable modules.

DD. A fire prevention plan shall be included as part of the construction documents for review as required in Division B. The project-specific plan is to be developed by the Contractor/Construction Manager.

EE. Perform a radio coverage study as part of the design process to determine if City of Pittsburgh Fire Department Radios have proper coverage in a building. Incorporate a radio signal boosting system if necessary. The following are the frequencies that need to be provided:

Channel	RX	PL	TX	PL	
PGH POL 1	453.1000	186.2	458.1000	186.2	25.0 kHz
PGH POL 2	453.2500	186.2	458.2500	186.2	25.0 kHz

PGH POL 3	453.4000	186.2	458.4000	186.2	25.0 kHz
PGH FIR 1	453.7000	186.2	458.7000	186.2	25.0 kHz
PGH FIR 2	453.8500	186.2	458.8500	186.2	25.0 kHz
PGH OPS	453.4500	186.2	458.4500	186.2	25.0 kHz
PGH ADMIN	453.9500	186.2	458.9500	186.2	25.0 kHz
PGH EMS 1	462.9500	100.0	467.9500	100.0	25.0 kHz
PGH EMS 2	462.9750	100.0	467.9750	100.0	25.0 kHz
PEMA 6 ALLE	453.5250	210.7	458.5250	210.7	25.0 kHz
PGH INC CMD	453.4125	203.5	458.4125	203.5	12.5 kHz
AC REGIONAL	471.1375	156.7	474.1375	156.7	25.0 kHz
UNIV PGH POL	453.1500	103.5	458.1500	103.5	25.0 kHz

K.42 SECURITY SYSTEM

A. The Professional, under the guidance of the University's Project Manager, shall coordinate all security systems with the University of Pittsburgh Police Department Integrated Security Division.

B. Door lock releases shall be tied into fire alarm systems as required by codes.

K.43 TELEDATA SYSTEM

The Professional, under the guidance of the University's Project Manager, shall coordinate teledata systems with the University Computing Services and System Development Division (refer to Division L CSSD Specifications).

K.44 INSTRUCTIONAL EQUIPMENT

The Professional, under the guidance of the University's Project Manager, shall coordinate the power, control, and lighting requirements for instructional equipment with the University Center for Teaching and Learning (Teaching Center). Instructional equipment includes but is not limited to the following: projection, reproduction, imaging, sound, photography, film, and television.

K.45 ELECTRICAL ACCEPTANCE TESTING

A. Field acceptance testing shall be performed according to recommendations of the InterNational Electrical Testing Association (NETA), NEMA, ANSI, IEEE, and the manufacturer's instructions. The acceptance testing shall include verification of electrical and mechanical integrity as well as functional performance.

B. The following systems and equipment shall be included as a minimum in the testing program:

1. All medium-voltage (over 600V) electrical equipment, including cable systems and motors.

2. Main electrical service switchboard or switchgear.

3. Grounding system.

4. Emergency and optional standby systems (gensets and ATSs).

5. Fire alarm system. (All devices)

6. Motor starters and VFDs.

7. UPSs.

8. Lighting control systems.

The Professional shall determine if additional systems or equipment should be tested. The cost of testing should be justified by the avoided cost of an unscheduled failure or its impact on personnel safety and the mission of the facility.

C. Proposed test procedures and report forms shall be submitted for review in advance of testing.

D. Testing shall be performed by a testing company that is professionally independent of the installers of the equipment or systems being evaluated. Manufacturers' service organizations or similar factory-authorized service companies, including ABM, Square D, Eaton, and HVM, are acceptable. The name of the proposed testing organization shall be submitted to the University's Senior Electrical Engineer for approval.

E. The testing personnel shall have National Institute for Certification in Engineering Technologies (NICET), NETA, or equivalent certification and a minimum five years experience in testing the specific types of equipment

F. The Contractor shall be responsible to hire, supervise, and assist the independent testing company, and correct all problems identified.

G. Tests on medium-voltage cable shall consist of a non-destructive dielectric test of the insulation of the cable system. Tests shall be performed after all splices and stress cones have been completed in order to fully test the installation. A Very-Low-Frequency (VLF) AC highpot cable tester shall be used in accordance with IEEE 400.2. DC hipot testers shall not be used. The VLF test voltage shall be 10kV for new 133% insulation level, 5kV cable and 7kV for existing 5kV cable.

H. When replacing any three-phase electrical equipment, perform phase rotation check and record rotation and cable marking before removing existing conductors. After equipment replacement and prior to energizing any load, perform phase rotation check and confirm that rotation matches that of the original equipment. For medium voltage equipment and buildings' main unit substations, both the initial and final phase rotation checks shall be reviewed and approved by either the University's Electrician Foreman or Senior Electrical Engineer before proceeding. Immediately after load is energized, confirm that affected gensets shut down, elevators are operational, and motor rotation is correct.

I. Completed test reports shall be submitted for review prior to placing equipment in service and shall identify "as found" and "as left" conditions.

SECTION 270528 — CABLE TRAY FOR TELECOMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to the work of this Section.

1.2 SUMMARY

A. Provide all materials and labor for the installation of a cable tray system for communications infrastructure. This section includes requirements for providing a cable tray system for communications circuits. These requirements are in addition to any that may exist in Section 27 – “Cable Tray.”

B. Related Sections

1. Division 7 Section — "Firestopping"

2. Division 10 Section — "Cutting and Patching"

3. Division 27 Section — "Basic Electrical Materials and Methods"

4. Division 27 Section — "Raceway and Boxes for Communications Circuits"

5. Division 27 Section — "Inside Plant Communications Circuits"

6. Division 27 Section — "Outside Plant Communications Circuits"

7. Division 27 Section – “Telecommunications Room Requirements”

8. Division 27 Section – “Backbone Cabling Requirements”

9. Division 27 Section – “Horizontal Cabling Requirements”

1.3 REFERENCES

A. The applicable portions of the following specifications, standards, codes and regulations shall be incorporated by reference into these specifications.

1. General:

a. National Electrical Code (NEC)

b. National Electrical Safety Code (NESC)

c. Washington Industrial Safety and Health Act (WISHA)

d. Occupational Safety and Health Act (OSHA)

e. ASTM A123 – Specification for Zinc (Hot Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.

f. ASTM A653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process, Structural (Physical) Quality.

g. ASTM A1011 – Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low Alloy and High-Strength Low-Alloy with Improved Formability.

h. ASTM A1008 – Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low Alloy and High-Strength Low-Alloy with Improved Formability.

i. ASTM B633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel

j. NEMA VE 1 – Metallic Cable Tray Systems

k. NEMA VE 2 – Cable Tray Installation Guidelines

2. Communications:

a. TIA/EIA - 568: *Commercial Building Telecommunications Cabling Standard*

b. TIA/EIA - 569: *Commercial Building Standard for Telecommunication Pathways and Spaces*

c. TIA/EIA - 606: *The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings*

d. TIA/EIA - 607: *Commercial Building Grounding and Bonding Requirements for Telecommunications*

e. ISO/IEC IS 11801: *Generic Cabling for Customer Premises*

f. BICSI: *BICSI Telecommunications Cabling Installation Manual*

g. BICSI: *BICSI Telecommunications Distribution Methods Manual (TDMM)*

1.4 DEFINITIONS

A. "EMT shall mean Electrical Metallic Tubing.

B. "RMC" shall mean Rigid Metal Conduit.

C. "Raceway" shall mean any enclosed channel for routing wire, cable or busbars.

D. "TMGB" shall mean Telecommunications Main Grounding Busbar. There is typically one TMGB per building, located in the main telecommunications room. This busbar is directly bonded to the electrical service ground.

E. "TGB" shall mean Telecommunications Grounding Busbar. There is typically one TGB per telecommunications room. The TGB is connected both to the TMGB and to building structural steel or other permanent metallic systems.

F. "TBB" shall mean Telecommunications Bonding Backbone. The TBB is a conductor used to connect TMGBs to the TGBs.

G. "Pullbox" shall mean a metallic box with a removable cover, used to facilitate pulling cable through conduit runs longer than 100' or in which there are more than 180 degrees of bends. Pullboxes shall have no more than one conduit entering and one conduit exiting the box.

H. "Junction box" shall mean a pullbox wherein a conduit run transitions from a feeder conduit to multiple distribution conduits.

1.5 SYSTEM DESCRIPTION

A. Furnish, install, and place into satisfactory and successful operation all materials, devices, and necessary appurtenances to provide a complete, permanent Cable Tray infrastructure for communications circuits as hereinafter specified and/or shown on the Contract Documents. The Cable Tray system shall support an ANSI/TIA/EIA and lSO/IEC compliant communications Structured Cabling System (SCS) as specified in Inside Plant Communications Circuits.

B. The work shall include materials, equipment and apparatus not specifically mentioned herein or noted on the plans but which are necessary to make a complete working ANSI/TIA/EIA and ISO/IEC compliant Cable Tray system.

1.6 SUBMITTAL INFORMATION

A. Product Data Submittals: Provide submittal information for review before materials are delivered to the job site. Provide product data submittals for all products at the same time.

1. Submit a letter stating that the materials will be provided as specified, and specifically listing any items that will not be provided as specified. The letter shall also state that the Contractor has reviewed the specified items and agrees that they are applicable to this project in all respects.

2. For those items noted as allowing "or equal," and which are not being provided as specifically named, submit standard manufacturer's cut sheets or other descriptive information, along with a written description detailing the reason for the substitution.

3. Provide standard manufacturer's cut sheets and the operating and maintenance (O&M) instructions at the time of submittal review for each device in the system, regardless of whether it is submitted as specified or as an approved equal. These instructions shall detail how to install and service the equipment and shall include information necessary for rough-in and preparation of the building facilities to receive the materials.

B. Closeout Submittals: Provide submittal information for review as follows:

1. O&M Manual for Communications - At the completion of the project, submit O&M information from product data submittals (above), updated to reflect any changes during the course of construction, to the Designer in the telecommunications-specific O&M Manual for Communications binder labeled with the project name and description.

2. Records - Maintain at the job site a minimum of one set of Record Drawings, Specification, and Addenda. Record Drawings shall consist of redline markups of drawings, specifications and spreadsheets.

a. Document changes to the system from that originally shown on the Contract Documents and clearly identify system component labels and identifiers on Record Drawings.

b. Keep Record Drawings at the job site and make available to the Owner and Designer at any time.

c. Keep Record Drawings current throughout the course of construction. ("Current" is defined as not more than one week behind actual construction).

d. Show identifiers for major infrastructure components on Record Drawings.

1.7 SEQUENCING

1.8 CONTRACTOR WARRANTY:

A. Provide a Contractor-endorsed two-year service warranty against defects in materials and workmanship.

1. Provide labor attributable to the fulfillment of this warranty at no cost to the Owner.

2. The Contractor Warranty period shall commence upon Owner acceptance of the work.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials shall consist of tray sections, tray fittings, connectors, supports, expansion joints, blind end plates, barrier strips, radius drops, bonding conductors and other incidentals and accessories as required. Provide all incidental

and/or miscellaneous hardware not explicitly specified or shown on the Contract Documents that is required for a fully operational and warranted system.

B. Unless specifically stated as "Or equal", equivalent items are not acceptable. Provide items as specified.

C. Physically verify existing site conditions prior to purchase and delivery of the materials.

D. Cable tray components shall be manufactured by a single manufacturer. Components shall not be intermixed between different manufacturers.

1. The cable tray manufacturer shall be one of the following:

a. GS Metals

b. Cablofil

2. Substitution is not acceptable unless the cable tray manufacturer has been pre-approved prior to bidding. Contractors, in order to obtain approval for cable tray manufacturer substitution, shall submit their request for substitution to the Engineer at least two weeks prior to the bid date. Approval or denial of a substitution request will be based upon the sole judgment of the Engineer.

E. For a given manufacturer, all components shall be part of a single cable tray product line – components shall not be intermixed between a manufacturer's cable tray product lines.

1. The cable tray product one shall be one of the following:

a. For GS Metals: Flextray Series

b. For Cablofil, Inc.: EZ Tray CF54/xxx Series

2.2 MATERIALS AND FINISH

A. General: Except as otherwise indicated, provide metal cable runways of types, classes and sizes indicated with splice connectors, bolts, nuts and washers for connecting units.

B. Welded Wire (Basket Tray): Cable tray shall be constructed of welded wire mesh (high strength steel wires) with a continuous safety edge wire lip. Cable tray shall be complete will all tray supports, materials, and incidental and miscellaneous hardware required for a complete cable tray system.

1. Finish: Carbon steel with electro-plated zinc galvanized finish.

2. Width: Widths shall be as shown on the Contract Documents. Where cable tray width is not shown on the Contract Documents, it shall be sized according to the amount of cable to be placed in the trays (as shown on the Contract Documents) plus an additional 100% for future expansion capability.

3. Depth: 2 inches.

4. Mesh: 2 x 4 inches.

5. Width: 12 inches

6. Fittings: Fittings shall be field fabricated from straight sections using manufacturer-approved tools and in accordance with manufacturer's instructions.

C. Solid Bar Style (Ladder Tray): Cable tray shall be ladder type with 1-1/2 inch stringer height with welded rungs

1 Stringer side rail shall confirm to the minimum chemical and mechanical properties of ASTM A36 structural steel.

2 Cable runway rungs shall be constructed from ASTM A1011 SS Grade 33 structural steel. Each rung shall be 1/2 inch by 1 inch steel c-channel shape with radius edges.

3 Runway shall be 12 inches wide and installed as shown on drawings.

D. Grounding/bonding: In accordance with ANSI/NFPA 70 Section 318-7, cable tray shall be complete with bolted splicing hardware for grounding/bonding throughout the entire cable tray system.

E. Cable tray installed in each MDF/IDF should be Ladder type.

F. All other horizontal Cable Tray should be Basket type.

G. All Cable Tray should be UL listed and have UL compliance.

2.3 FIRESTOPPING MATERIAL

A. Firestopping material: Conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire test in a configuration that is representative of the actual field conditions. Manufactured by:

1. Specified Tech. Inc.

2.4 LABELING AND ADMINISTRATION

A. Labels: As recommended in ANSI/TIA/EIA 606. Permanent (i.e. not subject to fading or erasure), permanently affixed, and created by a hand-carried label maker or a computer/software-based label making system. Handwritten labels are not acceptable.

1. Hand-carried label maker: Brady: ID Pro Plus (or approved equal).

2. Labels: Brady: Bradymaker Wire Marking Labels WML-511-292 (or approved equal)

3. Label Clips: Cablofil, Inc. (regardless of cable tray manufacturer)

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.

B. All work shall comply with applicable safety rules and regulations including OSHA and WISHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

C. All work shall comply with the standards, references and codes listed in PART 1 -- REFERENCES above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.

D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.

E. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.

F. Install the cable tray system in a manner ensuring that communications circuits, when installed, are able to fully comply with the ANSI/TIA/EIA and other references listed in Part 1 — References, above.

G. Remove surplus material and debris from the job site and dispose of legally.

3.2 EXAMINATION

A. Examine surfaces and spaces to receive cable tray for compliance with installation tolerances and other conditions affecting performance of cable tray installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Notify the Engineer/Owner of conditions that may adversely affect the installation, subsequent use, or cause the tray (or circuits to be subsequently installed in the tray) to not comply with ANSI/TIA/EIA standards.

3.3 INSTALLATION

A. Provide cable tray, in the locations and widths shown on the Contract Documents and in accordance with manufacturer's requirements and industry practices (NEMA VE 2). Ensure that the cable tray equipment complies with the requirements of NEC, and applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.

1. Cable tray shall be installed plumb, level and square with finished building surfaces.

2. Provide factory-manufactured connection hardware between each cable tray segment. Cable tray segments shall be mutually aligned. Connection hardware shall be installed according to the manufacturer's requirements.

3. Cable tray elevation changes shall be gradual.

B. Slots/sleeves: Provide slots/sleeves where required and where shown on the Contract Documents. Provide roto-hammering, core drilling and saw cutting where required for installation. Seal and firestop (firestop only if fire rated barrier) between slot/sleeve and cable tray.

C. Cable Tray Routing:

1. Route cable tray as shown on the Contract Documents. Where not shown on the Contract Documents, route cable tray in the most direct route possible, parallel to building lines.

2. Do not route cable tray through areas in which flammable material may be stored or through wet, hazardous or corrosive areas.

D. Cable Tray Clearance Requirements:

1. Clearance requirements for cable tray accessibility:

a. Maintain a clearance of 6" between top of cable tray and ceiling structure or other equipment or raceway.

b. Maintain a clearance of 8" between at least one side of cable tray and nearby objects.

c. Maintain a clearance of 6" between bottom of cable tray and ceiling grid or other equipment or raceway.

2. Clearance requirements from sources of electromagnetic interference (EMI):

a. Maintain a clearance of 5" or more from fluorescent lighting.

b. Maintain a clearance of 12" or more from conduit and cables used for electrical power distribution.

c. Maintain a clearance of 48" or more from motors or transformers.

d. Pathways shall cross perpendicularly to electrical power cables or conduits.

3. Maintain a clearance of at least 6 inches from parallel runs of flues and steam or hot-water pipes or other heat sources operating at temperatures above one-hundred degrees Fahrenheit.

E. Cable Tray Fittings: Provide field-fabricated fittings from straight sections of cable tray using manufacturer-approved tools and in accordance with manufacturer's instructions. Bends shall be long radius. Short radius bends and T-sections shall not be used unless specifically called out on the Contract Documents.

F. Cable tray supports shall be provided where shown on the Contract Documents. Where not shown on the Contract Documents, supports shall be provided according to the manufacturer's recommendations.

1. Supports shall be attached to structural ceiling or walls with hardware or other installation and support aids specifically designed for the cable tray and designed to support the cable tray's weight and required cable weight and volume.

2. Where cable trays abut walls, provide wall-mounted supports.

3. Do not attach cable tray supports to ceiling support system or other mechanical support systems.

G. Load span criteria: Install tray supports in accordance with the load criteria of L/240, and as shown on the Contract Documents.

H. Cable tray shall be installed free of burrs, sharp edges, or projections which may damage cable insulation.

I. Wire-type cable tray shall be cut with a manufacturer-approved cutter with "offset cutting blade" jaws and a minimum 24 inch handle.

1. The choice and position of the jaws at the point where the cut is to be made shall allow shearing as close as possible to the intersection of the steel wires.

2. Cuts shall ensure the integrity of the galvanic protective layer.

J. Supports: Trays shall be supported at 6 foot intervals as shown on the Contract Documents, or more frequently if required by the manufacturer.

K. Expansion Joints: Provide cable tray sliding or offsetting expansion joints/fittings where shown on the Contract Documents and where cable tray crosses building expansion joints. Provide bonding jumper except where expansion joints are specifically approved for bonding.

L. Thermal contraction and expansion: Install cable tray sections with gap settings between cable tray sections that are appropriate for the range of thermal expansion and contraction expected for the space during construction and also during normal occupancy and operation.

M. Blind End Plates: Close unused openings using factory-made blind end plates.

N. Barrier Strips: Provide barrier strips as shown on the Contract Documents

O. Radius Drops: Provide cable tray radius drops where shown on the Contract Documents and where cable trays cross other telecommunications cable trays or ladder rack.

3.4 GROUNDING AND BONDING

A. Grounding/Bonding: Grounding and bonding work shall comply with the Uniform Building Code, Uniform Fire Code, WAC, National Electrical Code, and UL 467, ANSI/TIA/EIA standards and the references listed in PART 1 – REFERENCES above, as well as local codes which may specify additional grounding and/or bonding requirements.

B. Bond metallic raceway (including cable tray) together and to the nearest TGB (as provided under Division 27 Section — "Grounding and Bonding for Telecommunications"). Ensure that bonding breaks through paint to bare metallic surface of painted metallic hardware.

C. Cable tray bonding splices: Provide cable tray splices according to manufacturer requirements to create a continuous bonding conductor throughout the entire cable tray.

D. Bonding conductors:

1. Bond distribution conduits to cable tray.

2. Provide bonding jumpers at expansion joints, sleeves and any other locations where electrical continuity is interrupted.

3. Provide bonding conductor between cable tray and the electrical power distribution system grounding infrastructure.

3.5 FIRESTOPPING

A. Only employees trained/certified by the firestopping manufacturer shall apply firestopping materials.

B. Maintain the fire rating of all penetrated fire barriers. Fire stop and seal all penetrations made during construction.

1. Provide firestopping material for through and membrane penetrations of fire-rated barriers.

2. Install firestops in strict accordance with manufacturer's detailed installation procedures.

3. Install firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer's recommendations, local fire and building authorities, and applicable codes and standards referenced in PART 1 – REFERENCES. Apply sealing material in a manner acceptable to the local fire and building authorities.

4. For demolition work, apply firestopping to open penetrations in fire rated barriers where cable is removed. Apply firestopping regardless of whether or not the penetrations are used for new cable or left empty after construction is complete.

5. Firestopping material used to seal open penetrations through which cable passes shall be re-usable/re-enterable.

3.6 CLEANING AND PROTECTION

A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and in accordance with accepted industry practice, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.7 TESTING

A. Test cable trays to ensure electrical continuity of bonding and grounding connections. Demonstrate compliance with maximum grounding resistance per NFPA 70B, Chapter 18.

3.8 LABELING AND ADMINISTRATION

A. Provide the following two labels, alternating one label every 10 feet, along the entire length of the cable tray:

1. Label #1: Label shall read “TELECOMMUNICATIONS / LOW VOLTAGE CABLING ONLY”.

2. Label #2: Label shall read “WARNING! CABLE TRAY SERVES AS A TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT DISCONNECT!”

END OF SECTION

SECTION 270543 - UNDERGROUND DUCT BANKS AND UTILITY STRUCTURES:

PART 1 - GENERAL

1.1 RELATED ITEMS

A. Drawings and General and Supplementary Conditions apply to this section. Refer to the following for additional requirements:

1. Earthwork.
2. Firestopping.
3. Raceways and Boxes.

1.2 Related Sections:

1. Division 7 Section — "Firestopping"
2. Division 10 Section — "Cutting and Patching"
3. Division 27 Section – “Telecommunications Room Requirements”

1.3 SUMMARY

A. This Section includes the following:

1. Conduits in direct-buried duct banks.
2. Conduits in concrete-encased duct banks.
3. Manholes and manhole accessories.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Manhole hardware.
2. Duct-bank materials, including spacers and miscellaneous components.
3. Warning tape.
4. Grounding and bonding.

B. Shop Drawings: Show fabrication and installation details for underground conduits and utility structures and include the following:

1. For manholes:

a. Conduit sizes and locations of conduit entries.
b. Reinforcement details.
c. Manhole cover design.
d. Step details.
e. Grounding details.

f. Dimensioned locations of cable rack inserts, pulling-in irons, and sumps.

For precast manholes, Shop Drawings shall be signed and sealed by a qualified professional engineer, and shall show the following:

g. Construction of individual segments.
h. Joint details.
i. Design calculations.

C. Coordination Drawings: Show duct bank profiles and coordination with other utilities and underground structures. Include plans and sections drawn to scale, and show all bends and location of expansion fittings.

D. Product Certificates: For concrete and steel used in underground precast manholes, according to ASTM C 858.

E. Product Test Reports: Indicate compliance of manholes with ASTM C 857 and ASTM C 858, based on factory inspection.

1.5 QUALITY ASSURANCE

A. Devices and Accessories (Including Conduits for Communications and Telephone Service): Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with ANSI C2.

C. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver conduits to Project site with ends capped. Store nonmetallic conduits with supports to prevent bending, warping, and deforming.

B. Store precast concrete units at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate layout and installation of conduits and manholes with final arrangement of other utilities and site grading, as determined in the field.

B. Coordinate elevations of conduits and duct bank entrances into manholes with final profiles of conduits as determined by coordination with other utilities and underground obstructions. Revise locations and elevations from those indicated as required to suit field conditions and to ensure conduit runs drain to manholes and as approved by University of Pittsburgh and Engineer.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Furnish cable-support stanchions, arms, insulators, and associated fasteners in quantities equal to 5 percent of amount installed.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Underground Precast Concrete Utility Structures:

a. Carder Concrete Products.
b. Christy Concrete Products, Inc.
c. Elmhurst-Chicago Stone Co.
d. Riverton Concrete Products.
e. Rotondo Precast/Old Castle.
f. Utility Vault Co.
g. Wausau Concrete Co.
h. AC Miller.

2. Frames and Covers:

a. Campbell Foundry Co.
b. East Jordan Iron Works, Inc.
c. McKinley Iron Works, Inc.
d. Neenah Foundry Co.

2.2 CONDUIT

A. Conduit and fittings are specified in "Raceways and Boxes."

B. CSSD requires a minimum of two (2) 4” conduits. Specific project plans will identify the required number of conduits. All underground conduits must be Schedule 40 (thick-walled PVC) or Schedule 80 encased in a 4,000 minimum psi concrete, to a minimum thickness of 6” from any conduit. Concrete encasement shall be reinforced with ½” steel rebar. The top of the encasement shall be a minimum of 36” below grade and a magnetically detectable tape (minimum width 1”) is to be buried 6” below finished grade and following the centerline of the encasement. Conduits within the encasement are to be spaced 6” apart on center. Direct-buried conduit is not acceptable unless approved by CSSD. The distance between telecommunications manholes shall be no greater than 400 feet. All conduit segments are to be supplied with a nylon pull rope or ribbon of sufficient tensile strength to facilitate the installation of cable or PVC innerduct.

2.3 PRECAST MANHOLES

A. Precast Units: ASTM 478, with interlocking mating sections, complete with accessories, hardware, and features as indicated. Include concrete knockout panels for conduit entrance and sleeve for ground rod. The size for the vaults is 6’ X 8’ X 7’ height with a 30” manhole.

B. Design and fabricate structure according to ASTM C 858.

C. Structural Design Loading: ASTM C 857, Class A-16.

D. Joint Sealant: Continuous extrusion of asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

E. Source Quality Control: Inspect structures according to ASTM C 1037.

F. Covers are to be indented with the word "University of Pittsburgh Telecommunications" which shall be cast on the upper side of each cover.

2.4 CAST-IN-PLACE MANHOLES

A. Loading: AASHTO HS20 traffic load.

2.5 TELECOM IN-GROUND PULL BOXES

A. The Contractor shall furnish all labor and material to construct the pull boxes, complete with all appurtenances at the locations and as shown in detail on the drawings. Pull boxes shall be precast reinforced composite. Pull boxes shall be as manufactured by Quazite Composite Co., or equal as approved by the Architect.

B. The locations of the pull boxes indicated on the drawings are approximate. Exact locations shall be determined at the job site.

C. Excavation, shoring, bracing, backfilling, grading, etc., shall be in accordance with the applicable portions of the "Excavating and Backfilling" section of the specification. Pull boxes shall not be installed until final conduit grading has been determined including any field changes required by underground interferences. Shop drawings shall be submitted for all pull ox details.

D. The pull boxes shall be of size shown on the drawings. The pull boxes shall be complete with the proper size openings for all conduits. The pull boxes shall be furnished with dowel rods at all openings as required to reinforce conduit envelopes. Refer to underground conduit herein for required reinforcing.

E. Pull box covers shall be heavy-duty type, suitable for occasional heavy vehicles. Covers are to be indented with the word "University of Pittsburgh Telecommunications" which shall be cast on the upper side of each cover. The cover shall be of a gasketed waterproof locking type.

F. Pull boxes shall be constructed of an aggregate consisting of sand and gravel bound together with a polymer and reinforced with continuous woven glass strands. The material shall have the following Mechanical properties:

Compressive Strength - 11,000 psi.
Tensile Strength - 1,700 psi.
Flexural Strength - 7,500 psi.

ACCESSORIES

G. Conduit Spacers: Rigid PVC interlocking spacers, selected to provide minimum conduit spacings and cover depths indicated while supporting conduits during concreting and backfilling; produced by the same manufacturer as the conduits.

H. Manhole Frames and Covers: Comply with AASHTO loading specified for manhole.

1. Provide cast iron covers with the engraved word "University of Pittsburgh Telecommunications" as required.
2. Manhole Frames and Covers: ASTM A 48; Class 30B gray iron, 30-inch size, machine-finished with flat bearing surfaces.

I. Sump Frame and Grate: ASTM A 48, Class 30B gray cast iron.

J. Pulling Eyes in Walls: Eyebolt with reinforcing-bar fastening insert 2-inch- diameter eye and 1-by-4-inch bolt.

1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.

K. Pulling and Lifting Irons in Floor: 7/8-inch- diameter, hot-dip-galvanized, bent steel rod; stress relieved after forming; and fastened to reinforced rod. Exposed triangular opening.

1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.

L. Bolting Inserts for Cable Stanchions: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.

1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.

M. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.

N. Cable Stanchions: Hot-rolled, hot-dip-galvanized, T-section steel; 2-1/4-inch size; punched with 14 holes on 1-1/2-inch centers for cable-arm attachment.

O. Cable Arms: 3/16-inch- thick, hot-rolled, hot-dip-galvanized, steel sheet pressed to channel shape; 12 inches wide by 14 inches long and arranged for secure mounting in horizontal position at any location on cable stanchions.

P. Cable-Support Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.

Q. Grounding Materials:

1. Ground Rods: Copper clad, 3/4 inch in diameter by 120 inches in length.
2. Ground Wire: No. 4 AWG minimum, stranded, hard-drawn copper conductor.
3. Connector Products:

    a. Comply with IEEE 837 and UL 467 listed for use for specific types, sizes.
    b. Bolted Connectors: Bolted pressure type connector or compression type. Use only approved connectors. "Split-Bolts" are not approved connectors.
    c. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

R. Ladder: UL-listed, hot-rolled, hot-dip galvanized steel ladder specifically designed for manhole use. Minimum length equal to the distance from the manhole floor to grade. Each manhole to contain its own ladder.

S. Conduit-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and of adhering to clean surfaces of plastic conduits, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

T. Conduit Duct Plugs:

1. Duct plugs shall be manufactured from high impact plastic components and shall be corrosion proof.
2. Duct plugs shall contain a durable elastic compressible gasket which will make it effective as a long term or temporary seal. They shall be removable and reusable.
3. They shall meet or exceed the following mechanical requirements:

    a. Air Pressure 7.5 psi
    b. Water Head 15 ft.
    c. Pull Out 100 Kgf

4. Duct plugs shall be equipped with a rope tie device on the back compression plate to allow the securing of a pull rope. This will allow excess rope slack to be stored within the conduit.

U. Warning Tape: Underground-line warning tape specified in Section 2.2, “CONDUIT”.

2.6 CONSTRUCTION MATERIALS

A. Dampproofing: Bituminous Dampproofing.

B. Mortar: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. where packaged mix complying with ASTM C 387, Type M, may be used.

C. Brick for Manhole Chimney: Sewer and manhole brick, ASTM C 32, Grade MS or approved grade rings.

PART 3 - EXECUTION

3.1 APPLICATION

A. Manholes: Underground precast concrete utility structures.

3.2 EARTHWORK

A. Excavation and Backfill: Comply with "Excavation, Backfilling, and Compacting for Utilities" Section, but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore all areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

D. Restore disturbed pavement.

3.3 CONDUIT INSTALLATION

A. Slope: Pitch conduits a minimum slope of 1:300 down toward manholes and away from buildings and equipment. Slope conduits from a high point in runs between two manholes to drain in both directions.

B. Curves and Bends: Use manufactured long sweep bends with a minimum radius of 24 inches.

C. Use solvent-cement joints in conduits and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent conduits do not lie in the same plane.

D. Conduit Entrances to Manholes: Space end bells approximately 10 inches o.c. for 5-inch conduits and vary proportionately for other conduit sizes. Change from regular spacing to end-bell spacing 10 feet from the end bell without reducing conduit line slope and without forming a trap in the line. Grout end bells into manhole walls from both sides to provide watertight entrances.

E. Building Entrances: Make a transition from underground PVC to rigid galvanized steel conduit 5 feet from exterior wall of the building. Use fittings manufactured for this purpose. Follow the appropriate installation instructions below:

1. Concrete-Encased Conduit: Install reinforcement in conduit banks passing through disturbed earth near buildings and other excavations. Coordinate duct bank with

structural design to support duct bank at wall without reducing structural or watertight integrity of building wall.

2. Waterproofed Wall and Floor Penetrations: Install a watertight entrance-sealing device with sealing gland assembly on the inside. Anchor device into masonry construction with one or more integral flanges. Secure membrane waterproofing to the device to make permanently watertight.

F. Concrete-Encased, Nonmetallic conduits: Support conduits on spacers, spaced as recommended by manufacturer and coordinated with conduit size, conduit spacing, and outdoor temperature. Install as follows:

1. Separator Installation: Space separators close enough to prevent sagging and deforming of conduits and secure separators to earth and to conduits to prevent floating during concreting. Stagger spacers approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around conduits or conduit groups.
2. Concreting: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto conduits. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application. Pour each run of envelope between manholes or other terminations in one continuous operation. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.
3. Reinforcement: Reinforce duct banks where they cross disturbed earth and where indicated.
4. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
5. Minimum Clearances between Conduits: 3 inches between conduits and exterior envelope wall, 3 inches between conduits for like services, and 4 inches between power and signal conduits.
6. Depth: Install top of duct bank at least 30 inches below finished grade in non-traffic areas and at least 36 inches below finished grade in vehicular traffic areas, unless otherwise indicated.

G. Nonmetallic Conduits - No Encasement (with approval from CSSD): Support conduits on spacers, spaced as recommended by manufacturer and coordinated with conduit size, conduit spacing, and outdoor temperature. Install as follows:

1. Separator Installation: Space separators close enough to prevent sagging and deforming of conduits and secure separators to earth and to conduits to prevent floating during backfilling. Stagger spacers approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around conduits or conduit groups.
2. Backfilling: Spade backfill carefully to prevent voids under and between conduits and exterior surface of envelope. Do not allow a heavy mass of backfill to fall directly onto conduits. Comply with "Earthwork Section", but do not use heavy-duty hydraulic-operated compaction equipment.
3. Reinforcement: Reinforce duct banks where they cross disturbed earth and where indicated.

4. Minimum Clearances Between Conduits: 3 inches between conduits and exterior envelope wall, 1-1/2 inches between conduits for like services, and 4 inches between power and signal conduits.
5. Depth: Install top of duct bank at least 30 inches below finished grade in nontraffic areas and at least 36 inches below finished grade in vehicular traffic areas. If depth cannot be met, contact Owner for variance before proceeding.

H. Warning Tape: Bury magnetically detectable warning tape approximately 6 inches below finished grade to make it more easily detectable. Align tape parallel to and within 3 inches of the centerline of duct bank.

I. Sealing: Provide temporary closure at terminations of conduits and innerducts that have cables pulled. Seal spare conduits and innerducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

J. Pulling Cord: Install 100-lbf- test nylon cord in conduits, including spares.

3.4 MANHOLE INSTALLATION

A. Elevation: Install manholes with rooftop at least 13 inches below finished grade.

B. Drainage: Install drains in bottom of units where indicated. Coordinate with drainage provisions indicated.

C. Access: Install cast-iron frame and cover.

1. Install brick chimney to support frame and cover and to connect cover with roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.
2. Install precast collars and rings to support frame and cover and to connect cover with roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.
3. Set frames in paved areas and traffic ways flush with finished grade. Set other frames 1 inch above finished grade.

D. Damp proofing: Apply damp proofing to exterior surfaces of units after concrete has cured at least three days. Apply bituminous damp proofing. After conduits have been connected and grouted, and before backfilling, damp proof joints and connections and touch up abrasions and scars. Damp proof exterior of manhole and handhold chimneys after brick mortar has cured at least three days.

E. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

F. Field-Installed Bolting Anchors: Do not drill deeper than 3-7/8 inches for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

G. Grounding: Install ground rod through floor in each structure with top protruding 4 inches above floor. Seal floor opening against water penetration with waterproof non-shrink grout.

Ground exposed metal components and hardware with bare-copper ground conductors. Train conductors neatly around corners. Use cable clamps secured with expansion anchors to attach ground conductors.

H. Precast Concrete Manhole Installation: Unless otherwise indicated, comply with ASTM C 891.

1. Install units' level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
2. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

3.5 FIELD QUALITY CONTROL

A. Testing: Demonstrate capability and compliance with requirements on completion of installation of underground conduits and utility structures. Manhole grounds shall measure 10 ohms or less.

B. Grounding: Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified. Record test procedures used, test results that comply with requirements, and results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Conduit Integrity: Pull aluminum or wood test mandrel through conduit to prove joint integrity and test for out-of-round conduit. Provide mandrel equal to 80 percent fill of the conduit. If obstructions are indicated, remove obstructions and retest.

D. Correct installations if possible and retest to demonstrate compliance. Remove and replace defective products and retest.

3.6 CLEANING

A. Pull leather-washer-type conduit cleaner, with graduated washer sizes, through full length of conduits. Follow with rubber conduit swab for final cleaning and to assist in spreading lubricant throughout conduits.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 270543

SECTION 271100 – TELECOMMUNICATION ROOM REQUIREMENTS

This documentation shall include but not limited to all cabling, conduits, data outlets, distribution patch panels, equipment racks and wire management systems as required for a fully tested and certified data network based on a structure cabling end-to-end implementation. CSSD shall be responsible for providing all active telecommunications electronics for both the data and voice networks, e.g. UPSs, data routers, data switches, wireless access points, voice switches, and telephony peripherals.

No deviation from this standard shall be incorporated without written direction from the University's Computing Services and Systems Development group.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and *Division 1 Specification Sections, apply to this Section*.

B. Related Sections:

1. Division 27 Section – "Underground Duct Bank"
2. Division 27 Section – "Cable Tray for Telecommunications"
3. Division 27 Section – "Backbone Cabling Requirements"
4. Division 27 Section – "Horizontal Cabling Requirements"

1.02 SUMMARY

A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, and equipment to fit out the MDF/IDF rooms as shown on the drawings.

B. MDF/IDF rooms must be located within 90 meters or 292.5 feet of the most-distant telecommunication outlets they will serve. It is preferable to have the MDF/IDF room centrally located on a floor and all IDFs vertically stacked within the building. Cable runway/ basket tray system is required within the room and for cable distribution throughout the floor. All MDF/IDF room doors must open into a common accessible hallway and not require passage through any occupied space. The MDF/IDF rooms are dedicated to telecommunications equipment only and are not to be shared with storage, equipment, or other utilities. No plumbing or mechanicals are to be mounted in or pass through the MDF/IDF rooms unless specifically required for the space.

C. For the Main Distribution Frame (MDF), CSSD requires a room sized at 20' x 20'. Proper cooling and ventilation, power, grounding, lighting, VCT-SD (Static Dissipating) flooring, and security are required. A finished ceiling is not required, unless the area above the space acts as a plenum. Plywood is not required on the walls as all equipment and cable will be housed in racks/cabinets. Provide a cable runway system to include, but not limited to straight sections of continuous raceway, field formed horizontal and vertical bends, tees, drop outs, supports and accessories, core drills and conduits in telecommunication rooms as indicated on drawings. No other utilities are to reside in the MDF. Specifics are to be determined in collaboration with CSSD based on the telecommunications delivery for the building.

D. For the Intermediate Distribution Frame (IDF), CSSD requires a room sized at 10’ x 10’ with proper cooling and ventilation, power, grounding, lighting, VCT-SD (Static Dissipating) flooring, and security. A finished ceiling is not required, unless the area above the space acts as a plenum. Plywood is not required on the walls as all equipment and cable will be housed in racks/cabinets. Provide a cable runway system to include, but not limited to straight sections of continuous raceway, field formed horizontal and vertical bends, tees, drop outs, supports and accessories, core drills and conduits in telecommunication rooms as indicated on drawings. For multiple IDFs, a vertically stacked riser is required. These requirements apply to all IDFs. No other utilities are to reside in the IDFs. Specifics are to be determined in collaboration with CSSD based on the telecommunications delivery for the building.

E. Provide wire management in the rooms as indicated on the drawings.

F. Provide equipment racks and all necessary hardware in the rooms as indicated on the drawings.

1.03 REFERENCES

A. ASTM A36 – Specification for Carbon Structural Steel

B. ASTM A1011 – Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
(Formerly ASTM A570)

C. ASTM A513 – Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing

D. ASTM B633 - Specification for Electro-deposited Coatings of Zinc on Iron and Steel

E. ANSI/ TIA/ EIA 568B. Commercial Building Telecommunications Cabling Standard

F. ANSI/ TIA/ EIA 569 - Commercial Building Standard for Telecommunications Pathways and Spaces

G. ANSI/TIA/EIA 606 & 607 – Grounding Specification

H. NFPA 70, National Electrical Code

1.04 SUBMITTALS

A. Submittal Drawings: Submit drawings of runway and accessories including connector assemblies, clamp assemblies, brackets, splice plates, splice bars, grounding clamps and hold down plates showing accurately scaled components.

B. Product Data: Submit manufacturer’s data on cable runway system including, but not limited to, types, materials, finishes and inside depths.

1.05 RECORD DOCUMENTS

A. When all work has been completed and prior to final acceptance, the Contractor shall furnish to the engineer a complete set of CAD marked drawings clearly showing the contract work and labeling.

B. Mark up a clean set of Specifications to indicate approved substitutions, change orders, and actual equipment and materials used.

PART 2 - PRODUCTS

2.01 GENERAL

A. Product: New, free from defects and listed by UL when an applicable UL Standard exists. Provide product of a given type from one manufacturer.

B. Regardless of the length or completeness of the descriptive paragraph herein, provide product complying with the specified manufacturer's published specifications to insure a complete system.

2.02 CABLE RUNWAY SYSTEMS

A. Manufacturers: Chatsworth

B. General: Except as otherwise indicated, provide metal cable runways of types, classes and sizes indicated with splice connectors, bolts, nuts and washers for connecting units.

C. Runway Types: Material specifications for each runway type are as follows:

1 Solid Bar style runway: Runway shall be ladder type with 1-1/2 inch stringer height with welded rungs.
2 Stringer side rail shall conform to the minimum chemical and mechanical properties of ASTM A36 structural steel.
3 Cable runway rungs shall be constructed from ASTM A1011 SS Grade 33 structural steel. Each rung shall be 1/2 inch by 1 inch steel c-channel shape with radius edges.
4 Runway shall be 12 inches wide and installed as shown on drawings.

D. Ground runway sections to grounding bus bar located in MDF/IDF Room per ANSI/TIA/EIA 606 & 607 specification.

2.03 EQUIPMENT RACKS

A. Manufacturers: Panduit. CSSD's preferred local distributor for infrastructure materials is Anixter. CSSD will provide all racks/cabinets.

B. Racks shall be UL listed and of aluminum construction with a black polyurethane or mil finish. Rack base shall be pre-drilled and secured to the floor. Racks shall have 12/24 mounting screws included in the package.

C. Rack rails shall be spaced for 19" mounting rail-to-rail and shall be of a U shaped construction with 12/24 pre-tapped holes in the EIA-310-E standard hole pattern on both the front and rear.

D. Rack shall be 84" high. In certain cases where physical restrictions apply, racks/cabinets may be shorter in height.

E. Each rack is served by a TrippLite PDU power strip. CSSD will provide the power strip(s).

F. Ground all racks to grounding bus bar located in MDF/IDF Room.

G. All cabling (fiber and copper) will be supported via appropriate horizontal and vertical wire

management per CSSD's specifications: Solid Bar Ladder Tray in the MDF, Basket Tray throughout the Floor. "J" Hooks or Bridal Rings are not acceptable.

H. Positioning of rack(s) within the room will be determined by CSSD.

I. All racks shall be securely bolted to the floor of the MDF/IDF room per CSSD's layout and instructions.

2.04 POWER DISTRIBUTION

A. The Contractor shall provide power receptacles in the MDF/IDF room as per CSSD specifications for the project. CSSD will list the number, source (normal power, optional standby power, UPS power), voltage, amperage, phasing, and locations of the power receptacles in the room. Receptacles for power to the UPS shall be mounted to the overhead ladder tray, above the back of the rack, facing back, with sufficient clearance to prevent interference with cable installation or rack access. Receptacles are to be labeled with panel number, breaker number, and circuit ID. Normal installation is two, single phase, 120v, 30 amp circuits with an L5-30 (Locking) Receptacle, above each rack/cabinet. One circuit is fed by Optional Standby Power, if available. One circuit is fed by Normal (House) power.

B. CSSD will provide cut sheets and single-line diagrams as necessary to facilitate the installation and placement of appropriate power for any CSSD-provided devices that require hard-wired power.

C. CSSD shall specify the location(s) for any wall-mounted 'courtesy' receptacles in the MDF/IDF room.

D. All receptacles shall be installed in compliance with local and national electrical codes.

E. Overhead lighting per current University specifications is to be installed in the MDF/IDF room. The room is to be illuminated to 50 foot candles at 3 feet above floor level. Provide an occupancy sensor switch within the room to control only the lights in the MDF/IDF room.

2.05 ESD CONTROL FLOORING

A. The Contractor shall provide and install ESD Control Flooring. The solid, homogeneous ESD Control Vinyl Tile shown in the finish schedule or listed herein shall be Roppe StatDefend STATIC DISSIPATIVE VINYL TILE as manufactured by Roppe Corporation, Fostoria, Ohio. It shall be constructed of first-quality materials and shall be smooth and free from imperfections which detract from its appearance. The StatDefend solid vinyl tile shall conform to ASTM F-1700, Class 1, Type A. The resistance of the Stat Defend conductive floor shall be less than an average of 1,000,000 ohms and shall be more than an average of 25,000 ohms as tested in accordance with NFPA 99 2-6.3.8, ASTM F-150, and ESD S7.1 at 100 or 500 volts. The tile shall be 1/8" (3.175mm) in thickness, and of size 12" x 12" and in color per architect's recommendation. Roppe RO0605 or ROP604 ESD adhesive must be used with this product. Roppe vinyl welding beads, .160" in diameter, are available in matching colors. Armstrong Excelon SDT comparable ESD flooring is acceptable.

B. Flooring must be grounded per manufacturer's specification.

2.06 HVAC GUIDELINES

A. Cooling and ventilation are required in the MDF and the IDFs. Capacity and type of unit to be determined by MEP engineer.

B. Room temperatures must be maintained at 64^{o} F to 75^{o} F at 30% to 55% relative humidity.

2.07 CEILING

A. Drop ceilings are not required in any MDF/IDF room, unless the space above MDFs/IDFs is a plenum. If the area above MDFs/IDFs acts as a plenum a ceiling is required as a means to contain dust and particulates.

B. Cable distribution system is required within the MDF/IDF room.

2.08 DOOR and PHYSICAL SECURITY

A. The minimum door dimensions are 3'6" wide by 7' tall and are to swing out of the MDF/IDF room.

B. The primary method of securing the MDF/IDF rooms is via the University of Pittsburgh Police Department of Integrated Security RS/2 keycard system. If conditions do not permit this door security, then a Unican five-button lock is required.

2.09 SIGNAGE

A. The outside of each MDF/IDF room requires a sign indicating the room number in accordance with the building signage standard.

2.10 FIRE PROTECTION

A. Fire protection must be provided in the MDF/IDF rooms in accordance with the campus fire codes.

PART 3 – EXECUTION

3.01 GENERAL

A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final product.

B. All work shall be installed in a neat and workmanlike manner.

C. Strictly adhere to all industry, manufacturers Category 6A UTP (500 MHz) installation practices when installing telecommunications raceway.

D. Reference the BICSI TDDM manual for acceptable installation methods.

3.02 DELIVERY, STORAGE AND HANDLING

A. Ship product in its original container, to prevent damage or entrance of foreign matter.

B. Handling and shipping in accordance with manufacturer's recommendation.

C. Provide protective covering during construction, to prevent damage.

D. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

3.03 INSTALLATION

A. Mount raceways plumb and level.

B. Cable runway fitting supports shall be located such that they meet the strength requirements of straight sections. Install fitting supports per NEMA VE-2 guidelines, or in accordance with manufacturer's instructions.

C. Cable runway shall be installed as indicated on drawings. No diagonal routing will be acceptable.

D. Support: Raceway shall be supported from walls and shall not attach to floor mounted equipment racks, and according to manufacturers recommendations and load capacities.

E. Cutting: Raceway shall be cut to a smooth, even surface. Cuts shall be made with a fine tooth hacksaw, and a miter box.

F. Ground all runway tray, racks, flooring, and equipment per TIA/EIA and NEC codes.

END OF SECTION

SECTION 271300 – BACKBONE CABLING REQUIREMENTS

This documentation shall include but not limited to all cabling, conduits, data outlets, distribution patch panels, equipment racks and wire management systems as required for a fully tested and certified data network based on a structure cabling end-to-end implementation. CSSD shall be responsible for providing all active telecommunications electronics for both the data and voice networks, e.g. UPSs, data routers, data switches, wireless access points, voice switches, and telephony peripherals.

No deviation from this standard shall be incorporated without written direction from the University's Computing Services and Systems Development group (CSSD).

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Telecommunications Systems Drawings and general provisions of the contract including general supplementary and special conditions and Division 1 Specification Sections, apply to this section.

B. Related Sections:

1. Division 27 Section – "Underground Duct Banks and Utility Structures"
2. Division 27 Section – "Cable Tray for Telecommunications"
3. Division 27 Section – "Telecommunications Room Requirements"
4. Division 27 Section – "Horizontal Cabling Requirements"

1.02 SUMMARY

A. This specification describes the actions to be taken, tasks to be performed and responsibilities of the certified Communications Contractor in order to provide and install a complete Backbone Cabling System. Unless otherwise noted all following sections which describe such actions, tasks, and responsibilities refer to the Contractor.

B. MDF/IDF Rooms will be served by means of copper and optical fiber backbone cabling.

C. Demarcation Point shall be serviced from various providers with optical fiber and copper cables. Contractor shall coordinate the installation of these services to insure no service disruption and extend all services as described on planning documents.

D. No terms used in this specification are intended to indicate that work or equipment called for shall be less than completely executed or installed or that the system shall be less than complete in any respect.

1.03 SUBMITTALS

A. General: Submit the following in accordance with the Conditions of the Contract and Specifications Sections.

1. Product data for each type of product specified. Product data shall consist of cut sheets, shop drawings, or other drawings that show the dimensions of the specified components

in the intended configuration. For installed electrical components such as Uninterruptible Power Supply (UPS), systems Automatic Transfer Switches (ATS) or Power Distribution Units (PDU), electrical single-line diagrams are also required. If CSSD is ordering any equipment for a given project, CSSD shall provide cut sheets and other relevant drawings so that they may be incorporated into the construction drawings.

2. The Contractor shall provide a complete set of drawings that detail the full scope of the work to be performed. This shall include all building systems that land in or pass through the space where the work is to be performed. This could include but is not limited to electrical, plumbing, HVAC, lighting, and physical security work. Additionally, a set of drawings shall be provided which detail any demolition or site preparation work that must be performed prior to construction. Electronic format (PDF files or CAD drawings) is preferred for all drawings; however, printed drawings are acceptable.

3. The Contractor shall meet with representatives from the University's CSSD and Facilities Management groups to review scope of work and submittals prior to beginning any work.

1.04 QUALITY ASSURANCE

A. UL Compliance: Provide cables that have passed the UL VW-1 flame test. All cables shall be rated for the environment where they will be installed.

1.05 ABBREVIATIONS

A. Utilize the following abbreviations for the Drawings and Specifications.

1. MDF – Main Distribution Frame

2. IDF – Intermediate Distribution Frame

1.06 SCHEDULING

A. Coordinate the work with the General and Sub-contractors, and the scheduled work of the other trades. Size and bend radius of all raceway must adhere to all EIA/TIA standards and manufacturers requirements.

B. Schedule installation of all work to minimize the possibility of damage during construction.

1.07 RECORD DOCUMENTS

A. When all work has been completed and prior to final acceptance, the Contractor shall furnish to CSSD a complete set of CAD marked drawings clearly showing the contract work and labeling.

B. Mark up a clean set of specifications to indicate approved substitutions, change orders, and actual equipment and materials used.

C. The Contractor shall meet with representatives from the University's CSSD and Facilities Management groups during construction, to review progress and address issues.

PART 2 - PRODUCTS

2.01 GENERAL

A. Product: New, free from defects and listed by UL when an applicable UL Standard exists. Provide product of a given type from one manufacturer.

B. All cable shall be installed in a neat and workmanlike manner.

C. Regardless of the length or completeness of the descriptive paragraph herein, provide product complying with the specified manufacturer's published specifications.

D. Provide product specified with the quality and standards established.

E. All abandoned backbone, vertical, fiber & riser copper shall be removed completely, per NEC 770.25 and 800.25, to each termination point, up to, and including the Fiber LIU or copper Patch Panel.

2.02 ACCEPTABLE MANUFACTURERS

A. Model numbers and manufacturers included in this specification are listed to establish a standard of product quality.

B. Other qualified manufacturers will be considered subject to prior approval of complete technical data, samples, and, if requested, results of independent testing laboratory tests of proposed equipment.

C. All copper cable, connectors, and hardware shall comply with the warranty requirements of Section 271500 – Horizontal Cabling Requirements.

D. Manufacturers: General is the primary manufacturer for vertical copper cable. Panduit is the secondary manufacturer for ***copper riser*** cable and is acceptable. Panduit or AFL is the primary manufacturer for ***fiber*** cable and General is the secondary for fiber cable. CSSD's preferred local distributor for infrastructure materials is Anixter.

2.03 EQUIPMENT

A. Optical Fiber Distribution Cable-Multimode (General, Panduit, or AFL) CSSD's preferred local distributor for infrastructure materials is Anixter.

1. Physical Specifications: Multimode Cable – 50 micron, tight buffered (900 micrometers), laser-optimized, optical cable with extended bandwidth (OM4). Maximum attenuation of 3.50dB/km at 850 nm and 1.50dB/km at 1,300 nm. Minimum Modal Bandwidth: 3500 MHz-km at 850 nm, 500 MHz-km at 1,300 nm for Overfilled Launch and 4700 MHz-km at 850 nm for "Laser" Launch. EIA/TIA 568-B.3, IEEE 802 compliant. Link distance support for 10GBase-SR of 550 meters, 10GBase-LX4 of 300 meters, 10GBase-LRM of 220 meters, 40GBase-SR4 of 150 meters, and 100GBase-SR10 of 150 meters.
2. Refractive index profile: Graded index.
3. Jacket: UL listed, non-conductive,
4. Fiber Count: as specified by CSSD per project requirement.
5. Optical Fiber Connectors Multimode: Panduit ST Connectors or AFL FuseConnect ST Connectors. Mated pair insertion loss shall be less than 0.75 dB. Connector shall accept both 250 and 900-micron fiber coatings. Fiber Optic Connector utilizes a zirconia

ferrule for fiber alignment. The connector has push-pull hardware for easier connections, as well as high optical stability. Each optical fiber strand shall be secured to the ferrule with anaerobic epoxy and the end faces are to be polished appropriately. Connector must be compliant with TIA/EIA 568-B.3. Under no circumstances are "crimp-and-cleave" type connectors acceptable for terminating multimode fiber.

B. Optical Fiber Distribution Cable-Single Mode (General, AFL, or Panduit) - CSSD's preferred local distributor for infrastructure materials is Anixter.

1. Physical Specifications: Singlemode Cable – 8.3/125 micron, tight buffered (900 micrometers) optical cable. Maximum attenuation of 1.0 dB/km at 1300 nm, 1.00dB/km at 1,550 nm. EIA/TIA 568-B.3, IEEE 802 compliant.
2. Refractive index profile: Graded index.
3. Jacket: UL listed, non-conductive, ONFP rated.
4. Fiber Count: as specified by CSSD per project requirement.
5. Single Mode: Panduit SC Connectors or AFL FuseConnect SC Connectors. Fiber Optic Connector utilizes a zirconia ferrule for fiber alignment. Insertion loss average shall be 0.15 dB. The connector has push-pull hardware for easier connections, as well as high optical stability. Each optical fiber strand shall be secured to the ferrule with anaerobic epoxy and the end faces are to be polished appropriately. Connector must be compliant with TIA/EIA 568-B.3. Under no circumstances are "crimp-and-cleave" type connectors acceptable for terminating singlemode fiber.

C. Copper Distribution Cable: CSSD's preferred local distributor for infrastructure materials is Anixter.

1. Outside Plant: General is the primary manufacturer; Essex is the secondary manufacturer and is acceptable; pair count as specified by CSSD per project requirement.
2. Inside Plant/Riser Rated: Panduit is the primary manufacturer; General is the secondary manufacturer and is acceptable; pair count as specified by CSSD per project requirement.
3. CAT 5E (25 pair) cable is the standard for Vertical Backbone copper cabling from each MDF to each IDF.

D. Optical Fiber Interconnect/Rack Mount - Panduit - CSSD's preferred local distributor for infrastructure materials is Anixter.

1. Provide rack mounted optical fiber cabinet(s) and appropriate adapters in each MDF/IDF Room as indicated on drawings per CSSD construction requirements. Panel(s) shall come with rack mounting brackets that allow it/them to be mounted on a 19" rack.
2. Panel shall contain rear corner slots for cable entry, wire retainers for holding the buffered fiber in place, and fiber storage drums for maintaining a minimum bend radius of 1.5 in. (3.81 cm) for the buffered fiber.
3. Provide SC duplex adapter panels and blank filler panels for all unused openings.
4. Provide ST adapter panels and blank filler panels for all unused openings.
5. All connectors must have appropriate dust covers in place as soon as termination is completed, and termination work should be scheduled at a point in the construction timeline to minimize the possibility of the new connectors becoming contaminated with dust and construction debris.
6. Provide a minimum 30 feet service loop on all fiber cables inside each MDF/IDF room. CSSD will provide guidance on the location of the service loop.
7. Provide only Velcro type wire wraps in all MDF/IDF Rooms. No tape or plastic wraps shall be permitted. Velcro wire ties shall be installed 'hook side out'.
8. CSSD will provide a single optical fiber cabinet for each MDF/IDF (Panduit Part

#MRE3). Additional optical fiber cabinets are the responsibility of the EC.

E. CAT 5E Patch Panels (Copper Riser): Panduit Part Number (#DPA245E88TGY) CSSD's preferred local distributor for infrastructure materials is Anixter.

1 Panel(s) shall come with rack mounting brackets that allow it/them to be mounted on a 19" rack.
2 Wiring blocks shall be available for 24 pairs. (A single 25 pair CAT 5E copper cable should be installed from each MDF to each IDF.)
3 Connecting blocks shall be available as kits that include the wiring blocks, the proper number of connecting blocks and label strips for 24 pair sizes.
4 Connecting Blocks shall be 4 pair configuration. Provide all connecting blocks to terminate 24 pair.
5 Wiring blocks shall be fire-retardant molded plastic block with horizontal strips, each of which secures and organizes cable pairs.
6 Connecting blocks shall be rated EIA/TIA Category 5E compliant.
7 Connecting blocks shall accept 22-26 (0.4-0.65mm) solid copper conductors and 22-26 (0.4-0.65mm) 7-stranded copper conductors.
8 Provide only Velcro type wire wraps in all MDF/IDF Rooms. No tape or plastic wraps shall be permitted. Velcro wire ties shall be installed 'hook side out'.
9 Binder can forgo the last pair (Violet Slate).
10 CSSD will provide a single 24 Port Patch Panel for each MDF/IDF. Additional 24 Port Patch Panels are the responsibility of the EC.

G. Inner Duct – (Inside Plant) Carlon, eABF, or Pyramid - CSSD's preferred local distributor for infrastructure materials is Anixter. (Both Inside & Outside Plant) – Must be a ducted tube (microcell) capable of being pushed without air 200 feet. Each microcell must be capable of carrying at least (48) strands of fiber.

1 All optical fiber shall be installed in Inner Duct Ducted Tube (microcell) raceway. All Inner Duct will be UL listed and shall be 1.25" diameter.
2 The standard number of microcells for the ducted cell Inner Duct to each IDF is nine.
3 Each IDF should have an individual nine microcell, ducted tube, Inner Duct from the MDF.
4 The Backbone Inner Duct into the MDF from the Outside Plant should contain nineteen microcells.
5 Inner Duct will be plenum rated, UL listed, and contain a factory installed pull tape.
6 Inner Duct shall be corrugated, orange in color and labeled "Danger Optical Fiber" a minimum of every 50 feet.
7 Inner Duct must be labeled with cable count at far-and-near end points. Specific labeling requirements will be provided by CSSD.

H. Cable Runway System

A. Manufacturers: Chatsworth

B. General: Except as otherwise indicated, provide metal cable runways of types, classes and sizes indicated with splice connectors, bolts, nuts and washers for connecting units.

C. Runway Types: Material specifications for each runway type are as follows:

1 Solid Bar style runway: Runway shall be ladder type with 1-1/2 inch stringer height with welded rungs.

2 Stringer side rail shall conform to the minimum chemical and mechanical properties of ASTM A36 structural steel.

3 Cable runway rungs shall be constructed from ASTM A1011 SS Grade 33 structural steel. Each rung shall be 1/2 inch by 1 inch steel c-channel shape with radius edges.

4 Runway shall be at least 12 inches wide and installed as shown on drawings.

D. Ground runway sections to grounding bus bar located in MDF/IDF Room per ANSI/TIA/EIA 606 & 607 specification.

PART 3 – EXECUTION

3.01 GENERAL

A. Coordinate incorporation of the work specified herein with other project work so as to facilitate an industry standard final product.

B. All cable shall be installed within industry best practice and standards.

C. Strictly adhere to all industry and manufacturer's installation practices when installing optical fiber cabling, maximize duct and raceway utilization and maintain 40% fill factor.

D. As all fiber/copper cable is to be terminated in the racks/cabinets, no plywood is required on the walls.

E. Contractor will be responsible for all consumables required to perform an industry standard installation as part of the base bid and in accordance with CSSD standards.

3.02 DELIVERY, STORAGE AND HANDLING

A. Ship product in its original container, to prevent damage or entrance of foreign matter.

B. Handling and shipping in accordance with manufacturer's recommendation.

C. Provide protective covering during construction, to prevent damage or entrance of foreign matter.

D. Replace, at no expense to Owner, product damaged during storage, handling or the course of construction.

E. Any remaining consumables will be packaged and delivered to CSSD within two weeks of project completion.

F. All job sites are to be properly secured, with access limited only to authorized persons. The Contractor shall be responsible for securing the job site at the end of each work day.

3.03 INSTALLATION

A. Install copper distribution cables and associated equipment in accordance with industry standards and manufacturer's written recommendations.

B. Install copper cable without damage to pairs, or jacket. Ensure that manufacturer's recommended pulling tensions are not exceeded. Do not at any time bend cables to smaller radii than recommended by manufacturer.

C. All copper pairs must be terminated, usable, and meet specifications. Do not splice fiber or copper cable runs between MDF and IDFs.

D. At each MDF/IDF room, coil a minimum of ten feet of copper cable as a Service Loop for future relocation.

E. Install optical distribution fiber, copper distribution cables, and associated equipment in accordance with industry standards and manufacturer's written recommendations.

F. Install optical distribution fiber cable without damage to fibers, cladding or jacket. Ensure that manufacturer's recommended pulling tensions are not exceeded. Do not at any time bend cables to a smaller radius than recommended by manufacturer.

G. Optical fiber: No splicing is allowed, with the exception of a transition splice at each end of a run if armored cable is used for inter-building runs. Such splices are to be made inside of the building at each end, in a location to be determined by CSSD. Pre-connectorized or field connectorization is acceptable. Connector installation shall be anaerobic epoxy and the end faces are to be polished appropriately. "Crimp and cleave" type connectors are not acceptable under any circumstances.

H. All optical fiber cables shall be installed in plenum rated microcell innerduct. Install optical fiber cable simultaneously where more than one cable is being installed in the same raceway or innerduct. Use an approved pulling lubricant where necessary.

I. All fibers must be terminated, usable, and meet specifications.

J. At each MDF/IDF room, coil a minimum of thirty feet of optical fiber cable for future relocation. Properly support innerduct and cable along the entire pathway. CSSD will provide guidance on the placement of service coils.

K. Clean optical fiber cable and components of dirt and construction debris upon completion of installation and termination. Install dust covers on fibers after cleaning.

3.04 LABELING

A. Securely label all cables at each entry and exit point of conduit, innerduct, or raceway. Label the inner duct with "Fiber Optic Cable" cable number, fiber count, starting location, end location, and installation date. Label the copper cable with starting location, end location, pair count, and installation date.

Rack-mount units

"Rack" in this context could refer to a relay rack or an enclosed cabinet.
Each rack is assigned a row number and a rack number, based on the ID of the room where it is located. These numbers start at 1 and increment sequentially as needed. Row and rack numbers will be determined by CSSD, but normally run from left to right in a given row and rows run front to back.

Fiber termination bays in a given rack are numbered starting at 1, which would be at the top of the rack, and incrementing as more bays are added, working down from the top. Existing devices (electronics, Ethernet patch panels, etc) in a given rack do not interfere with the numbering of the fiber termination bays.

A room ID (EHB4A, for example) is a combination of the two-letter building code assigned by CSSD ("EH" for Old Engineering Hall) and the MDF/IDF room number ("B4A" in this example). CSSD will provide actual building code.

In the "EHB4A" example above, the first rack in the first row in that room would be "EHB4A-R1-1", with the "R" indicating that the unit is a rack.

A rack mounted fiber termination bay ID follows the form:
(ROOM_ID)-R(RACK_ROW_ID)-(RACK_ID)-(POSITION_IN_RACK)

Extending the examples above, the first (uppermost) fiber termination bay in the first rack in the first row in room EHB4A would be "EHB4A-R1-1-1". The next bay below this one, in the same rack, would be "EHB4A-R1-1-2". The first bay in the next rack in that row would be "EHB4A-R1-2-1" and the first bay in the first rack in the next row would be "EHB4A-R2-1-1".

Additional notes

1. Fiber to multiple locations, such fiber from an MDF to several IDFs in the same building, may terminate in the same bay in the MDF, if necessary. The bay needs to be labeled appropriately to denote which panels within the bay terminate fiber to each specific location. Label is to include both endpoints of the fiber terminations.
2. Labels are to be made using a label printer. Hand-written labels are not acceptable.
3. Notations made to the legend card (if applicable) in a given bay should also be made using a label printer.
4. If the finish of a termination bay prevents adhesive labels from sticking properly, the relevant area of the finish may be lightly sanded to allow for a better contact between the label and the surface. This problem is common on bays that have a textured finish.

B. Provide typed label on each patch panel designating port signal. Provide an 80 pound paper stock utilizing 10 point block sans serif font, unless manufacturer supplied labels and schemes are included with products. Panels shall be properly labeled on front and back with the cable number and port connections for each port.

C. Provide labeling compliant with ANSI/TIA/EIA 606 standards and per Owner’s requirements.

D. Provide logical and legible cable wiring label permanently affixed for easy identification.

1. Labels on cables to be adhesive strip type covered with clear heat-shrink tubing. Factory stamped heat shrink tubing may be used in lieu of the adhesive strip style.
2. Wiring designator to be an alphanumeric code unique for each cable.
3. Labels shall not be handwritten.

3.05 TESTING

A. Testing is crucial in assuring the overall integrity and satisfactory performance of the intrabuilding backbone system.

B. Prior to usage, test all equipment and components in accordance with manufacturers’ published test procedures. In addition, test optical fiber cable in accordance with TIA/EIA 568-B.3 at both 850 nm and 1300 nm window for multimode optical fiber. Record and submit an electronic copy of all results, as specified in section 3.08. Multimode optical fiber is to be tested at 850 and 1300 nm, and single mode optical fiber is to be tested at 1310 and 1550 nm.

C. Any cable, which fails any test, must be removed, replaced, and re-tested at no additional cost to the Owner.

D. The optical fiber tests shall include but not limited to:

1. Backbone Link Measurement

    a. Each strand of the backbone optical fiber cabling link segment shall be tested in two directions for end-to-end attenuation. Testing shall be performed at both operating wavelengths to account for attenuation deltas associated with wavelength. Multimode optical fiber strands shall be tested at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper. Singlemode optical fiber strands shall be tested at 1310 nm and 1550 nm, in accordance with TIA/EIA-526-14A, method B.
    b. Because backbone length will vary depending upon site conditions, the link attenuation equation should be used to determine acceptance values based upon this standard's component requirement at each of the applicable wavelengths, ANSI/EIA/TIA – 568.B.1 11.3.3.4.

E. The copper distribution cable tests shall include but not limited to:

1. Pair Integrity

    a. Continuity to the remote end
    b. Shorts between any two or more conductors
    c. Crossed pairs
    d. Reversed pairs
    e. Split pairs
    f. Power faults
    g. Ground faults
    h. Foreign voltage
    i. Sheath continuity
    j. Any other miswiring

2. Record and submit a hard copy of all results.

3.06 TEST EQUIPMENT

A. Thirty days prior to start of testing, provide a list of test equipment make, model numbers, adaptors and calibration dates that will be used. Test equipment to be of the kind and quality recommended by the manufacturer of the components being tested.

B. Notify the Owner and engineer seven (7) working days prior to testing dates. Owner or Owner's representative shall have the right to witness any/all testing. Upon completion of testing, all test results and a statement of certification shall be forwarded to the engineer for approval. Failure to comply may result in Contractor performing all tests in the presence of the Owner or Owner's representative at no additional cost.

C. Equipment listed by manufacturer and model number establishes a standard of quality; other approved equal equipment will be acceptable.

D. Contractor, at his own expense, shall perform all tests directed by an inspection authority, Engineer, or as required by the Manufacturer.

E. Furnish the following equipment if needed. Equipment to be available for the entire test period through final System testing:

1. Ladders and scaffolding necessary to inspect cable in cable trays and ceiling mounted junction boxes.
2. Optical Time Domain Reflectometer (OTDR). OTDR must do Tier 1 and Tier 2.

3. Optical Power Meter. 850/1300nm LED light source. For single mode fiber, 1,310/1,550 nm laser light source for testing purposes.
4. Test-All 25-Independent Technologies Inc.
5. Fluke Level III Cable Tester

3.07 FINAL INSPECTION AND TEST

A. Upon completion of installation, initial adjustments, tests and measurements specified above, and submission and review of the results, a final inspection and test will be observed by the Owner, Owner's Representative, or Engineer no earlier than two weeks after receipt of the written results.

B. Provide a minimum of one person for inspection and two persons for testing familiar with aspects of the System to assist.

C. The process of testing the System may necessitate moving and adjusting certain components.

D. Testing includes operation of each major system and any other components deemed necessary. Perform tests and provide required test equipment, tools and material required to make any necessary repairs, corrections, or adjustments.

E. The following procedures will be performed on each System:

1. Inspection of the methods and means employed to incorporate the System within the facility.
2. Verification of proper operation, from controlling devices to controlled devices.
3. Verification of proper adjustment, balance, and alignment of equipment for optimum quality and to meet the manufacturers published specifications.
4. Other tests on equipment or systems deemed appropriate.

F. In the event the need for further adjustment or work becomes evident during testing, the Contractor is to continue his work until the System is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications and any extension of the inspection and testing period is required, the contract price will be reduced for the additional time and expenses of the Owner, at the standard rate in effect at that time.

3.08 DOCUMENTATION

A. Test documents shall be provided by the installer to CSSD in electronic format, delivered either via electronic mail, or on appropriate storage media (CD-ROM, USB flash drive, etc).. PDF documents are preferred, but other industry-standard formats are acceptable. The documents should include the following:

1. Fiber test results.
2. Copper test results.
3. Manufacturers' and warranty certificates.

END OF SECTION

SECTION 271500 – HORIZONTAL CABLING REQUIREMENTS

This documentation shall include but not limited to all cabling, conduits, data outlets, distribution patch panels, equipment racks and wire management systems as required for a fully tested and certified data/voice network based on a structure cabling end-to-end implementation to be installed by the Contractor. CSSD shall be responsible for providing all active telecommunications electronics for all networks, e.g. UPSs, data routers, data switches, wireless access points, voice switches, and telephony peripherals.

No deviation from this standard shall be incorporated without written direction from the University's Computing Services and Systems Development group (CSSD).

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Telecommunications Systems Drawings and general provisions of the contract including general supplementary, special conditions and Division 1 Specification Sections apply to this section.

B. Related Sections:

1. Division 27 Section – "Underground Duct Banks and Utility Structures"

2. Division 27 Section – "Cable Tray for Telecommunications"

3. Division 27 Section – "Telecommunications Room Requirements"

4. Division 27 Section – "Backbone Cabling Requirements"

1.02 SUMMARY

A. This specification describes the actions to be taken, tasks to be performed and responsibilities of the Certified Cabling Contractor in order to provide and install a complete Warranted Horizontal Structured Cabling **Panduit** System. A Certification Plus System Warranty shall provide a complete system warranty to guarantee end-to-end high performance cabling systems that meet application requirements. The guarantee shall include cable and connectivity components and have one point of contact for all cabling system issues. The system shall be warranted for a period of at least 20 years. Unless otherwise noted all following sections, which describe such actions, tasks, and responsibilities refer to the Contractor.

1. A factory registered Panduit PCI contractor shall complete network installation. The contractor shall have completed standards based product and installation training. A copy of the PCI Contractor Registration shall be submitted in the proposal.

2. A factory registered Panduit PCI contractor shall have a Superintendent on the job with at least 10 years' experience.

3. A factory registered Panduit PCI contractor shall have at least one BICSI RCDD on staff locally.

4. A factory registered Panduit PCI contractor shall be Union Affiliated.

B. No terms used in this specification are intended to indicate that work or equipment called for shall be less than completely executed or installed or that system shall be less than complete in any respect.

C. Demarc and IDF(s) will be served by means of copper and optical fiber backbone cabling. See specification section 271300.

D. Install the cabling plant constructed in a physical star topology. Serve information outlets from IDF(s) by means of unshielded twisted pair (UTP) Category 6A copper, with 568B pin configuration.

E. Provide, install, terminate, test, and label cable to each information outlet as indicated on drawing.

1.03 ABBREVIATIONS

A. Utilize the following abbreviations for the Drawings and Specifications

1 NEC National Electrical Code
2 ANSI American National Standards Association
3 NFPA National Fire Protection Association
4 IEEE Institute of Electrical and Electronic Engineers
5 NEMA National Electrical Manufactures Association
6 UL Underwriters' Laboratories, Inc.
7 ASTM American Society of Testing Materials
8 ASA American Standards Association
9 ICEA International Cable Engineers Association
10 EIA Electronic Industries Association
11 TIA Telecommunications Industries Association
12 FCC Federal Communications Commission
13 OSHA Occupational Safety and Health Act
14 OEM Original Equipment Manufacturers
15 EC-Sub Teledata Contractor for Electrical Contractor
16 EC Electrical Contractor

1.04 DEFINITIONS

A. Utilize the following definitions for the Drawings and Specifications

1 "PROVIDE" or "FURNISH" means to supply, purchase, transport, place, erect, connect, test and turn over to Owner, complete and ready for regular operation, the work referred to.
2 "SUPPLY" means to purchase, procure, acquire, and deliver complete with related accessories.
3 "INSTALL" means to move from property line, set in place, join, fasten, attach, set up or otherwise connect together before testing and turn over to the Owner. Installation is to be complete and ready for regular operation.
4 "WIRING" or "CABLING" includes the furnishing of all fittings, conductors, connectors, grounding accessories, tape, connections, splices, labeling, and all other items necessary for such work.
5 "CONDUIT" and "CABLE SUPPORTS" include furnishing of all fittings, hangers, supports, sleeves, grounding etc.,
6 "AS DIRECTED" means as directed by the Owner or their representative.
7 "ACCEPTED" means as accepted by the Owner or their representative.
8 "CONCEALED" means embedded in masonry or other construction, installed behind wall furring or within double partitions, or installed within hung ceilings.
9 "EXPOSED" means not installed underground or "CONCEALED" as defined above.
10 "EQUAL" means equivalent as approved by the Owner or their representative.
11 "TMGB" means Telecommunication Main Ground Buss.
12 "TGB" means Telecommunication Ground Buss

1.05 PROJECT DRAWINGS AND SPECIFICATIONS

A. The Drawings and Specifications are not intended to define all details, finish materials, and special construction, which may be required or necessary.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. The Contractor shall verify the work of all other trades and shall arrange their work to avoid conflicts. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Engineer for approval, showing how the work may be installed.

C. It is the intent of the Drawings and Specifications to provide a complete and workable System ready for the Owner's use. Any item not specifically shown on the drawing or called for in the Specifications, but normally required to conform to the intent, is to be considered as part of the Contract. The Drawings and Specifications are not intended as a complete materials list of items required by the Contract.

1.06 SUBMITTALS

A. General: Submit the following in accordance with the Conditions of Contract and Supplementary Conditions Specifications Sections.

B. Submittals shall be made as complete systems including all required accessories and special installation tools (i.e. termination hardware).

C. Product information including the following cable transmission characteristics:

1 Mutual Capacitance
2 DC Resistance
3 Characteristic Impedance
4 Attenuation
5 Near-end Crosstalk (NEXT)
6 Far-end Crosstalk (FEXT)
7 Nominal Velocity of Propagation and Propagation Delay
8 Attenuation to Crosstalk Ratio (ACR)
9 Return Loss
10 Delay skew

D. Manufacturers' complete installation instructions including the following information:

1 Minimum bend radius
2 Maximum pulling tension
3 Recommended installation pulling points (i.e. every 270 degrees of bend in the raceway, or every 150 feet of raceway)
4 Recommended pulling lubricants

E. Provide information regarding all termination and connectors that shall be required for a complete installation.

F. Product Data. CSSD's preferred local distributor for infrastructure materials is Anixter.

1. Provide manufacturer's product data sheets for the following equipment for approval to CSSD no later than thirty (30) days after issuance of notice but prior to commencement of work to proceed.

- Patch Panels (fiber, UTP, etc.)
- Wall Jacks
  - Faceplates
  - Cable (fiber, UTP, etc.)
    Patch cords
  - Racks
  - Cable Management Devices
- Labeling

All other equipment identified or inferred. Submit complete list for Engineer/Owner approval.

1.07 PERMITS, CODES AND INSPECTIONS

A. General: Contractor shall obtain and pay for all permits and inspections necessary for the warranty and execution of any/all work pertaining to the installation and shall submit final approval certificates to the Owner or their representative.

B. Codes: The Telecommunications System installation shall comply fully with all local, county, and state laws, ordinances, and regulations applicable with electrical installations.

C. The Telecommunications System shall be in compliance with the requirements of the latest revisions of:

1 American National Safety Institute (ANSI)
2 American Society of Testing and Materials (ASTM)
3 Americans with Disabilities Act (ADA)
4 Building Officials and Code Administrators (BOCA)
5 Building Industry Consulting Service International (BICSI)
6 BICSI's Telecommunications Distribution Methods Manual (TDMM)
7 Electronics Industries Association (EIA)
8 Federal Communications Commission (FCC)
9 Institute of Electrical and Electronic Engineers (IEEE)
10 Legislative Act 235 (1965) - Handicapped
11 National Board of Fire Underwriter's (NBFU)
12 National Cable Television Association (NCTA)
13 National Electrical Manufacturer's Association (NEMA)
14 National Electrical Safety Code (NESC)
15 National Electrical Code (NEC)
16 Society of Cable Television Engineers (SCTE)
17 Telecommunications Industries Association (TIA)
18 Underwriters Laboratories (UL)
19 All requirements of the electrical and utility companies.
20 All approved published instructions set forth by equipment manufacturers.

D. At the completion of the work, submit all certificates issued by approved agencies to indicate conformance of all work with the approved requirements, as well as any additional certificates as may be required for the performance of this contract work.

E. Should any change in Drawings or Specifications be required to comply with governmental regulations, the Contractor shall notify the engineer prior to execution of the work. The work shall be carried out according to the requirements of such code in accordance with the instructions of the engineer and at no additional cost to the Owner.

1.08 QUALITY ASSURANCE

A. Provide work complying with all applicable codes, standards, and manufacturers' requirements.

B. UL Compliance: Comply with applicable requirements of UL Standard 910 "Test Method for Fire and Smoke Characteristics of Cable Used in Air Plenum Spaces". Provide products that are UL-listed and labeled as such.

C. Comply with the following Telecommunications Industry Association (TIA) and Electronic Industries Association (EIA) Standards:

1 TIA/EIA 568-B.1 568-B.2 & 568-B.3 "Commercial Building Telecommunications Cabling Standard"
2 TIA/EIA 569-A "Commercial Building Standard for Telecommunications Pathways and Spaces.
3 TIA/EIA 606 "The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings"

1.09 VISITING PREMISES

A. General: The Bidder shall visit the project site prior to submitting the Bid, in order to verify conditions on the job site applicable to this work. Notify Engineer in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. By submission of a bid, the Contractor is attesting that responsible personnel did, in fact, visit the site during the bidding period and verified all existing pertinent conditions.

1.10 COOPERATION AND COORDINATION WITH OTHER TRADES

A. Coordinate the work with the General and Electrical Contractors, and the scheduled work of all other trades.

1.11 RECORD DOCUMENTS

A. When all work has been completed and prior to final acceptance, the Contractor shall:

a. Furnish to CSSD and the engineer a complete set of CAD marked drawings clearly showing all contract work and labeling.

b. Mark up a clean set of Specifications to indicate approved substitutions, change orders, and actual equipment and materials used.

1.12 WARRANTY/WARRANTY MANUALS

A. At the conclusion of the work, prepare warranty manuals in accordance with the following information.

B. Any material or equipment that does not comply with the requirements of the Contract Documents or which is damaged prior to acceptance will be deemed as defective and shall be removed and properly replaced at no additional cost to the Owner.

C. Warranty and Certification of the Structural Cabling System:

1 The Contractor shall provide a minimum twenty year product and performance warranty that all cable, connectors, and connecting hardware shall be free from defects in material, workmanship and fabrication.

2 The system shall be certified by the cable/component manufacturer and warranted for the specified performance for a minimum of twenty years. The Contractor shall conform to the manufacturer's certification program including submittal of all required documentation to the manufacturer.

3 The Contractor shall obtain, from the manufacturer, a Registration Document and Certificate for the specific installation. Upon receipt of the Registration Document and Certificate, the Contractor shall forward a copy to the Engineer and deliver the original to the Owner.

D. Provide complete warranty information for each item to include date of beginning of warranty, names, addresses, telephone numbers, and procedures for filing a claim to obtain warranty service.

E. Within the warranty period, answer service calls within eight hours, and correct the deficiency within twenty-four hours.

PART 2 - PRODUCTS

2.01 GENERAL

A. Product: New, free from defects and listed by UL when an applicable UL Standard exists. Provide product of a given type from one manufacturer.

B. Regardless of the length or completeness of the descriptive paragraph herein, provide product complying with the specified manufacturer's published specifications.

C. All abandoned horizontal copper & fiber cable shall be removed completely, per NEC 770.25 and 800.25, to each termination point, up to and including the Wall Jack and Patch Panel.

2.02 ACCEPTABLE MANUFACTURERS

A. Model numbers and manufacturers included in this specification are required as the CSSD standard. CSSD's preferred local distributor for infrastructure materials is Anixter.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. All proposed equipment shall

be equivalent in every way to that of the equipment specified and subject to approval. If products of alternate manufacturers are selected from the approved manufacturers list, they must be equal to or exceed the standards and quality criteria set forth in this document. Alternate manufacturers must submit catalog cuts and samples for approval 10 days prior to bid date.

2.03 EQUIPMENT

A. General: The items indicated below shall not be construed as a "bill of materials". They represent items of significance used during the design of the Horizontal Cabling System. Where the items indicated are one portion of an assembly, the entire assembly shall be provided unless specified otherwise. Where items do not have a manufacturer or part number listed, no particular items have been selected at this time. CSSD's preferred local distributor for infrastructure materials is Anixter.

B. Two post 84" x 19" Relay Rack: Panduit (Part #CMR-19X84) CSSD will provide all Relay Racks (or Cabinets) unless otherwise noted on the drawings.

a. Relay Racks or Cabinets will be installed by the EC.
b. Racks shall be supported at the top by a 12" wide Solid Bar Type Ladder Tray, which will be secured to the walls of the MDF/IDF at both ends of the Ladder Tray. CSSD should be consulted as to proper installation points of the Ladder Tray.
c. Two 120v, 30 amp, single phase, electrical circuits with L5-30 (Locking) Receptacles shall be mounted on the Ladder Tray above each rack.
    i. One circuit shall use Optional Standby Power if available.
    ii. One circuit shall use House (Normal) Power.
    iii. If Optional Standby Power is not available, only one circuit is required.
d. The Receptacles should be facing to the rear of the Racks.
e. The Contractor is responsible for the Ladder Tray.

C. 48 Port Patch Panels – UTP: Panduit (Part #DPA486X88TGY)

1. Provide necessary panels equipped with 110-style termination made of fire retardant UL 94V0 rated thermoplastic.
2. Panel circuit boards shall be fully enclosed front and rear for physical protection.
3. Panels shall have port identification numbers on both the front and rear of the panel.
4. Panels shall provide wiring identification & color code and maintain a paired punch down sequence that does not require the overlapping of cable pairs. Panels shall be available in T568B wiring schemes.
5. Panels shall be ANSI/TIA/EIA-568-B.2 and ISO/IEC 11801 Category 6A compliant. Panels shall be UL VERIFIED for TIA/EIA Category, 6A performance.
6. Panels shall include rear cable management brackets to facilitate cable terminations.
7. Cables shall route from right and left of patch panels to facilitate terminations.
8. No 110 Connecting Blocks are acceptable.
9. CSSD will provide the first 48 Port Patch Panel as part of the Relay Rack Kit. The EC is responsible for all remaining 48 Port Patch Panels.

E. Cable Management

1 Depending on the density of cables in the IDF, multiple racks may be required.
2 Patch cord organizers create defined pathways for patch cords. Horizontal organizers shall be provided above and below every rack mounted patch panel. Vertical organizers shall be provided on each rack as indicated on the drawings.

3 Patch cord organizers, when properly installed, shall play a key role in creating a clean installation and allow easy access when circuits are moved, added or changed.

4 CSSD will provide a single Horizontal Organizer as part of the Rack Kit. Additional Horizontal Organizers are the responsibility of the EC. One Horizontal Organizer is required per 48 Port Patch Panel.

F. Cable Runway Systems

1 Manufacturers: Chatsworth

2 General: Except as otherwise indicated, provide metal cable runways of types, classes and sizes indicated with splice connectors, bolts, nuts and washers for connecting units.

3 Runway Types: Material specifications for each runway type are as follows:

i) Welded Wire (Basket Tray): Cable tray shall be constructed of welded wire mesh (high strength steel wires) with a continuous safety edge wire lip. Cable tray shall be complete will all tray supports, materials, and incidental and miscellaneous hardware required for a complete cable tray system.

(1) Finish: Carbon steel with electro-plated zinc galvanized finish.

(2) Width: Widths shall be as shown on the Contract Documents. Where cable tray width is not shown on the Contract Documents, it shall be sized according to the amount of cable to be placed in the trays (as shown on the Contract Documents) plus an additional 100% for future expansion capability.

(3) Depth: 2 inches.

(4) Mesh: 2 x 4 inches.

(5) Width: 12 inches

(6) Fittings: Fittings shall be field fabricated from straight sections using manufacturer-approved tools and in accordance with manufacturer's instructions.

ii) Solid Bar Style (Ladder Tray): Cable tray shall be ladder type with 1-1/2 inch stringer height with welded rungs

(1) Stringer side rail shall confirm to the minimum chemical and mechanical properties of ASTM A36 structural steel.

(2) Cable runway rungs shall be constructed from ASTM A1011 SS Grade 33 structural steel. Each rung shall be 1/2 inch by 1 inch steel c-channel shape with radius edges.

(3) Runway shall be 12 inches wide and installed as shown on drawings.

4 Ground runway sections to grounding bus bar located in MDF/IDF Room per ANSI/TIA/EIA 606 & 607 specification.

5 Basket tray is the delivery system for horizontal cabling throughout the floor.

6 Ladder tray is the delivery system for cabling in each MDF/IDF.

7 J- Hooks or bridal rings are not acceptable.

G. UTP Cable – Plenum Rated: General GenSpeed 10,000 is the primary manufacturer; Panduit TX6A 10Gig UTP Copper Cable is the secondary manufacturer and is acceptable. Cabling is distributed via cable tray throughout the floors.

1 Category 6A - Physical Specifications: 4-23 AWG unshielded twisted pairs, characteristic impedance @ 1.0 –500 Mhz 100 ± 15 %, nominal mutual capacitance 14 nF/1000 ft @ 1khz. Maximum capacitance unbalance (pair-to-ground) 400 pF/1000 ft. EIA/TIA 568-B.2-10 compliant

2 Category 6A – Cable Construction: Consists of 23-AWG solid-copper conductors insulated with color-coded FEP (all pairs & jacket) compounds and sheathed with a LSPVDF outer jacket. Plenum UL910, CMP rated.

3 Category 6A – TIA/EIA Internal Channel Test Limits over Category 6A cabling (568-B.2-10) at 500 MHz:
a. Frequency Range 1-500 MHz
b. Propagation Delay 536 nSec
c. Attenuation 49.4 dB
d. NEXT 26.1 dB
e. Power-sum NEXT 23.2 dB
f. ACR -23.2 dB
g. Power-sum ACR -26.1 dB
h. ELFEXT 9.3 dB
i. Power-sum ELFEXT 6.3 dB
j. Return Loss 6.0 dB

4 Cables for data/voice cabling shall be color blue.
5 Cables for wireless access point station cabling shall be color green.
6 All MDF/IDF patch cords (Category 6A patch cords, blue for data/voice and green for Wireless Access Points, to cross-connect from patch panel to data switch) are the responsibility of the contractor.

Alternate UTP Cable: (Panduit Part #PUP6ASD04BU-UG, No Substitutions)

Ideal for distances up to 60 meters, offering a smaller cable diameter compared to Category 6 UTP cable; cable diameter 0.240 in (6.1mm) nominal.

H. Faceplates

1 Provide Panduit faceplates for single gang and double gang installation.
2 Panduit faceplates shall accept modular 8 position/8 conductor information jacks.
3 Color, finish, and design shall be white, E/I, or building location requirements.
4 See drawings for faceplate configurations.

I. Faceplates-Wall Phones

1 Provide Panduit stainless steel faceplates for single gang installation.
2 Faceplates shall accept modular 8 position/8 conductor information jacks.

J. Modular Jacks Faceplates shall accept modular 8 position/8 conductor information jacks.

1 All information outlets are 8-position/8-conductor high-density non-keyed modular information jacks designed for networking applications using transmission rates with frequencies up to 100 MHz.

2 Category 6A jacks (Panduit Part #CJ6X88TGEI) shall be compatible with IEEE 802.3 applications. Fully supports 10 Mbps, 100 Mbps, and Gigabit Ethernet applications at 328 ft (100 m) over UTP.

3 Each jack shall be an individually constructed unit and shall snap mount in an industry standard keystone opening.

4 Jacks shall have a temperature rating of -10 °C (14°F) to 60°C (140 °F) in conformance with ANSI/TIA/EIA-568-B.2-10.

5 Pin/pair assignment shall be T568-B and Jack shall be marked as such.

6 Jacks shall utilize a paired punch down sequence. Cable pairs shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.

7 Jacks shall terminate 22-26 AWG stranded or solid conductors. Jacks shall terminate insulated conductors with outside diameters up to .050"

8 Jacks shall accept snap on icons for identification or designation of applications.

9 Jacks shall be supplied with installed dust covers to protect the jack opening and internal elements during installation until the jack is in use.

10 Jacks shall be UL VERIFIED for TIA/EIA 568-B.2-10 Category 6A electrical performance. Jacks shall be UL LISTED 1863 and CSA certified. Jacks shall be made by an ISO 9002 Certified Manufacturer.

11 Jacks shall be keystone type for poke-thru locations only. Quantity and location as per drawings.

12 Provide 20 additional jacks as maintenance spares.

K. Drawing Nomenclature

The following are examples of drawing nomenclature for Data & Voice Jack locations:

a.  1/0 – [1 Data – 1 Cable]

b.  1/1 – [1 Data/1 Voice (Standard Wall Jack) – 1 Cable] or simply 

c.  2/0 – [2 Data – 2 Cables]

d.  2/1 – [2 Data/1 Voice – 2 Cables]

e.  3/0 – [3 Data – 3 Cables]

f.  2/2 – [2 Data/2 Voice – 2 Cables]

g.  3/2 – [3 Data/2 Voice – 3 Cables]

h.  1/2 – [1 Data/2 Voice – 2 Cables]

i.  0/1 – Wall Phone Jack – 1 Cable] or simply 

<u>Voice requirements are still needed for electronics estimates by CSSD and are therefore required on the drawings.</u>

PART 3 – EXECUTION

3.01 GENERAL

A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final product.

B. All cable and equipment shall be installed in a neat and workmanlike manner.

C. Strictly adhere to all Industry and manufacturers' installation practices when installing UTP Category 6A cabling.

3.02 DELIVERY, STORAGE AND HANDLING

A. Ship product in its original container, to prevent damage or entrance of foreign matter.

B. Handling and shipping in accordance with manufacturer's recommendation.

C. Provide protective covering during construction, to prevent damage or entrance of foreign matter.

D. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

3.03 INSTALLATION

A. The installation recommendations contained within ANSI/TIA-568-B and ANSI/TIA-569, BICSI/TDMM and manufacturer recommendations are mandatory minimum standards and requirements.

B. Mount equipment and enclosures plumb and level.

C. Cables shall be installed without damaging conductors or jacket.

D. Ensure that minimum manufacturer's recommended pulling tension and bending radius specification are not exceeded.

E. Pull cables simultaneously where more than one cable is being installed in the same raceway.

F. Cables shall be run from the serving MDF/IDF rooms using Avenue and Streets design.

G. All avenues and streets shall run perpendicular to building structure. No diagonal routing shall be acceptable.

H. No splicing of copper cable shall be allowed.

I. Provide a minimum service loop of ten feet at both ends of cable runs. The total cable distance shall not exceed 90 meters in the permanent link.

J. Provide Velcro type tie wraps to bundle and manage cabling in all telecommunication rooms. Plastic cable ties or tape are not acceptable.

3.04 LABELING

A. Provide labeling to correspond between workstation jacks and respective patch panel port per CSSD's direction in accordance with current University labeling scheme.

Label: o[BldgId]-[BldgId][MDF/IDF]-nnnn
Example: oeh-eh110f-0025

B. Provide labeling to the front of the faceplate, on both ends of each cable, to the front of the patch panel. Install in a plumb, level, and permanent manner. All terminations shall be made in room number order.

C. Provide labeling compliant with ANSI/TIA/EIA-606. Handwritten labels are not acceptable.

D. Provide logical and legible cable wiring label permanently affixed for easy identification.

1 Labels on cables to be adhesive strip type covered with clear heat-shrink tubing. Factory stamped heat shrink tubing may be used in lieu of the adhesive strip style.
2 Wiring designator to be unique for each cable.
3 Locate the cable designator at the origination and destination of each circuit within 3 inches of the point of termination or connection.

E. Prior to final acceptance, the Contractor shall furnish, to both Facilities Management and CSSD, a comma separated value (CSV) file or spreadsheet containing the wire number, cable type, room number, cubicle number, or general location of the station data jack for all cables installed in accordance with University current labeling scheme. Contractor shall also provide CSSD with as-built drawing identifying wire numbers by room.

F. Mark up a clean set of specifications to indicate approved substitutions, change orders, and actual equipment and materials used.

3.05 EMI/RFI AVOIDANCE

A. To avoid electromagnetic interference (EMI) cables shall be routed in such a way as to maintain the following minimum distance from possible sources of EMI.

(In certain instances, especially in Lab environments, cable installation in the Basket Tray will need to be run in a staggered, serpentine, pattern to avoid EMI/RFI. CSSD should be contacted to verify if this is required.)

B. Three inches from power lines of 2 KVA or less installed in conduits or grounded flexible metallic raceway in ceilings and below access floors.

C. Three inches from fluorescent fixtures with remotely installed ballasts.

D. Five inches from power lines 2 KVA or less.

E. Twelve inches from power lines 2 KVA to 5 KVA.

F. Twelve inches from high voltage lighting, including fluorescent lighting.

G. Forty six inches from transformers or motors.

H. Maintain a minimum twelve-inch separation between telecommunications cables running exposed in ceiling or floor spaces and parallel electrical cables/conduits.

I. Telecommunication cables that must cross electrical cables/conduits shall do so only at 90 degree angles.

3.06 HORIZONTAL WIRING, AND COMPONENTS

A. General: Provide proper cabling, connections, and terminations.

1. Take precaution to prevent and guard against electromagnetic and electrostatic interference. For example, in Laboratories, safeguards should be taken that cables be unevenly staggered, and not run in a straight line.
2. Avoid cable stress due to cable twist during pulling or installation, tension in suspended cable runs and tightly cinched cable ties.
3. Isolate cables and wires of different signals or different levels; and separate, organize, and route to restrict channel crosstalk or feedback oscillation.
4. Make connections with approved mechanical connectors properly applied with proper tooling.
5. Cover edges of cable and wire pass-through holes in chassis, housings, boxes, etc., with rubber grommets, nylon grommetting or waterfall type fittings.
6. Provide splice free wiring and cabling from origination to destination.

B. UTP Connector Terminations:

1. Pair twist is to be maintained as close as possible to the point of termination to lessen near end crosstalk. (NEXT)
2. Untwisting of pairs is not to exceed 13mm (1/2 inch) for Category 6A cable.
3. Install connecting hardware in a manner to provide a well-organized installation with cable management and in accordance with manufacturer’s guidelines.
4. Stripping of wire jackets shall not exceed 13mm (1/2 inch) to terminate individual pairs.

C. Patch Panels - UTP

1. Panels shall be installed to provide minimal signal impairment by preserving wire pair twists as closely as possible to the point of mechanical termination. The amount of untwisting in a pair as a result of termination to the patch panel shall be no greater than 0.5 inches (13 mm).
2. Stripping of wire jackets shall not exceed 13mm (1/2 inch) to terminate individual pairs.
3. Panels shall be installed according to manufacturer’s instructions and properly mounted to a rack, cabinet, bracket or other appropriate mounting device.
4. Panels shall be installed such that cables terminated to the panel can maintain minimum bend radius of at least 4 times the cable diameter into the IDC contacts. Cables shall be terminated on the panels such that there is no tension on the conductors in the termination contacts.

D. Horizontal UTP Cabling:

1 Horizontal cable shall be no greater than 292 ft., (90 meters) inclusive of all slack, from the outlet to the horizontal cross connect. The length of jumpers, patch cords and equipment cables in the MDF/IDF rooms shall not exceed 20 feet (10 meters).

2 Prevent near end crosstalk (NEXT) by keeping the amount of untwisting of the pairs to a minimum when terminating to the connecting hardware.

3 Install cable so that the pulling tension applied to the cable does not exceed 25ftlb or the manufacturer's guidelines whichever is lesser.

4 Install cable so that a radius bend of no less than four (4) times the cables outside diameter is maintained.

E. Wireless Access Point UTP Cabling:

1 A quantity of two (2) Green Category 6A (500 Mhz) plenum cables runs, each with a 10 ft. cable coil, must be installed to each identified Access Point (AP) location. See drawings for locations.

2 All cables will be installed directly to AP locations from IDF closets as identified by CSSD. Cables will be installed horizontally along floor cable tray through existing drop ceilings and hardwall ceilings, and vertically through existing riser shafts. All telecommunications cable runs must comply with current electrical, telecommunications, and fire codes. Cable lengths must not exceed 292' (90 m) per Category 6A standards.

3 From each AP both Category 6A cables (primary and secondary station cable) shall be terminated onto a Panduit 24 port patch panel (provided by CSSD, installed by contractor) in IDF relay rack. The Contractor is responsible for additional 24 Port Patch Panels, if required, for Wireless Access Points. Wiring must be installed in accordance with University wire management specifications.

4 Green Category 6A modular jacks are required for termination of Green Category 6A cables at the AP locations and at the patch panel locations. Green modular jacks are to be mounted in Dual Port Surface Housings located at each AP location. The primary station cable and secondary station cable are to be terminated, tested, and labeled; testing results are to be provided to CSSD per University telecommunications infrastructure specifications.

5 All required wall and floor/ceiling penetrations must be in accordance with current electrical, telecommunications, and fire codes. Cable support hardware is required for horizontal and vertical cabling per University telecommunications infrastructure specifications.

6 All cables and APs are to be identified per University designated labeling scheme.

7 Wireless access points and peripherals will be provided by CSSD according to current University specifications. Installation will be performed by contractors at specified locations using mounting brackets. Two (2) 3' ***White*** Category 6A patch cords from Dual Port Surface Housing jacks to AP will be installed for each AP.

8 Access Point antennas, if required, will be provided by CSSD. Installation will be performed by contractor and mounted to AP, wall, or acoustical ceiling per manufacturer's instructions. If specified by Facilities Management, exposed APs and/or antennae may require painting to match area finishes.

3.07 TESTING

A. Notify Owner/Owner representative ten (10) business days prior to testing. Owner has right to witness any/all testing. Test UTP Category 6A cable in accordance with TIA/EIA 568-B2.10 and manufacturer's specifications. Any measurement reported by the field tester shall have a specified accuracy (level III). Record and submit to CSSD Network Engineering/Telecommunications a soft and hard copy of all test results. Failure to notify

owner of testing will result in the Contractor having to retest all cables prior to final acceptance.

B. Contractor shall perform channel test for all horizontal links. Any cable, which fails any test, must be removed, replaced, and re-tested at no additional cost to the owner.

C. Primary Field Test Parameters for Category 6A shall include but not limited to:

1 Wire Map
2 Characteristic Impedance
3 DC Loop Resistance
4 Length
5 Propagation Delay
6 NEXT, NEXT @ Remote
7 Return Loss (RL), RL @ Remote
8 Delay Skew
9 Attenuation
10 Attenuation-to-Crosstalk Ratio (ACR), ACR @ Remote
11 ELFEXT, ELFEXT @ Remote
12 Power Sum ACR, PSACR @ Remote
13 Power Sum ELFEXT, PSELFEXT @ Remote
14 Average Noise
15 Power Sum NEXT, PSNEXT @ Remote

Final test results must include data and wireless jack ID, and room number.

D. Testing includes operation of each major system and any other components deemed necessary. Perform tests and provide required test equipment, tools and material required to make any necessary repairs, corrections, or adjustments.

E. No later than two (2) weeks upon completion of testing, a statement of certification shall be forwarded to the engineer/owner for approval.

3.08 FINAL INSPECTION

A. Upon completion of installation, initial adjustments, tests and measurements specified in Part 3, and submission and review of the results, a final inspection and test will be observed by the Owner, Owner's Representative, or Architect no earlier than two weeks after receipt of the written results.

B. Provide a minimum of one person for inspection and two persons for testing familiar with aspects of the System to assist at no additional cost to the contract.

C. Contractor, at his own expense, shall perform all tests directed by an inspection authority, Engineer, or as required by the Manufacturer.

D. The process of testing the System may necessitate moving and adjusting certain components.

E. In the event the need for further adjustment or work becomes evident during testing, the Contractor is to continue his work until the System is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications and any extension of the inspection and testing period is required, the contract price will be reduced for the additional time and expenses of the Owner, at the standard rate in effect at that time.

END OF SECTION

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SIGNAGE STANDARD CONSTRUCTION METHODS
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DIVISION M
SIGNAGE

M.1 SIGN TYPES

A. Sign Type 1

Sign Type 1 is an ADA compliant signage for room numbers and permanent room name identification.

1. Type 1 Construction
2. Type 1.0 2” x 8” room number
3. Type 1.1 1 line room name
4. Type 1.2 2 line room name
5. Type 1.3 3 line room name
6. Type 1.4 4 line room name
7. Type 1.8 2” x 8” room number, to be used when no room name signage will be needed.

B. Sign Type 2

Sign Type 2 is a non-ADA compliant sign used for identifying non-permanent areas, long term personnel areas and informational needs.

1. Type 2.0 Construction
2. Type 2.0 1-1/2” x 8” room number
3. Type 2.1 1 line room name
4. Type 2.2 2 line room name
5. Type 2.3 2 line room name
6. Type 2.4 4 line room name

C. Sign Type 3

Sign Type 3 is ADA compliant signage for restroom identification.

1. Type 3.1 Women’s restroom
2. Type 3.2 Women’s accessible restroom
3. Type 3.3 Men’s restroom
4. Type 3.4 Men’s accessible restroom
5. Type 3.5 Unisex restroom

6. Type 3.6 Unisex accessible restroom

7. Type 3.7 → to accessible restroom

D. Sign Type 4

Sign Type 4 is room usage signage to indicate room status and personnel names.

1. Type 4 Slider Construction

2. Type 4 Window Construction

3. Type 4.1 1 line window sign

4. Type 4.2 2 line window sign

5. Type 4.3 3 line window sign

6. Type 4.4 4 line window sign

7. Type 4.5 5 + line window sign (additional windows can be added as needed)

8. Type 4.6 Changeable paper insert

9. Type 4.7 1 line room use slider

10. Type 4.8 2 line room use slider

E. Sign Type 5

Sign Type 5 is ADA compliant level information & regulatory signage.

1. Type 5.1 Floor # and Stairwell # Signage

2. Type 5.2 In Case of Fire…Use Stairway

3. Type 5.3 Fire Extinguisher indication

4. Type 5.4 No Smoking

5. Type 5.4a No Smoking—for window application

6. Type 5.5 a&b 3” x 8” and 4” x 8” General information and regulation signage

7. Type 5.6 To area of rescue assistance

8. Type 5.7 Area of rescue assistance

9. Type 5.8 TDD Telephone

10. Type 5.9 To TDD Telephone

F. Sign Type 6

Sign Type 6 is wall mounted directional and way-finding signage.

1. Type 6.1 1 line building or area header

2. Type 6.2 2 line building or area header

3. Type 6.3a-h Directional arrow strip

4. Type 6.4 1 line copy strip

5. Type 6.5 2 line copy strip

G. Sign Type 7

Sign Type 7 is overhead directional and way-finding signage.

1. Type 7 Construction

2. Type 7.1 1 line overhead

3. Type 7.2 2 line overhead

4. Type 7.3 3 line overhead

H. Sign Type 8

Sign Type 8 is ADA compliant elevator car signage.

1. Type 8.1 Car plate button indication

2. Type 8.2 Jamb plate information

I. Sign Type 9

Sign Type 9 consists of University seal and logotype header options for all sign types.

1. Type 9.1 a&b Seal and logotype headers for sign types 1, 2, and 4

2. Type 9.2 a&b Seal and logotype headers for sign type 6

M.2 PROJECT SCOPE

A. Furnish, fabricate and install signs and related work, complete, and in accordance with the Message Schedule, Locations Plans, Working Drawings, approved submittals, and as otherwise specified herein.

B. Examine Drawings, Specifications, and on-site work of the other trades or contractors coming in contact with this work to ensure proper installation and suitable connections to abutting construction. If errors, omissions or inconsistencies are discovered, the Fabricator will notify the University's Representative in writing.

C. Take additional measurements at the job site to ascertain if any variations in dimensions or surface occur in adjacent steel framing, concrete work, canopies, or post supports provided by other trades or contractors.

M.3 QUALITY OF CONTROL

A. Fabricator will assume full responsibility for completed sign work in accordance with the intent of the Working Drawings upon his/her acceptance of the work specified.

B. Prior the award of the Contract for all or any part of the work, the Fabricator will provide assurance of quality performance in all modes of fabrication, transportation, and installation, and in producing products of the number and complexity required. The Fabricator will have not less than five (5) years experience in work of this type or as necessary to achieve first quality and proper installation. Accepted Production Prototypes provided by the Fabricator will constitute the quality standards for work performed under the Contract.

C. The University's Representative will have the right to reject any sign or sign component that fails to meet the requirements.

D. Fabricator will allow the University's Representative access to the sign shop, should he/she so choose, to view and inspect the processes and methods for fabricating.

M.4 CONTRACT DOCUMENTS

A. The Working Drawings are necessarily diagrammatic and indicate only the general arrangements, and the Specifications are necessarily descriptive and indicate only the general aspects, insofar as related to requirements for the various items of material, equipment and apparatus required. The Fabricator will maintain the visual design concept as shown as accurately as possible.

B. Any discrepancies between written and scaled dimensions will be reported to the University's Representative prior to fabrication and/or installation.

C. University's Representative will be notified of any discrepancies in the Working Drawings or Message Schedule, in the field dimensions or conditions, and/or changes required in construction details.

D. Copy, quantities, and references shown on the Message Schedule will take precedence over Working Drawings.

E. Working Drawings indicate general arrangements and locations of such items as walls, doors and their framing, apparatus, and equipment. The Working Drawing and Specifications are for the guidance of the Fabricator and exact locations, distances, and levels will be governed by the building site and actual building conditions. The Fabricator will make accepted minor changes from arrangements or locations shown in order to meet structural or architectural conditions or because of interference with other work without additional expense.

F. The University hereby grants the Fabricator the limited right to fabricate designs herein for the sole purpose of completing the contract. The Fabricator may not manufacture reproduce, or exhibit these designs or modify them for any other purpose without the written approval of the University.

M.5 ALTERNATIVES

Fabricator will make no alternatives to the construction details, materials, fabrication processes, sign messages, and graphic layouts called for in the Message Schedule, Working Drawings, and Specifications.

M.9 LOCATION OF SIGNS

A. Locations shown on the Working Drawings are for general information only. The sign Fabricator will arrange a meeting with the University's Representative at the site for the final location of sign elements.

M.10 RESTORATION OF SITE CONDITIONS

A. Sign related waste and debris will be regularly removed by the Fabricator from the various local site work areas and periodically removed from the project site and disposed of in a safe and legal manner, as the work progresses. Upon completion of the work, the Fabricator will restore the work site and its adjacent area to existing conditions.

B. Large accumulations of sign-related waste and debris, burying or burning thereof, and accumulations of litter on or about the site will not be permitted.

C. Slabs, floors, carpets and decks will be periodically swept clean and free of sign-related dust, shavings, litter, etc. As the work progresses, each work area shall be left in broom clean condition prior to the start of subsequent operations.

D. As the work progresses, restore adjacent site work and/or building surfaces to their prior condition, remove temporary protection on signs and/or adjacent work, wash signs and adjacent surfaces with water and mild non-staining solvents, and then dry with clean flannel cloth. Abrasives, caustics, and steel wool will not be used in the cleaning of any sign unit or adjacent surface.

M.11 MATERIALS GENERAL

A. Material and products will be new and free from defects which impair strength or appearance.

B. Samples of materials comply with governing codes, including standards referred to under such codes or these Specifications, except said requirements will be considered as minimum.

M.12 MANUFACTURER'S SPECIFICATIONS & INSTRUCTIONS FOR STANDARD COMPONENTS

A. Preparation, handling and installation of standard components will be in accordance with the manufacturer's specifications, instructions and technical data particular to the materials or products specified as accepted.

B. Where area conditions encountered require modifications to said manufacturer's instructions, they will be accepted by manufacturer and the University's Representative prior to proceeding with the work.

M.13 METALS

A. Metals will be of sufficient gauge or thickness to be structurally sound and free of warpage after cutting, forming, assembly and installation. Metal cuts and bends will be straight, true, parallel and to angles as indicated on Working Drawings. Gauges and /or thickness of metals specified on working drawings are recommendations. Where required for structural, forming, appearance, or assembly reasons. The Fabricator will recommend or suggest gauges or thickness of metals.

B. Pre-formed metals shall be flat, free from irregularities or forming marks.

C. Structural metal for concealed framing or other sign supports will be of the sizes, shapes and thickness as indicated in the Working Drawings or as required to satisfy structural requirements, and shall meet applicable ASTM specifications. Structural steel parts will be protected with rust-preventive coatings and/or primers.

D. Unless otherwise specified herein, stainless sheet, bar, tube, plate, etc. will be with #4 finish with horizontal grain in the thickness indicated in the Working Drawings, and will meet applicable ASTM specifications.

M.14 VINYL DIE CUT

Vinyl die cut will be 3M brand High performance 2 mil vinyl by Gerber or equal.

M.15 ADHESIVE AND FASTENERS

A. Acrylic and fasteners will be adequate for producing structurally sound joints between similar and dissimilar materials without causing undue stress, discoloration, or deformation of surface joints.

B. Joining methods will be in accordance with best practices and recommendations made by the materials to be joined, using fasteners and adhesives that will not deface, discolor or delaminate as a result of continued exposure to sunlight, heat, cold, or moisture and will match material to be joined where specified. Adhesives and fasteners will not deteriorate the materials to which they are applied.

C. Mechanical fasteners will be of stainless steel, galvanized steel, or similarly corrosion proof to prevent rust or corrosion stains on signs or mounting surfaces.

D. Mechanical fasteners will be concealed, unless specified otherwise in Working Drawings, and of proper type and quantity to securely attach signage components to each other and to mounting surfaces.

M.16 PAINTS, INKS, AND COATINGS

A. Paints, inks, and coatings will be of colors and types as specified in the Working Drawings. Fabricator will submit samples of all color for approval prior to use. Color Samples will be applied to the background materials specified or accepted for final use.

B. Paints, inks, coatings, and finishes, including primers and other surface preparations, will be of the highest quality, manufactured specifically for the surface materials to which they are to be applied, and will be compatible with each other and with the materials to which they are applied.

C. Paints, inks, coatings, will be heavy duty exterior grade to withstand chalking, fading, discoloring, chipping, cracking, and peeling for a minimum of ten (10) years.

D. Paints, inks, coatings, will have an eggshell or matte finish unless otherwise specified in the Working Drawings.

M.17 FABRICATION GENERAL

A. The Contractor will fabricate signs and graphics following dimensions and details shown in the Working Drawings, and accepted Shop Drawings and as specified.

M.6 CODES

Designs, clearances, constructions, workmanship, and materials, will be in accordance with the requirements of the local Building Code, and other applicable codes. In case of conflict between codes, the local Building Code shall govern.

M.7 SUBMITTALS

A. Fabricator will make submittals in triplicate unless otherwise noted, and will clearly make them with the project name and date. In case of shop drawings and graphic layouts, a reproducible print will be submitted in addition to three (3) non-reproducible prints. It will be the Fabricator's responsibility to distribute copies of all reviewed and marked-up shop drawings and graphic layouts to parties designated by the University's Representative. Submittals shall be made promptly as to cause no delay in the work.

B. The University's Representative will check and approve schedules, drawings, etc. submitted by the Fabricator only for conformance with the general design intent of the project and compliance with the information given in the Working Drawings, Message Schedule, and Specifications.

C. The Fabricator will revise and re-submit submittals as often as the University's Representative deems necessary to ensure conformance of the final sign products with the design and quality intents of the project. Revisions and submittals will be made promptly as to cause no delay in the work.

D. The Fabricator will not charge any additional costs for the required submittals, revisions and re-submissions of any required submittal or subsequent incorporation of those revisions in the final sign products without first submitting a written breakdown of the additional costs to the University's Representative and obtaining the written approval of the additional costs from the University's Representative. The Fabricator will also provide the University's Representative with a written breakdown of, and credit for, any submittal revision(s) that result in cost savings for any of the final sign products.

M.8 REQUIRED SUBMITTALS

A. Materials List will have an orderly listing of data indicating the specific materials proposed for use in the work, including information as to exact dimension, type, kind, model, composition or other qualities, all as necessary for complete evaluation.

B. Shop Drawings: Fabricators will supply shop drawings drawn to scale and fully dimensioned and delineated to clearly call out materials, finishes and coatings. These will include a typical elevation and any sections and large scale details necessary to clearly show construction materials and details, sizes and shapes of members, methods of shop jointing, methods of jointing designated for field assembly, connections to adjacent construction, sign footings and foundations and fastenings. Shop Drawings for sign items will be submitted to the University's Representative for review, comment, and approval no later than four (4) weeks from the award of the fabrication contract. Shop Drawings will be submitted as two (2) sets of prints and one (1) set of reproducible drawings including final drawings with any required corrections.

C. Sample of Graphics will include the specific material required or proposed and color samples of mechanical and liquid finishes and coatings including sample graphics applications in the color and on the material specified.

B. Maintain the required tolerance and fitting of the various components of the sign system to assure smooth, proper fitting and correct alignment of all components when assembled and installed.

C. Maintain the following tolerances unless otherwise noted: For hardware components ±1/32", for graphic component ±1/32".

D. Metal bending, drilling, punching, milling, routing, shearing, and sawing will be accurate and consistent within the maximum tolerances for hardware components.

E. Sawed and sheared metal cuts will be straight, true, parallel, and square within maximum tolerances for hardware components. Sawed, sheared, or scored acrylic cuts will be straight, true, parallel and square within maximum tolerances for hardware components.

F. Signs will be constructed for maximum structural stability under local environmental conditions.

G. Exterior signs will be sealed against leakage, both within signs and between signs and mounting surfaces.

H. Materials will be cut, formed and jointed straight, true parallel, square, and flush within maximum tolerance of 1/32".

I. Cut material edges will be deburred and sanded or polished smooth prior to assembly. Parts with nicks, scratches, tool marks, surface imperfections, etc. will not be accepted.

J. Special attention will be given to the construction of sign components that fit together to prevent binding, warpage and tight or loose fitting of the parts.

K. Adhesive, welded, and mechanical joints will be adequately backed and reinforced to provide tight, rigid assemblies and to prevent bubbles, deformations, warpage and leakage at joint lines. Joint lines and gaps will be filled and ground smooth so as to be uniform in texture, color, finish of base material; and will be free from warps, spots, blemishes, and discoloration.

M.18 CUT-OUT LETTERS AND STENCIL-CUT LETTERS

A. Letters will be cut from the materials, thickness, and sizes indicated on the Working Drawings, with edges straight, true and perpendicular to faces within maximum tolerances for hardware components.

B. Curves and radii shall be cut accurately and uniformly to with maximum tolerances for hardware components.

C. Edges on cut letterforms shall be finished as indicated on Drawings.

M.19 TYPOGRAPY AND GRAPHIC APPLICATION

A. Sign message typography will be Helvetica Medium or Grade 2 Braille as specified.

B. Non-typography sign graphics will be photographically enlarged or reduced from artwork provided by the University's Representative to size indicated on Working Drawings for final application to signs. Photographic enlargements or reductions will be sharply focuses, and without alteration of artwork proportions. Mechanically or electronically enlarged or reduced artwork will be permitted only where accepted by the University's Representative.

C. Sign graphics will be applied accurately on signs or architectural surfaces per accepted Graphic Samples. Typography and graphic elements will be so aligned as to maintain straight, true base lines parallel to each other and to the sign format or architectural surface. Copy line breaks, letterspacing, workspacing, linespacing, baseline alignments, margins, and graphics positions per accepted Graphic Samples will be maintained.

M.20 SURFACE-APPLIED LIQUID PAINTS, INKS, COATINGS, AND FINISHES

A. Surface preparations, primers, paints, inks, coatings, and finishes will be compatible and shall be applied according to the manufacturer's instructions. Surface preparations and primers will be applied as recommended by the specified manufacturer of the finish coatings.

B. Final liquid finishes will be smooth and free of dust, debris, pinholes, streaks, orange peeling, pitting and other surface imperfections.

C. Paints, inks, and coatings will be fully dried and cured prior to packing, shipping, and installation of sign units to prevent scratching or other surface damage.

M.21 SUB-SURFACE APPLIED LIQUID PAINTS, INKS, COATINGS, AND FINISHES

A. Sub-surface preparations, primers, paints, inks, coatings, and finishes will be compatible and will be applied according to the manufacturer's instructions. Sub-surface preparation and primers will be applied as recommended by the specified manufacturer of the finish coatings.

B. Final liquid finishes will be smooth and free of dust, debris, pinholes, streaks, orange peeling, pitting, and other imperfections.

C. Paints, inks, and coatings will be fully dried cured prior to packing, shipping, and installation of sign units to prevent scratching or other surface damage.

M.22 INSTALLATION

A. Signs will be installed in the designated locations as indicated on Location Drawings as determined on site and will be set plumb, level, and square and at their proper elevations and planes and placed in accurate alignment with adjacent work.

B. Mounting techniques will be appropriate to the weight and material of the sign and the surface to which it is to be affixed.

C. Dimensions, locations, and spaces between sign units themselves or between sign units and adjacent work will be shown in the Working Drawings or as specified.

D. Modifications and deviations from the dimensions, locations, and spaces between sign units themselves or between sign units and adjacent work as shown in the Working Drawings or as specified and deemed necessary as a result of field conditions must be accepted by the University's Representative.

E. Fabricator will be responsible for securing required permits for hoists, lifts, rigs, booms, trucks, scaffolding, fencing, bridges, sidewalk obstructions, etc. as may be required or needed to complete the work.

F. Access to the site will be coordinated through the University's Representative.

M.23 SIGN LOCATIONS

Sign locations shown on the Plan Drawings are for General Reference only. Fabricator will arrange a meeting with the University's Representative and other concerned parties at the site for final location and stalking of signs, to be located in a single way.

M.24 MOUNTING HARDWARE AND SIGN FOOTINGS

A. Fabricator will engineer and provide sign mounting hardware and structure for maximum structural stability under local environmental conditions. Attachment and installation methods will be in accordance with best practices using devices, materials, and fasteners to suit the conditions of the mounting surface to receive the installation. Required engineering drawings for sign footings, structures, attachments, connections between sign components and connections between signs and adjoining construction will be signed and sealed by a licensed Pennsylvania professional engineer.

B. Mounting hardware, adhesives, and holes drilled into mounting surfaces will be fully concealed except as indicated on Working Drawings or as accepted by the University's Representative.

M.25 FINAL ACCEPTANCE

A. Prior to final acceptance of the Work, the Fabricator will meet at the site with the concerned parties to review work deemed incomplete or incorrect as itemized on the Punch List provided boy the University's Representative. The Fabricator will verify incorrect or incomplete work within six (6) weeks after the meeting.

B. Prior to final acceptance of the work, the Fabricator will restore adjacent site work and/or building surfaces to their prior condition, remove any temporary protection on signs or adjacent work, wash signs and adjacent surfaces with water and mild non-staining solvents and then dry with a clean flannel cloth. Abrasives, caustics, and steel wool will not be used in cleaning of sign units.

END OF DIVISION





University of Pittsburgh
Interior Signage

UNIVERSITY SEAL

Helvetica Medium

ABCDEFGHIJKLMN
OPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
123456789
.,/?!@#$%^&*()[]{}+-:;<>





RESTROOM



WOMEN



MEN



ELEVATOR



ACCESSIBLE



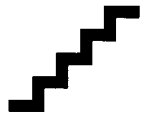
INFORMATION



NO SMOKING



TELEPHONE



STAIRWELL



DINING



NO ENTRY



SMOKING



IN CASE OF FIRE



HEARING IMPAIRED



FIRE EXTINGUISHER



DRINKING FOUNTAIN



MAIL



FIRST AID



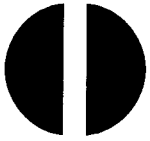
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RADIATION



TDD PHONE



EXIT



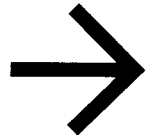
BIOHAZARD



TRASH DISPOSAL



QUIET



ARROW



BUS

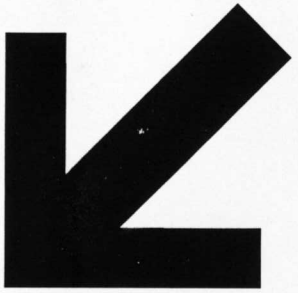
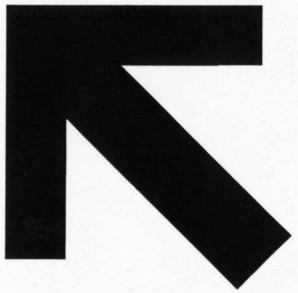
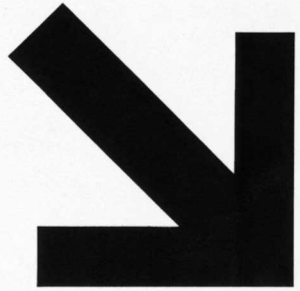
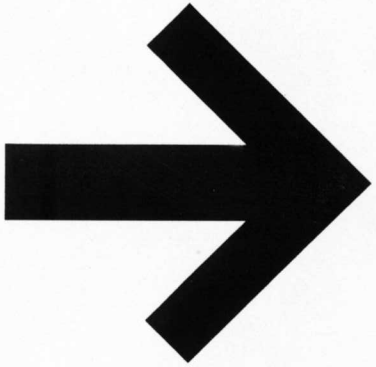
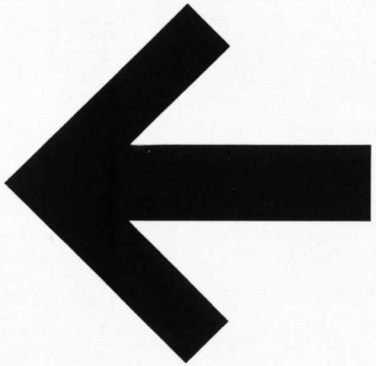
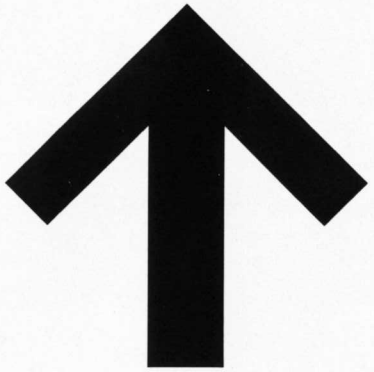
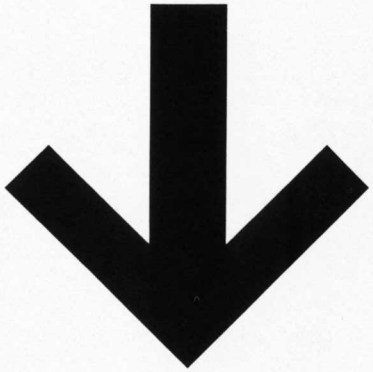


COAT CLOSET

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SYMBOL STYLE SHEET

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ARROWS



FRAME STANDARD

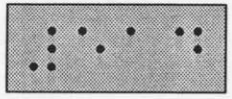
This frame is constructed of extruded aluminum and has a removable concealed edge for changing inserts. Frame is mechanically fastened to the wall. This frame is ordered by the actual dimensions of the sign and is available in any size. The removable edge of the sign is indicated by a small dot stamped into the side.

FINISH: Anodized Satin Aluminum

MANUFACTURER:
Diversa Manufacturing
6530 Carnegie Avenue
Cleveland, Ohio 44103

SUPPLIER:
Bunting Inc.
409 West Warrington Avenue
Pittsburgh, PA 15210
412-481-0445
FAX 412-481-1506

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FRAME OPTION • JRS

This frame can be mechanically fastened or mounted with with vinyl tape. The frame is constructed of extruded 1/16" aluminum angle and is set into 1/4" thick masonite. Signs will have a 1/16" reveal between frame. Frame is ordered by the outside dimension of the sign with an additional 1/8" added for the reveal.

FINISH: Anodized Satin Aluminum

MANUFACTURER:
The JRS Company, Inc.
544 North Rimsdale
Box 2035
Covina, California 91722

818-967-2432
FAX 818-966-0714

SUPPLIERS:

Ability Plastics
8721 Industrial Drive
Justice, Illinois 60458
800-323-2722
FAX 800-323-2723

Bunting, Inc.
409 West Warrington Avenue
Pittsburgh, PA 15210
412-481-1445
FAX 412-481-1506



FRAME OPTION • WOODEN
This frame is constructed of wood with a mahogany finish and gold accents. The frame is adapted to be mountable to the wall with concealed screws. A hardboard panels fills the frame interior and allows the sign insert to be mounted with double-sided vinyl tape or dual-lock tape. Frame size needs to compensate for inside opening allowed for sign.

FINISH: Charter Oak Scoop

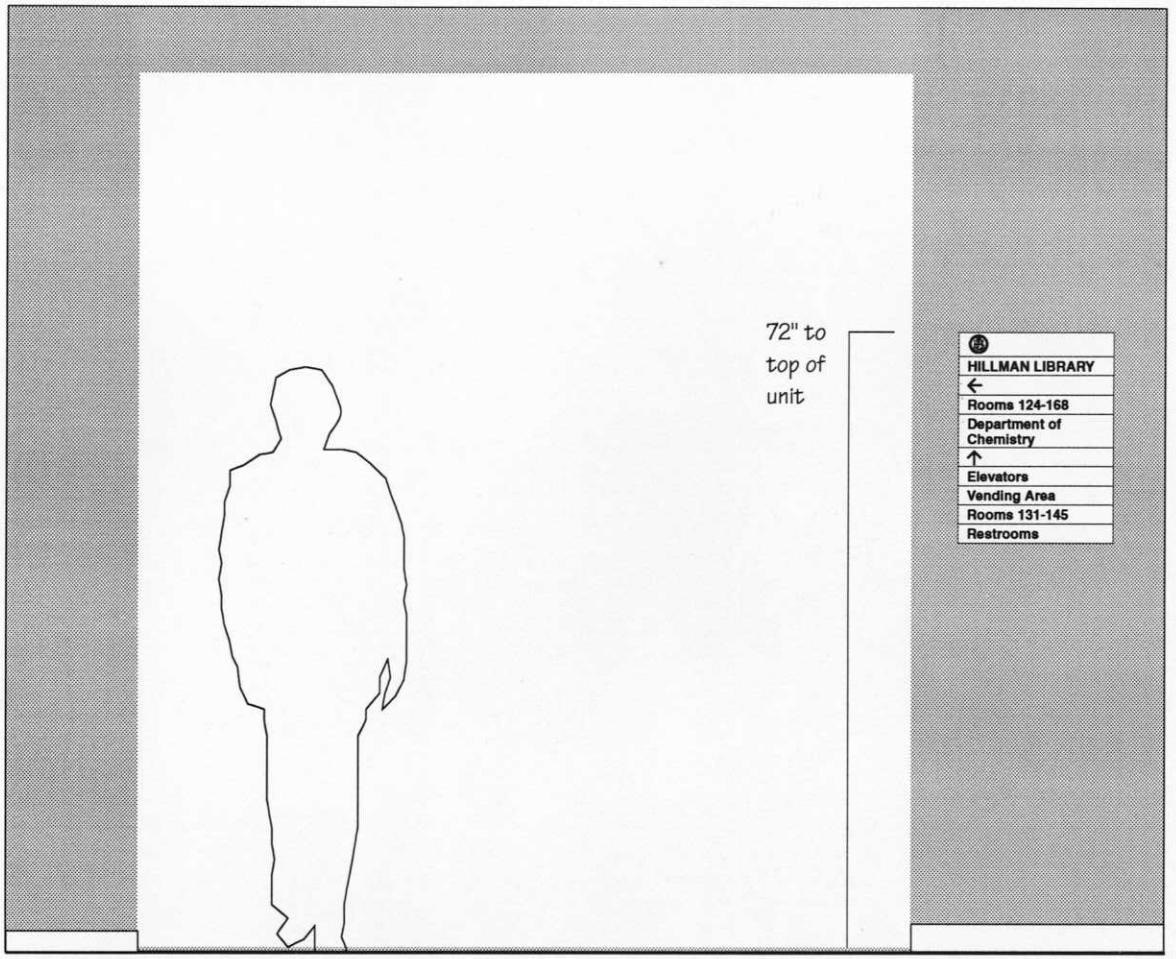
MANUFACTURER:
Graphik Dimensions
2103 Brentwood Street
High Point, NC 27263
800-221-0262
FAX 919-887-3773

SUPPLIER:
Bunting Inc.
409 West Warrington Avenue
Pittsburgh, PA 15210
412-481-0445
FAX 412-481-1506

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FRAME • WOODEN

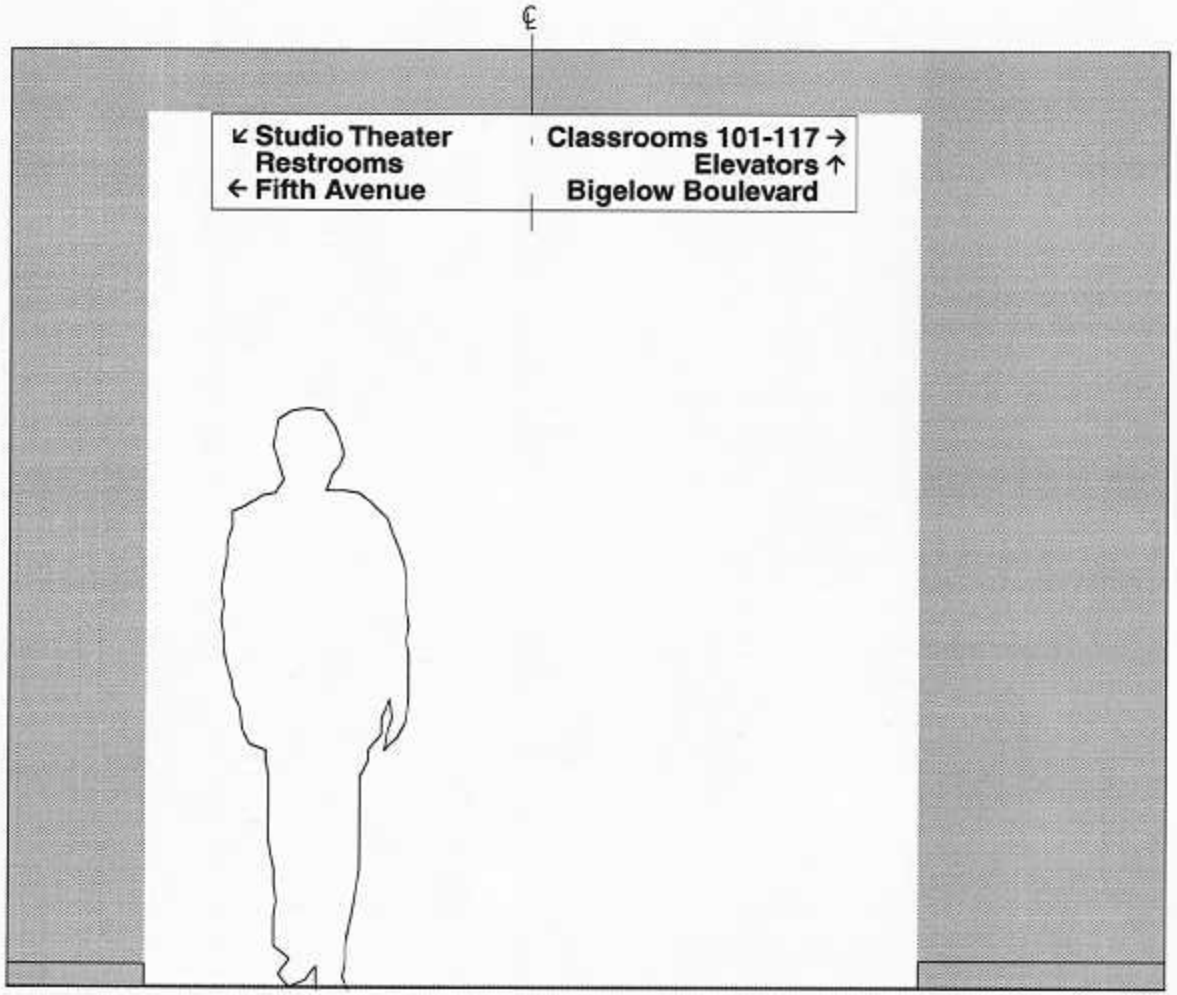


The number of inserts (Type 6) dictate the length yet, a consistant height from the floor must be established with consideration to human factors.

Typical Mounting Specifications
Modular Directional Wall Mounted Signs

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Interior Signage

DIRECTIONAL MOUNTING

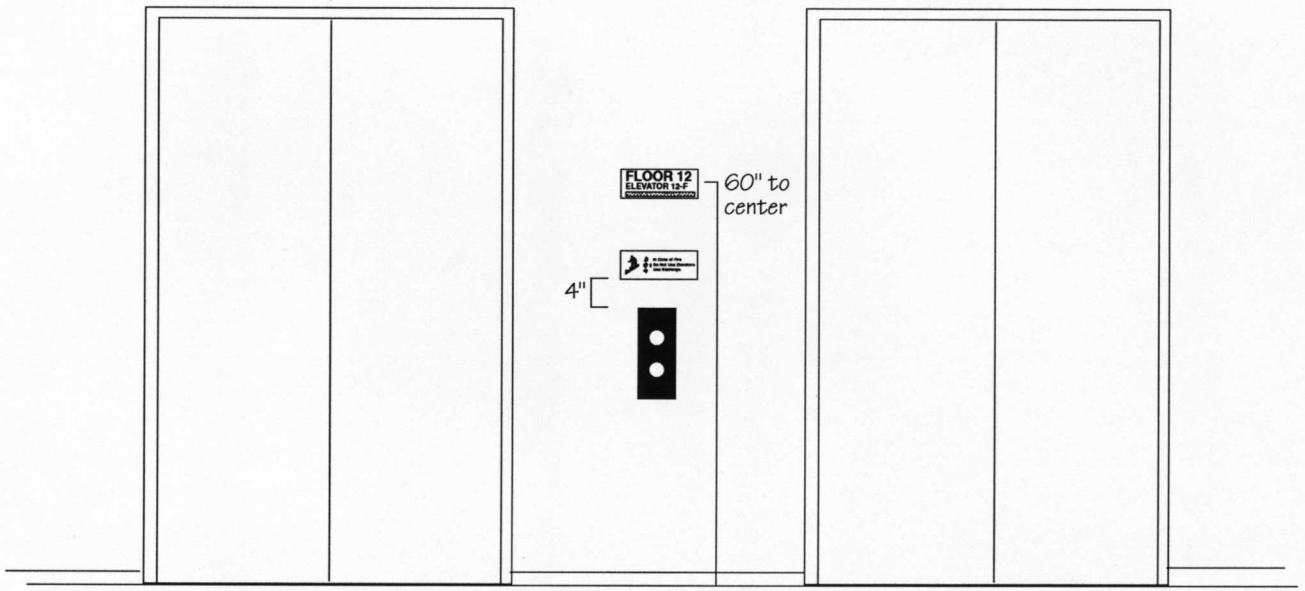


Overhead directional panels are attached to the ceiling with extruded aluminum T mounting hardware. The panel should be centered in the hallway opening at all specified locations.

Typical Mounting Specifications
Overhead Directional Signs

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OVERHEAD MOUNTING



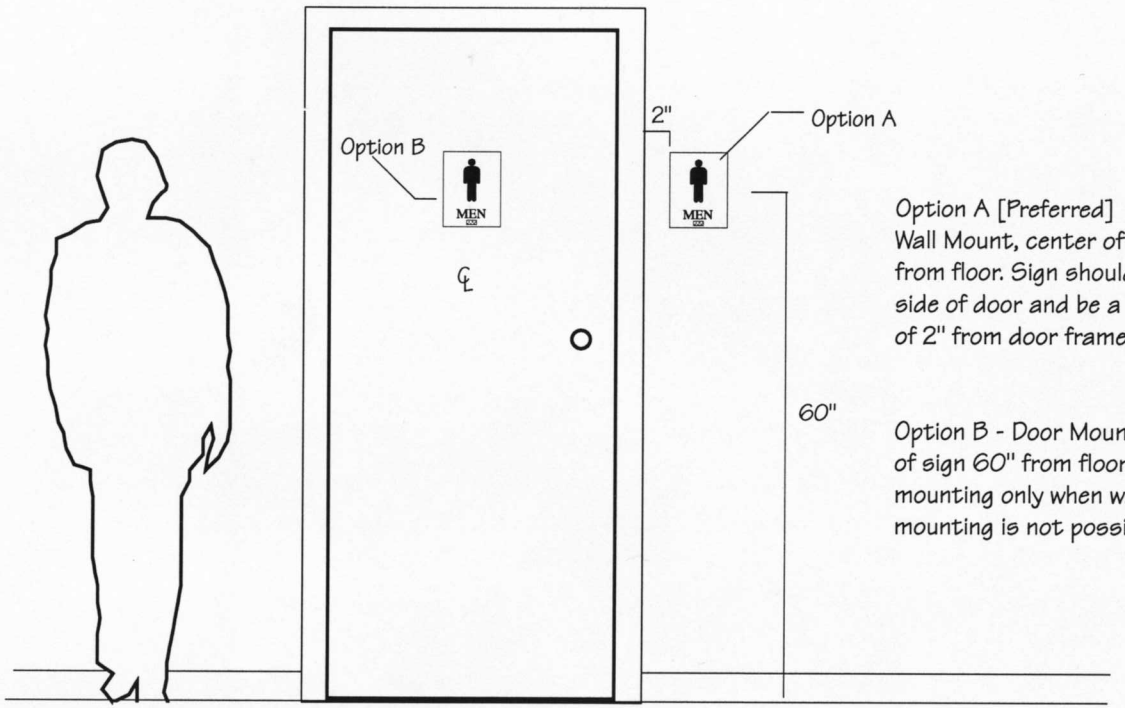
Typical Mounting

In Case of Fire (Type 5.2) plaque will be centered over elevator call buttons and 4" above plate,

Floor level indicators (Type 5.1) will be centered over elevator call buttons and 60" from floor to center of sign.

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ELEVATOR SIGN MOUNTING



Option A [Preferred]
Wall Mount, center of sign 60" from floor. Sign should on latch side of door and be a minimum of 2" from door frame

Option B - Door Mount, center of sign 60" from floor. Use this mounting only when wall mounting is not possible.

Typical Mounting Condition
Room Identification Plaque

University of Pittsburgh
Interior Signage

MODULAR MOUNTING

University of Pittsburgh

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BEHAVIORAL PSYCHOLOGY DEPARTMENT

Kathy Walker

Walter Halstead

FLOOR 12
STAIRWELL 12-F

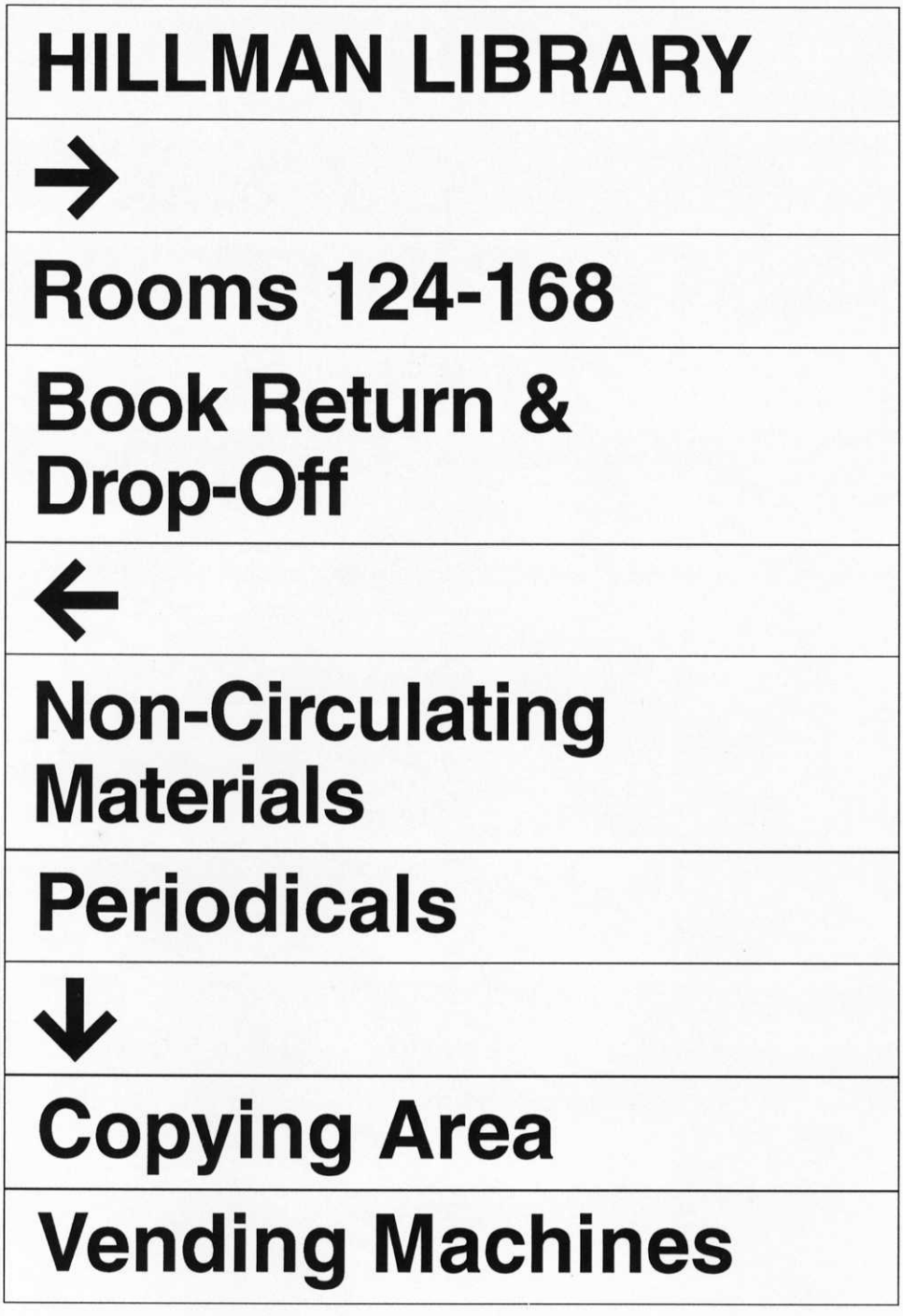


In Case of Fire
Do Not Use Elevators
Use Stairways



No Smoking

City of Pittsburgh Ordinance



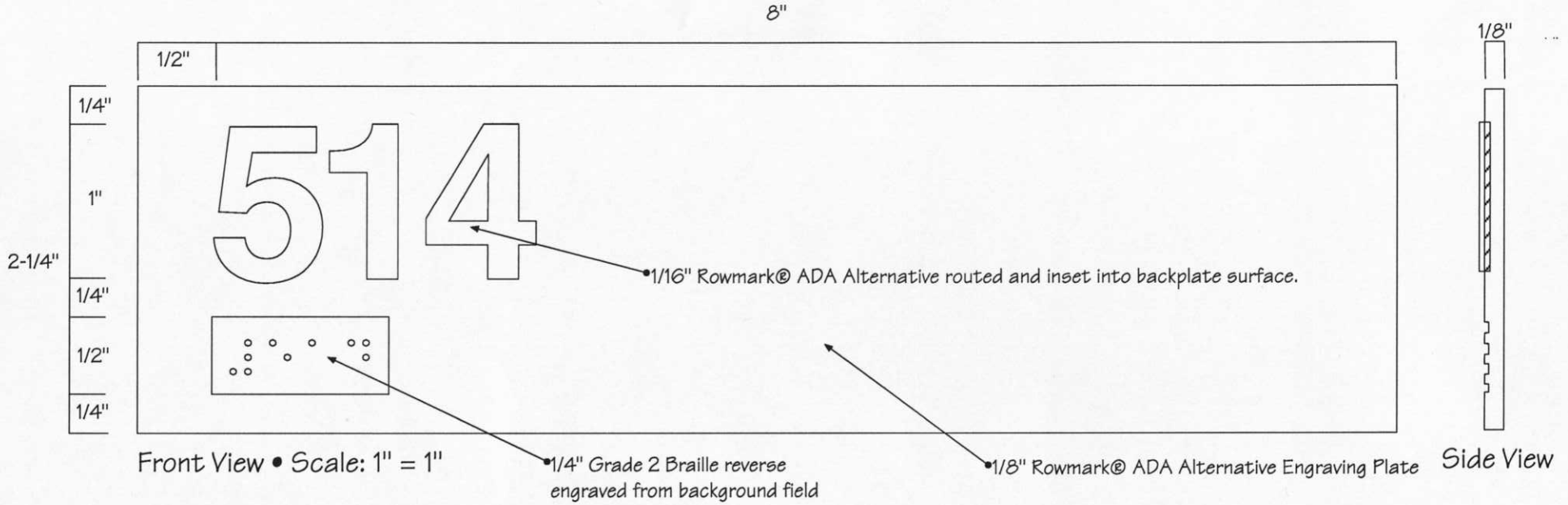
Scale 1/2"= 1"

16" WIDE

TYPE 6.

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Interior Signage



TYPICAL SIGN CONSTRUCTION TYPE 1 SIGNAGE

BACKPLATE CONSTRUCTION: 1/8" Rowmark ADA Alternative engraving stock

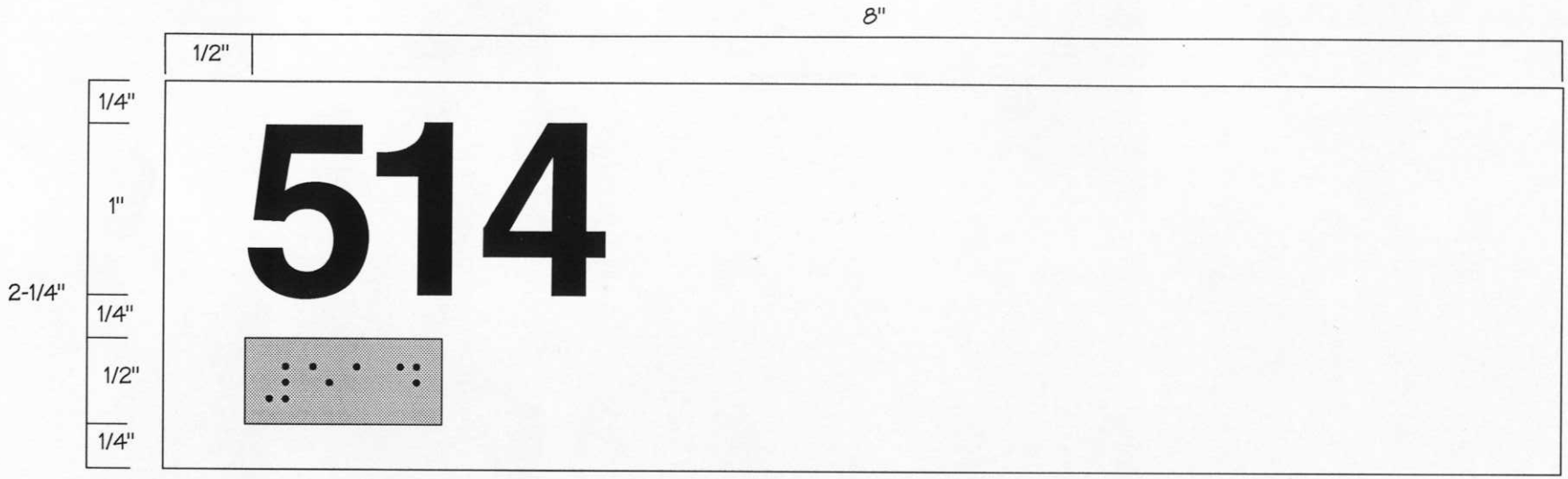
RAISED LETTER CONSTRUCTION: 1/16" Rowmark routed letters inset into backplate 1/16". Rowmark material is adhered with self adhesive sheeting.

TYPESTYLE: Helvetica Medium, upper case characters only.

BRAILLE: 1/4" Grade 2 translated Braille will be reverse engraved from within a field.

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TYPE 1 CONSTRUCTION



Front View • Scale: 1" = 1"

TYPE 1.0 • Room Number Header

SIZE: 2-1/4" x 8"

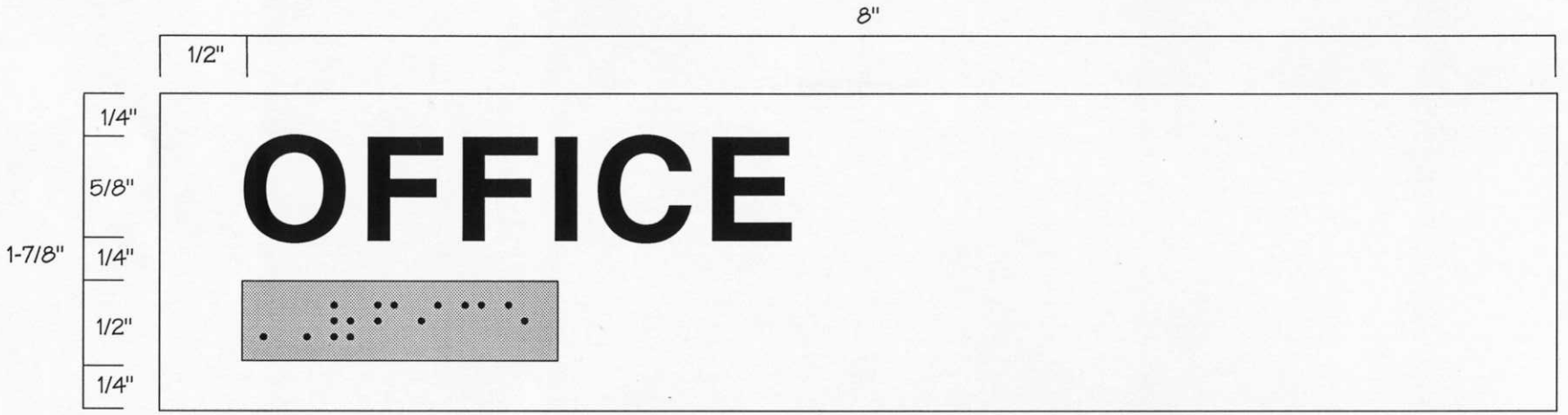
BACKPLATE CONSTRUCTION: 1/8" Rowmark ADA Alternative engraving stock

RAISED LETTER CONSTRUCTION: 1/16" Rowmark routed letters inset into backplate 1/32". Rowmark material is adhered with self adhesive sheeting.

TYPESTYLE: 1" Helvetica Medium, upper case characters only. (9 character maximum)

BRAILLE: 1/4" Grade 2 translated Braille will be reverse engraved from within a field.

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1" = 1"

TYPE 1.1 • 1 Line of Copy

SIZE: 1-7/8" x 8"

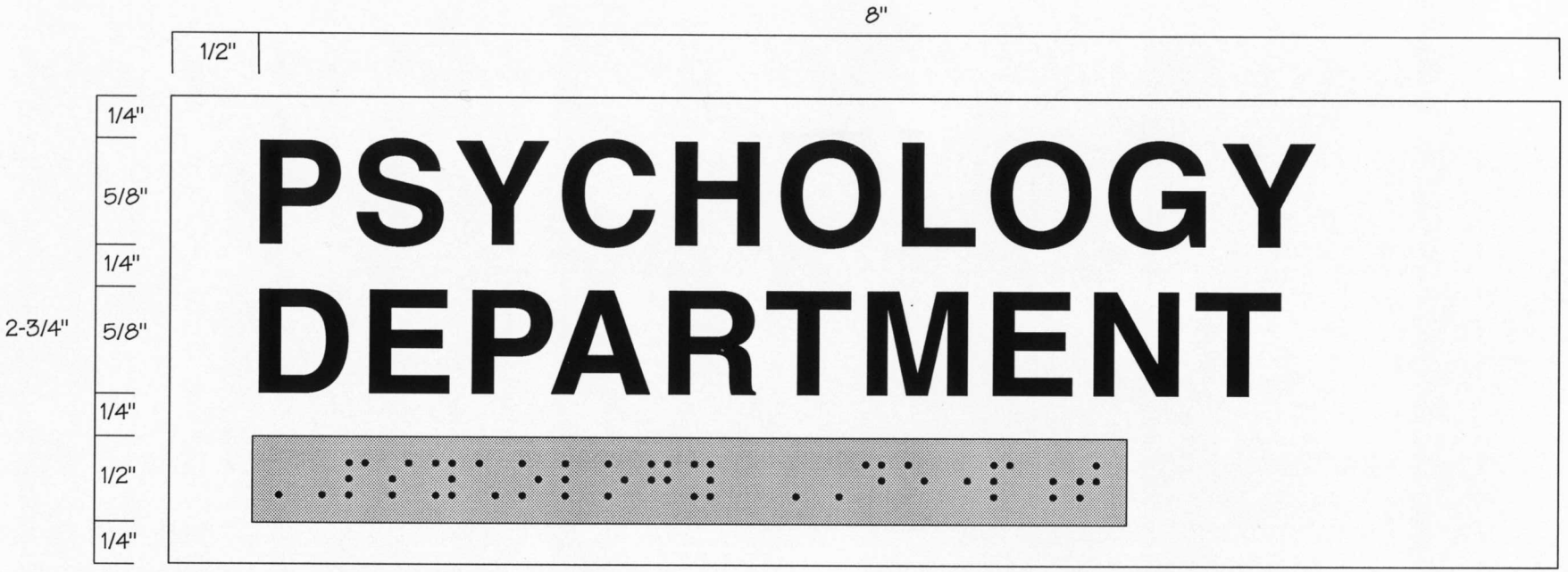
BACKPLATE CONSTRUCTION: 1/8" Rowmark ADA Alternative engraving stock

RAISED LETTER CONSTRUCTION: 1/16" Rowmark routed letters inset into backplate 1/32". Rowmark material is adhered with self adhesive sheeting.

TYPESTYLE: 5/8" Helvetica Medium, upper case characters only. (12 character per line maximum)

BRAILLE: 1/4" Grade 2 translated Braille will be reverse engraved from within a field.

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1" = 1"
TYPE 1.2 • 2 Lines of Copy

SIZE: 2-3/4" x 8"

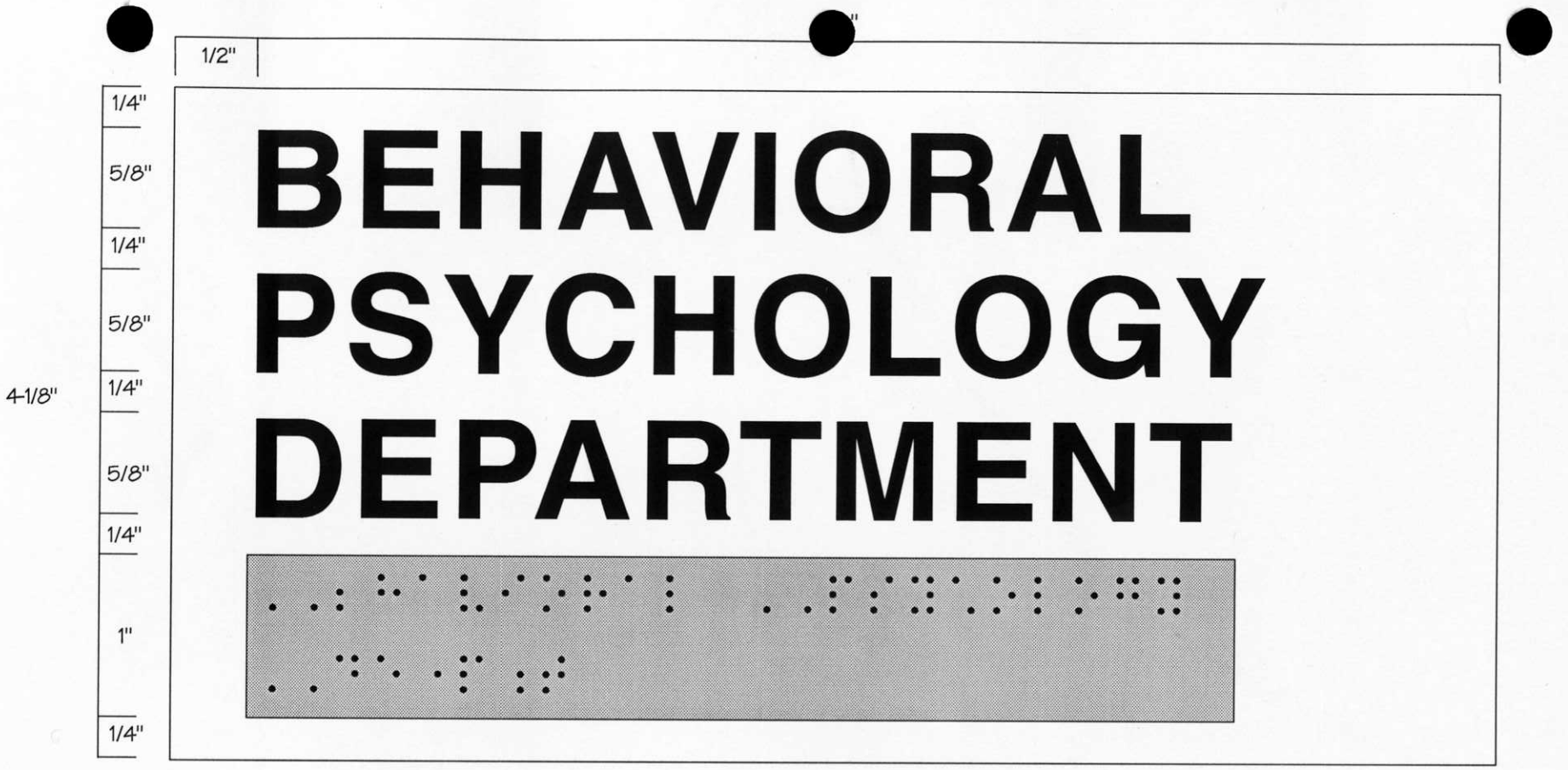
BACKPLATE CONSTRUCTION: 1/8" Rowmark ADA Alternative engraving stock

RAISED LETTER CONSTRUCTION: 1/16" Rowmark routed letters inset into backplate 1/32". Rowmark material is adhered with self adhesive sheeting.

TYPESTYLE: 5/8" Helvetica Medium, upper case characters only. (12 charcter per line maximum)

BRAILLE: 1/4" Grade 2 translated Braille will be reverse engraved from within a field.

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1" = 1"

TYPE 1.3 • 3 Lines of Copy

SIZE: 4-1/8" x 8"

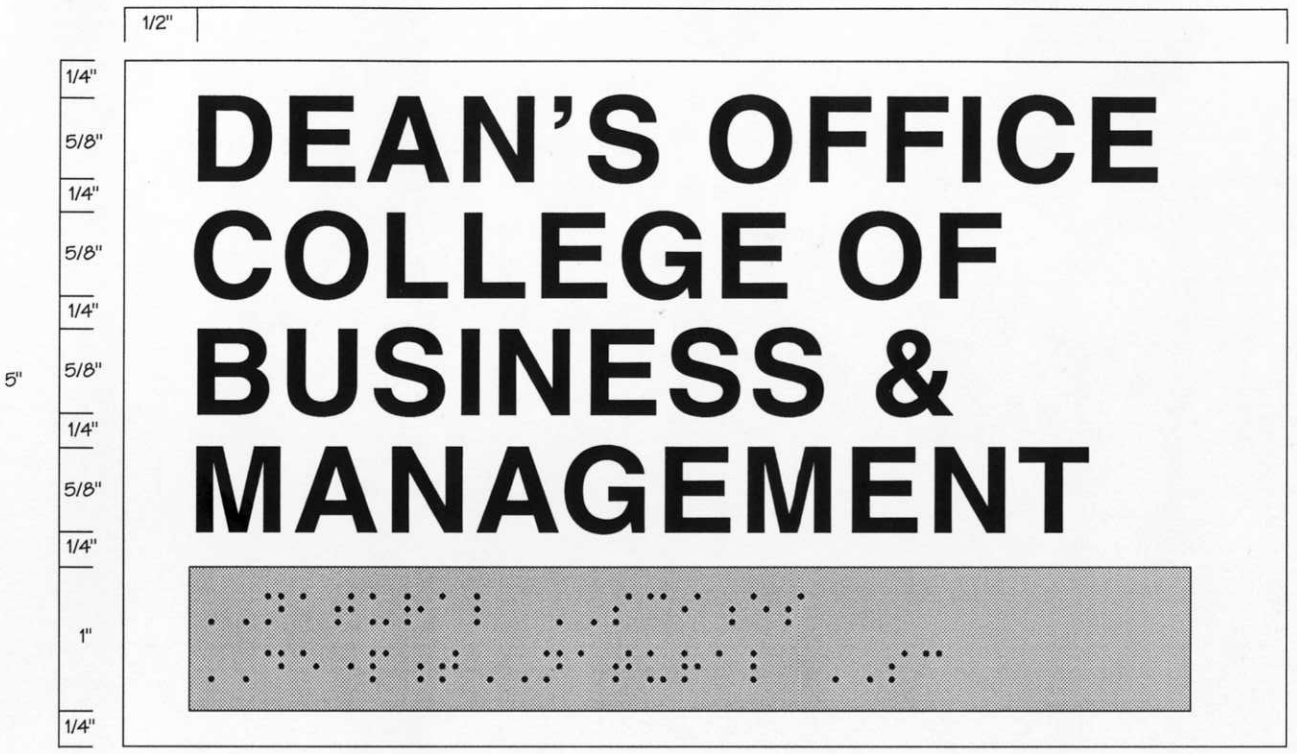
BACKPLATE CONSTRUCTION: 1/8" Rowmark ADA Alternative engraving stock

RAISED LETTER CONSTRUCTION: 1/16" Rowmark routed letters inset into backplate 1/32". Rowmark material is adhered with self adhesive sheeting.

TYPESTYLE: 5/8" Helvetica Medium, upper case characters only. (12 characters per line maximum)

BRAILLE: 1/4" Grade 2 translated Braille will be reverse engraved from within a field.

MOUNTING: Please see mounting options specifications.



Front View • Scale: 3/4" = 1"

TYPE 1.4 • 4 Lines of Copy

SIZE: 5" x 8"

BACKPLATE CONSTRUCTION: 1/8" Rowmark ADA Alternative engraving stock

RAISED LETTER CONSTRUCTION: 1/16" Rowmark routed letters inset into backplate 1/32". Rowmark material is adhered with self adhesive sheeting.

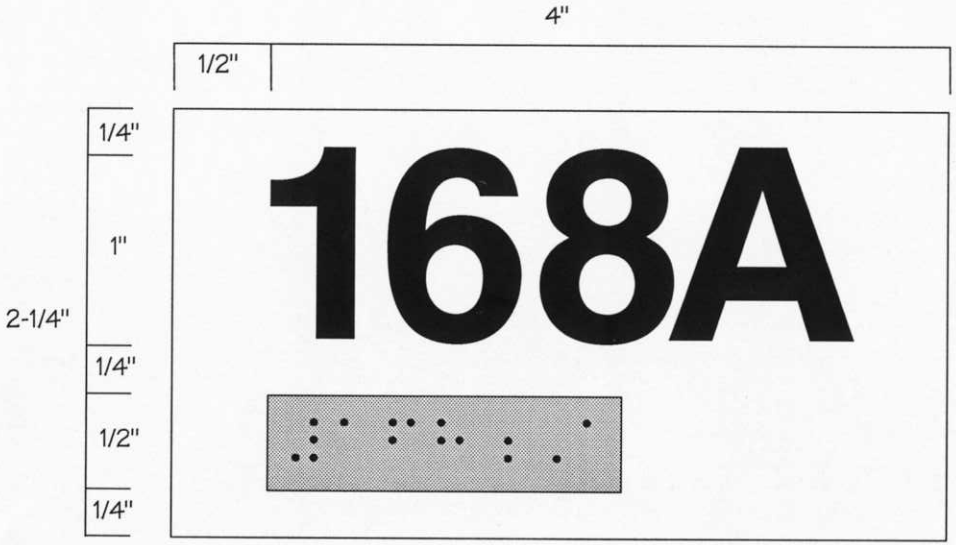
TYPESTYLE: 5/8" Helvetica Medium, upper case characters only. (12 characters maximum per line)

BRAILLE: 1/4" Grade 2 translated Braille will be reverse engraved from within a field.

MOUNTING: Please see mounting options specifications.

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Interior Signage

TYPE 1.4



Front View • Scale: 1" = 1"

TYPE 1.8 • Room Number

SIZE: 2-1/4" x 4"

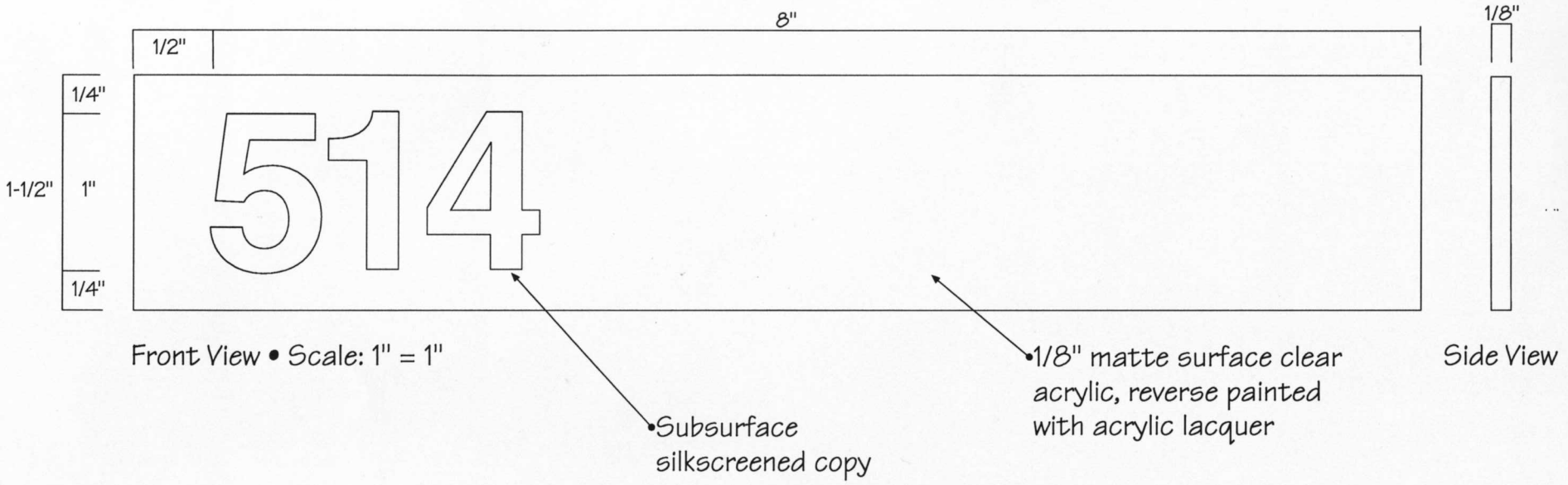
BACKPLATE CONSTRUCTION: 1/8" Rowmark ADA Alternative engraving stock

RAISED LETTER CONSTRUCTION: 1/16" Rowmark routed letters inset into backplate 1/32". Rowmark material is adhered with self adhesive sheeting.

TYPESTYLE: 1" Helvetica Medium, upper case characters only. (4 character maximum)

BRAILLE: 1/4" Grade 2 translated Braille will be reverse engraved from within a field.

MOUNTING: Please see mounting options specifications.



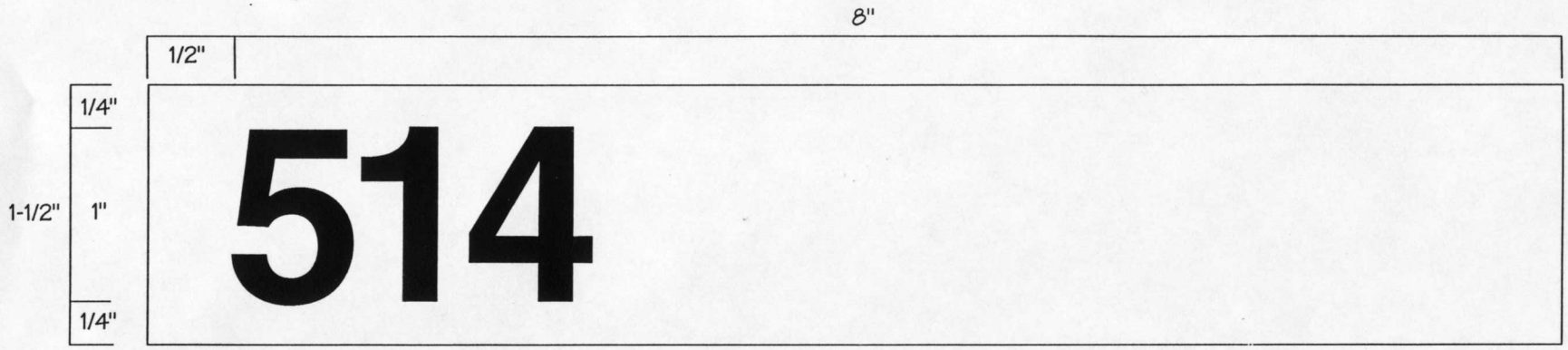
TYPICAL SIGN CONSTRUCTION TYPE 2 SIGNAGE

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed background and acrylic lacquer painted background.

TYPESTYLE: Helvetica Medium, upper & lower case characters.

University of Pittsburgh
Interior Signage

TYPE 2 CONSTRUCTION



Front View • Scale: 1" = 1"

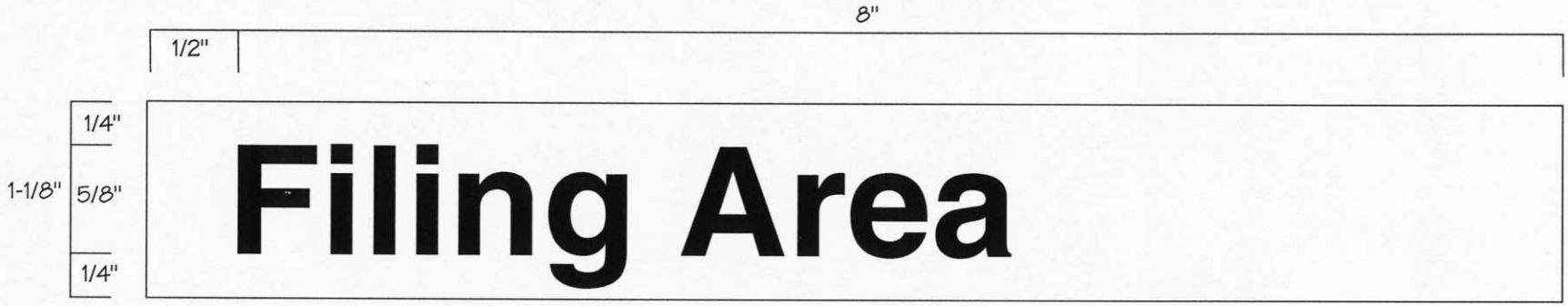
TYPE 2.0 • Room Number Header/Non ADA

SIZE: 1-1/2" x 8"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 1" Helvetica Medium, upper or lower case characters.

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1" = 1"

TYPE 2.1 • 1 Line of Copy/Non ADA

SIZE: 1-1/8" x 8"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 5/8" Helvetica Medium, upper & lower case characters. (12 upper case characters or 18 upper & lower case characters maximum per line)

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1" = 1"

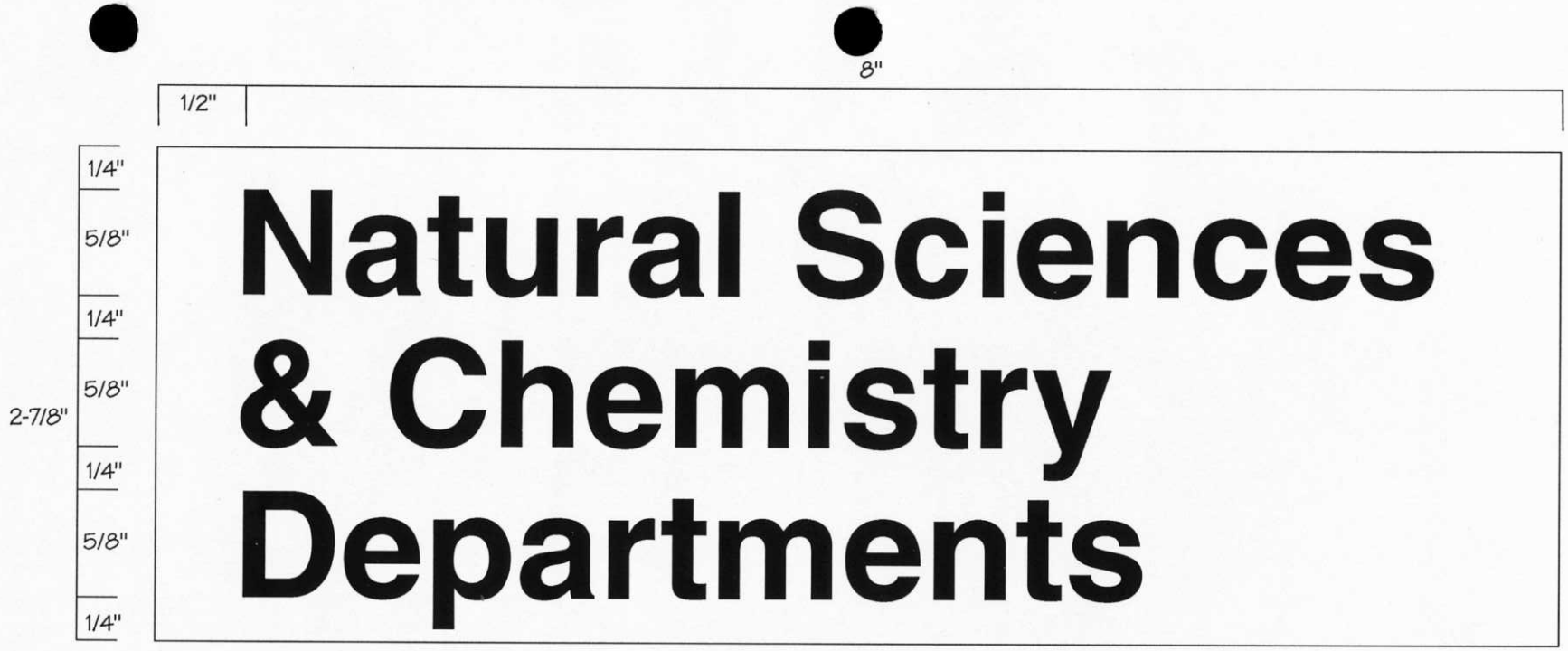
TYPE 2.2 • 2 Lines of Copy/Non ADA

SIZE: 2" x 8"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 5/8" Helvetica Medium, upper & lower case characters. (12 upper case characters or 18 upper & lower case characters maximum per line)

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1" = 1"

TYPE 2.3 • 3 Lines of Copy/Non ADA

SIZE: 2-7/8" x 8"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 5/8" Helvetica Medium, upper & lower case characters. (12 upper case characters or 18 upper & lower case characters maximum per line)

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1" = 1"

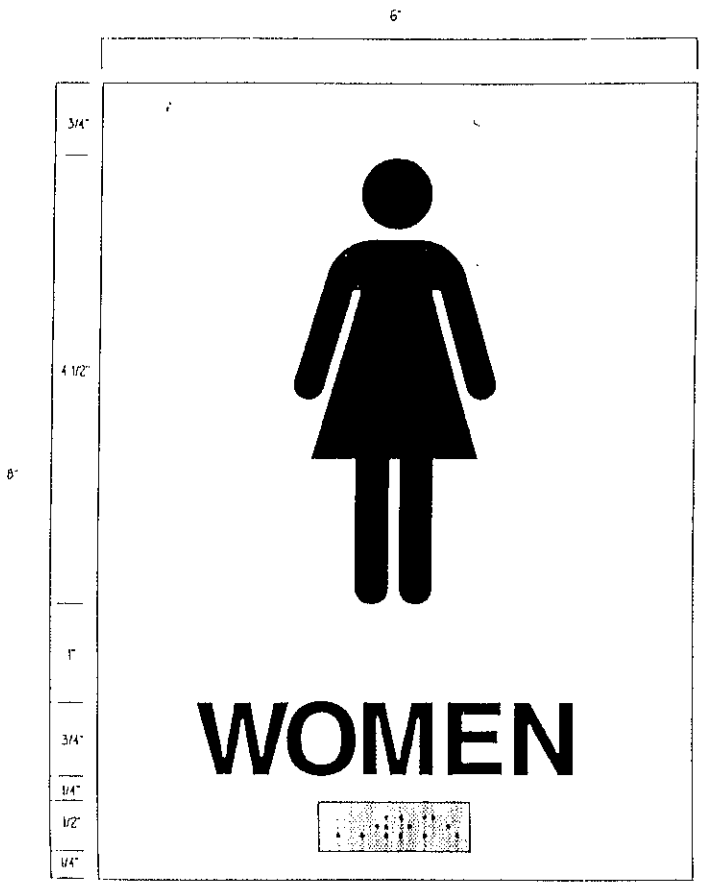
TYPE 2.4 • 4 Lines of Copy/Non ADA

SIZE: 3-3/4" x 8"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 5/8" Helvetica Medium, upper & lower case characters. (12 upper case characters or 18 upper & lower case characters maximum per line)

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1/2" = 1"

TYPE 3.1

SIZE: 6" x 8"

BACKPLATE CONSTRUCTION: 1/8" Rowmark ADA Alternative engraving stock

RAISED LETTER & SYMBOL CONSTRUCTION: 1/16" Rowmark routed letters inset into backplate 1/32". Rowmark material is adhered with self adhesive sheeting.

TYPESTYLE: 3/4" Helvetica Medium, upper case characters only.

SYMBOLS: 4-1/2" Women

BRAILLE: 1/4" Grade 2 translated Braille will be reverse engraved from within a field.

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1/2" = 1"

TYPE 3.2

SIZE: 6" x 8"

BACKPLATE CONSTRUCTION: 1/8" Rowmark ADA Alternative engraving stock

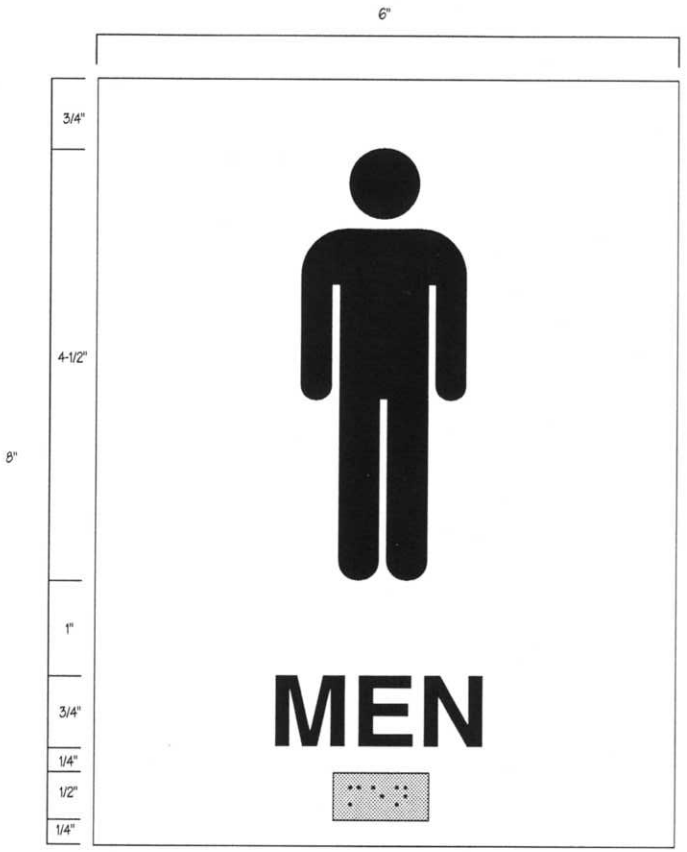
RAISED LETTER & SYMBOL CONSTRUCTION: 1/16" Rowmark routed letters inset into backplate 1/32". Rowmark material is adhered with self adhesive sheeting.

TYPESTYLE: 3/4" Helvetica Medium, upper case characters only.

SYMBOLS: 4-1/2" Women, 3-1/2" access

BRAILLE: 1/4" Grade 2 translated Braille will be reverse engraved from within a field.

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1/2" = 1"

TYPE 3.3

SIZE: 6" x 8"

BACKPLATE CONSTRUCTION: 1/8" Rowmark ADA Alternative engraving stock

RAISED LETTER & SYMBOL CONSTRUCTION: 1/16" Rowmark routed letters inset into backplate 1/32". Rowmark material is adhered with self adhesive sheeting.

TYPESTYLE: 3/4" Helvetica Medium upper case characters only.

SYMBOL: 4-1/2" Man

BRAILLE: 1/4" Grade 2 translated Braille will be reverse engraved from within a field.

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1/2" = 1"

TYPE 3.4

SIZE: 6" x 8"

BACKPLATE CONSTRUCTION: 1/8" Rowmark ADA Alternative engraving stock

RAISED LETTER & SYMBOL CONSTRUCTION: 1/16" Rowmark routed letters inset into backplate 1/32". Rowmark material is adhered with self adhesive sheeting.

TYPESTYLE: 3/4" Helvetica Medium, upper case characters only.

SYMBOLS: 4-1/2" Man, 3-1/2" access

BRAILLE: 1/4" Grade 2 translated Braille will be reverse engraved from within a field.

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1/2" = 1"

TYPE 3.5

SIZE: 6" x 8"

BACKPLATE CONSTRUCTION: 1/8" Rowmark ADA Alternative engraving stock

RAISED LETTER & SYMBOL CONSTRUCTION: 1/16" Rowmark routed letters inset into backplate 1/32". Rowmark material is adhered with self adhesive sheeting.

TYPESTYLE: 3/4" Helvetica Medium, upper case characters only.

SYMBOLS: 4-1/2" Man & Woman

BRAILLE: 1/4" Grade 2 translated Braille will be reverse engraved from within a field.

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1/2" = 1"

TYPE 3.6

SIZE: 7" x 8"

BACKPLATE CONSTRUCTION: 1/8" Rowmark ADA Alternative engraving stock

RAISED LETTER & SYMBOL CONSTRUCTION: 1/16" Rowmark routed letters inset into backplate 1/32". Rowmark material is adhered with self adhesive sheeting.

TYPESTYLE: 3/4" Helvetica Medium, upper case characters only.

SYMBOLS: 4-1/2" Man & Woman, 2" access

BRAILLE: 1/4" Grade 2 translated Braille will be reverse engraved from within a field.

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1/2" = 1"

TYPE 3.7

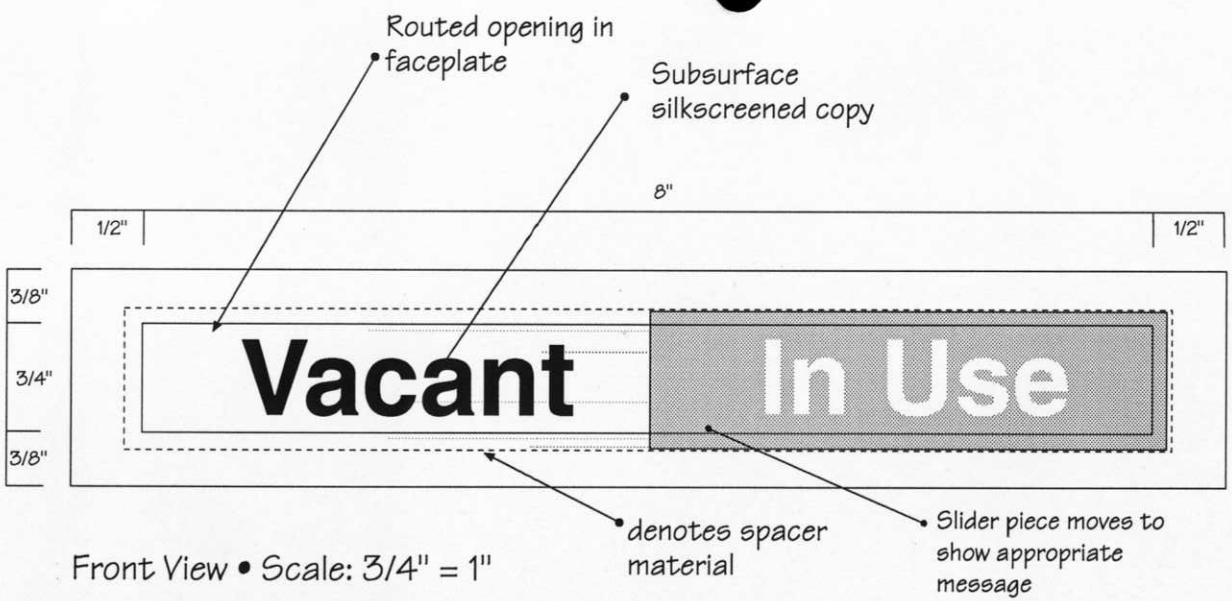
SIZE: 8" x 8"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

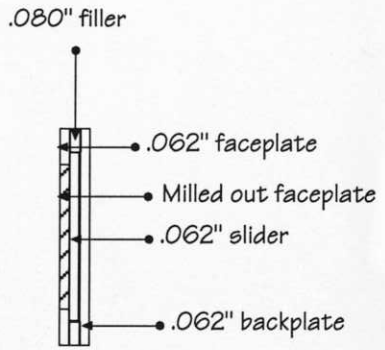
TYPESTYLE: 3/4" Helvetica Medium, upper case characters only.

SYMBOLS: 4-1/2" Women, 3-1/2" access, 1-3/4" arrow

MOUNTING: Please see mounting options specifications.



Front View • Scale: 3/4" = 1"



Side View

TYPE 4 SLIDER SIGN CONSTRUCTION

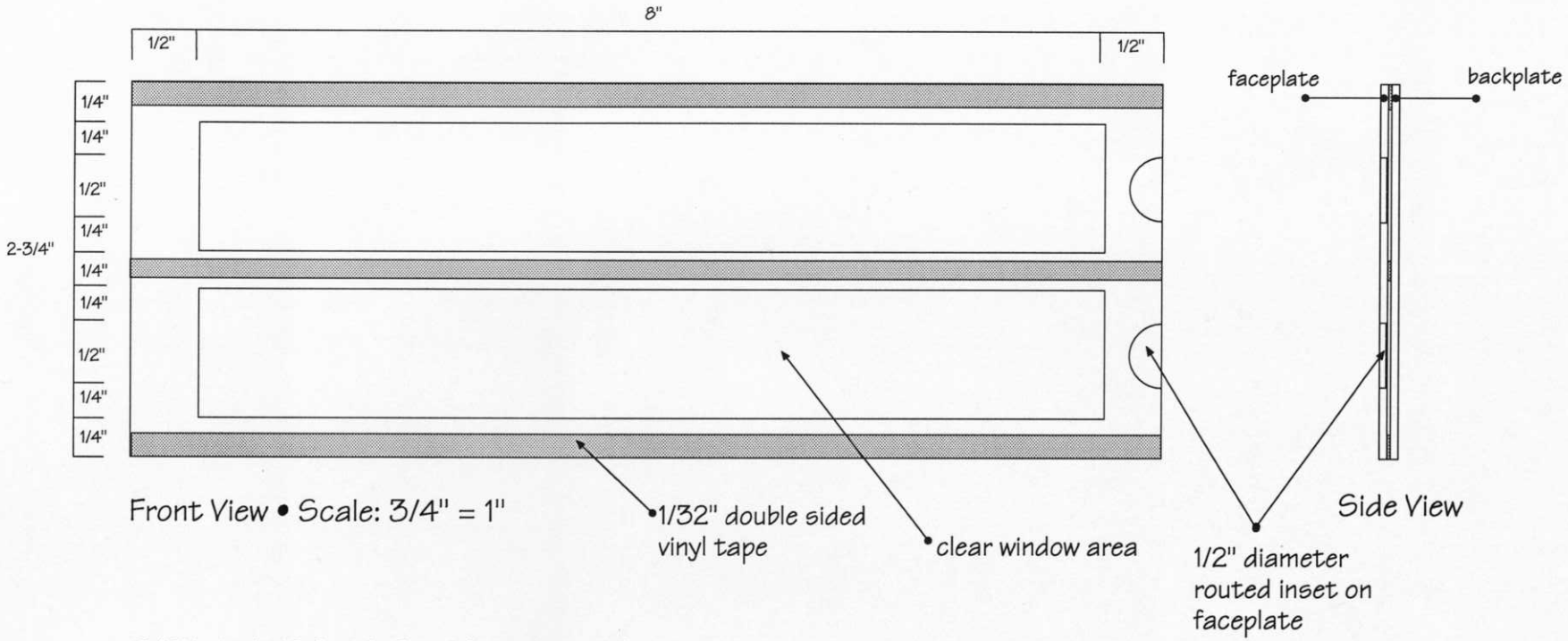
SIGN CONSTRUCTION: .062" matte surface clear acrylic faceplate with routed opening, .080" clear acrylic filler fastened to a .062" reverse painted and subsurface printed backplate with double sided adhesive. Slider insert is reverse painted.

COPY FOR INSERT: 1/2" Helvetica Medium, upper & lower case. Copy is subsurface printed on backplate and will be centered in area of window.

MOUNTING: Please see mounting options specifications.

University of Pittsburgh
Interior Signage

TYPE 4 SLIDER CONSTUCTION



TYPE 4 WINDOW SIGN CONSTRUCTION

SIZE: 2-3/4" x 8"

SIGN CONSTRUCTION: .062" matte surface clear acrylic faceplate with subsurface printed border fastened to a .062" reverse painted backplate with 1/32" double sided vinyl tape. Face plate will have routed 1/2" half circle inset for removal of inserts.

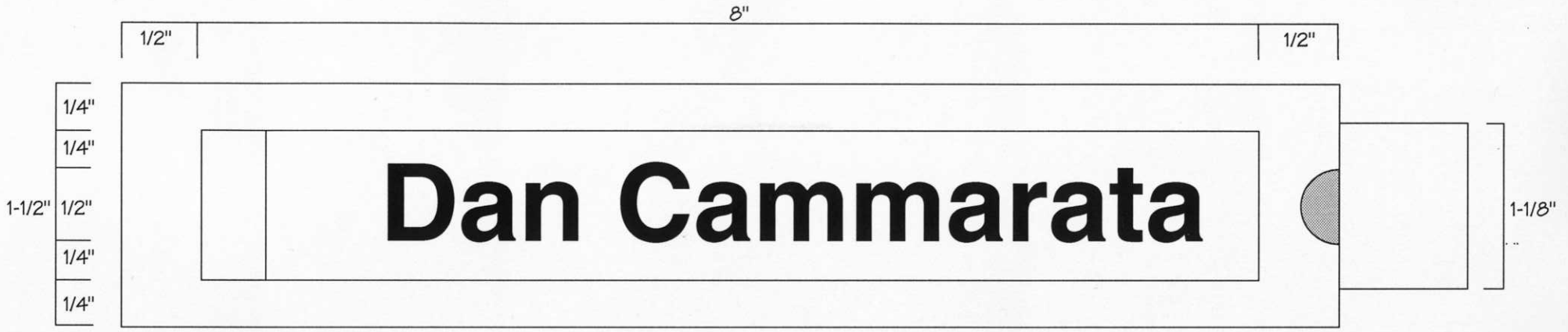
INSERT: 1-1/8" x 8" paper insert with laser printed copy.

COPY FOR INSERT: 1/2" Helvetica Medium, see Type 4.6 for insert details.

MOUNTING: Please see mounting options specifications.

University of Pittsburgh
Interior Signage

TYPE 4 WINDOW CONSTUCTION



Front View • Scale: 1" = 1"

TYPE 4.1 • 1 Line Window

SIZE: 1-1/2" x 8"

SIGN CONSTRUCTION: .062" matte surface clear acrylic faceplate with subsurface printed border fastened to a .062" reverse painted backplate with 1/32" double sided vinyl tape. Face plate will have 1/2" half circle inset for removal of inserts.

INSERT: 1-1/8" x 8" paper insert with laser printed copy.

COPY FOR INSERT: 1/2" Helvetica Medium, see Type 4.6 for insert details.

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1" = 1"

TYPE 4.2 • 2 Line Window

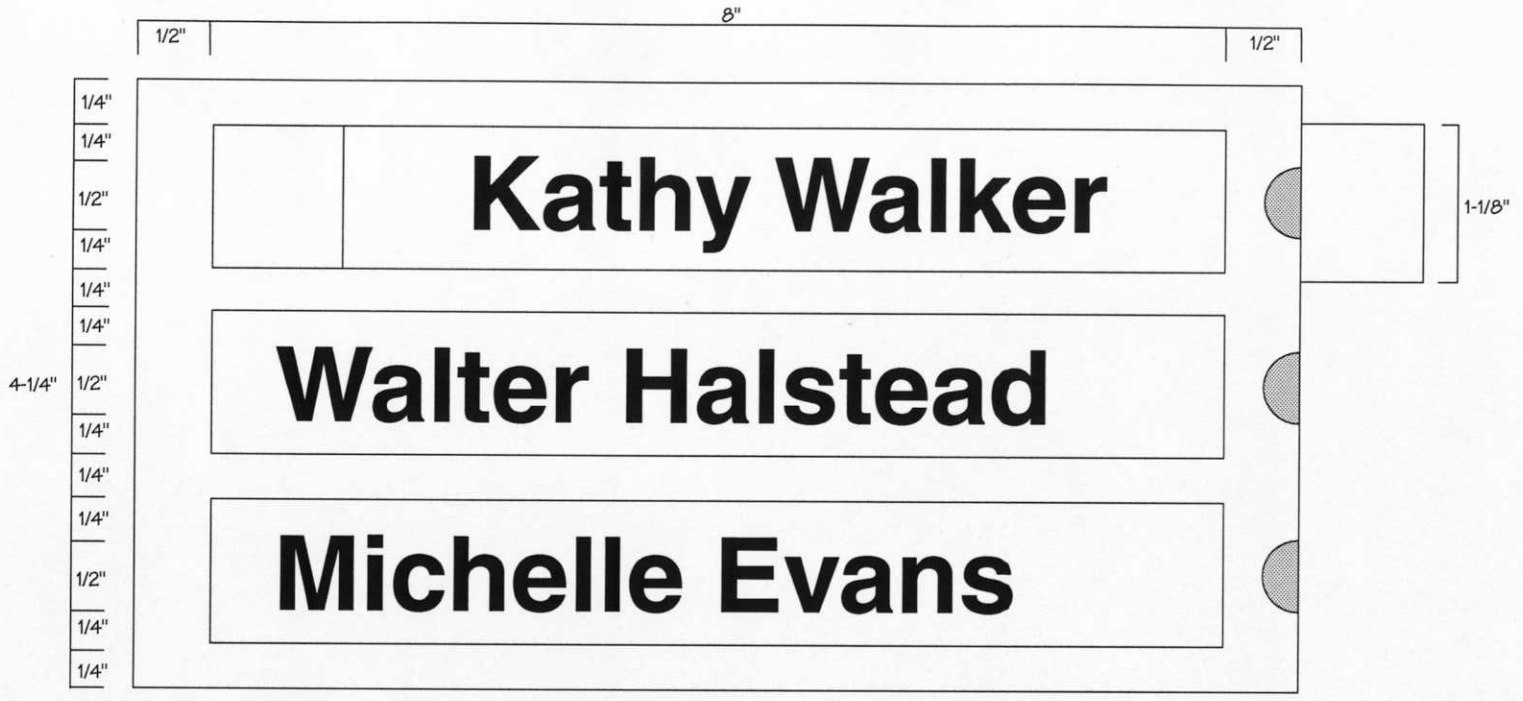
SIZE: 2-3/4" x 8"

SIGN CONSTRUCTION: .062" matte surface clear acrylic faceplate with subsurface printed border fastened to a .062" reverse painted backplate with 1/32" double sided vinyl tape. Face plate will have 1/2" half circle inset for removal of inserts.

INSERT: 1-1/8" x 8" paper insert with laser printed copy.

COPY FOR INSERT: 1/2" Helvetica Medium, see Type 4.6 for insert details.

MOUNTING: Please see mounting options specifications.



Front View • Scale: 3/4" = 1"

TYPE 4.3 • 3 Line Window

SIZE: 4-1/4" x 8"

SIGN CONSTRUCTION: .062" matte surface clear acrylic faceplate with subsurface printed border fastened to a .062" reverse painted backplate with 1/32" double sided vinyl tape. Face plate will have 1/2" half circle inset for removal of inserts.

INSERT: 1-1/8" x 8" paper insert with laser printed copy.

COPY FOR INSERT: 1/2" Helvetica Medium, see Type 4.6 for insert details.

MOUNTING: Please see mounting options specifications.

University of Pittsburgh
Interior Signage

TYPE 4.3



Front View • Scale: 3/4" = 1"

TYPE 4.4 • 4 Line Window

SIZE: 5-1/2" x 8"

SIGN CONSTRUCTION: .062" matte surface clear acrylic faceplate with subsurface printed border fastened to a .062" reverse painted backplate with 1/32" double sided vinyl tape. Face plate will have 1/2" half circle inset for removal of inserts.

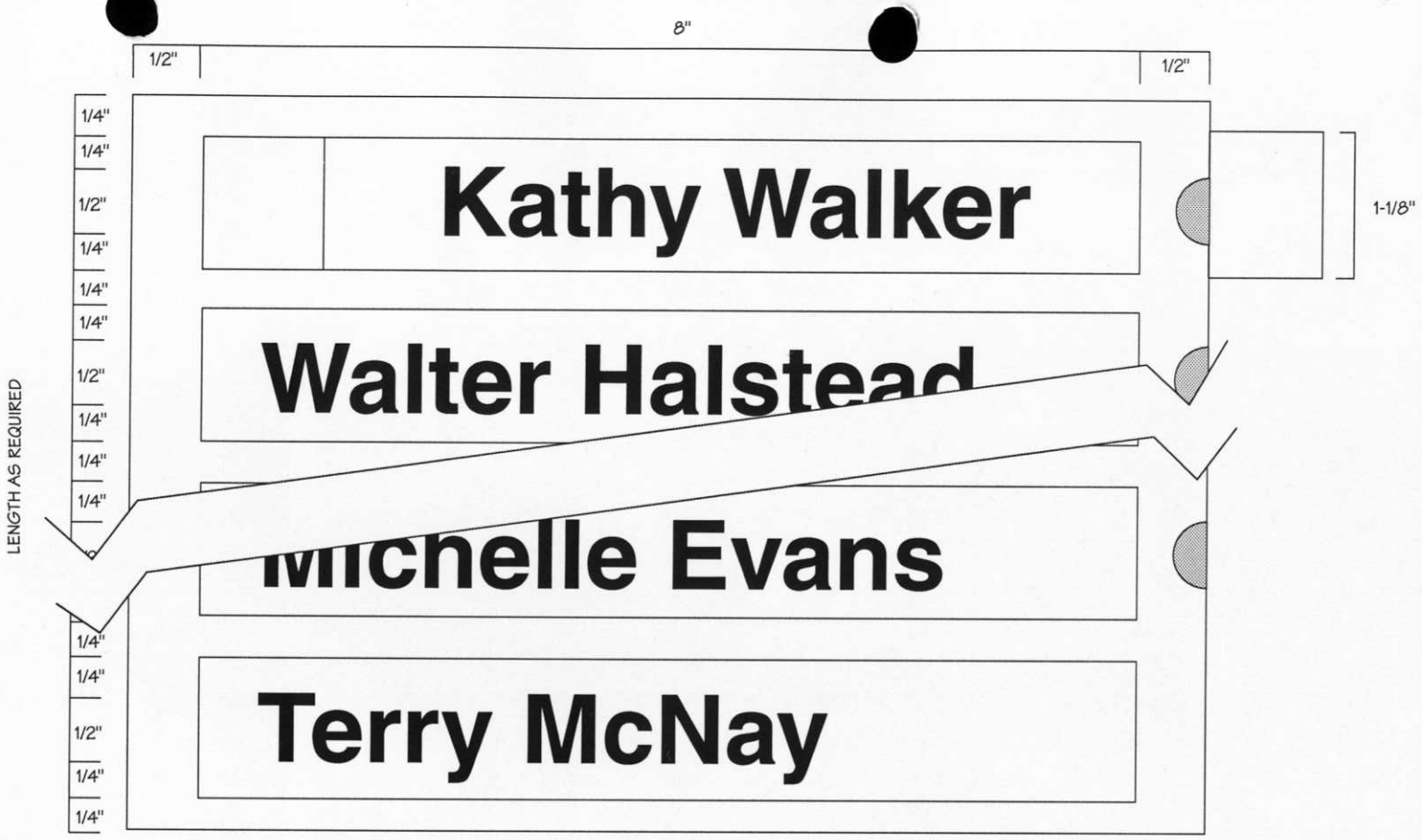
INSERT: 1-1/8" x 8" paper insert with laser printed copy.

COPY FOR INSERT: 1/2" Helvetica Medium, see Type 4.6 for insert details.

MOUNTING: Please see mounting options specifications.

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TYPE 4.4



Front View • Scale: 3/4" = 1"

TYPE 4.5 • 5 or more Line Window

SIZE: As required x 8"

SIGN CONSTRUCTION: .062" matte surface clear acrylic faceplate with subsurface printed border fastened to a .062" reverse painted backplate with 1/32" double sided vinyl tape. Face plate will have 1/2" half circle inset for removal of inserts.

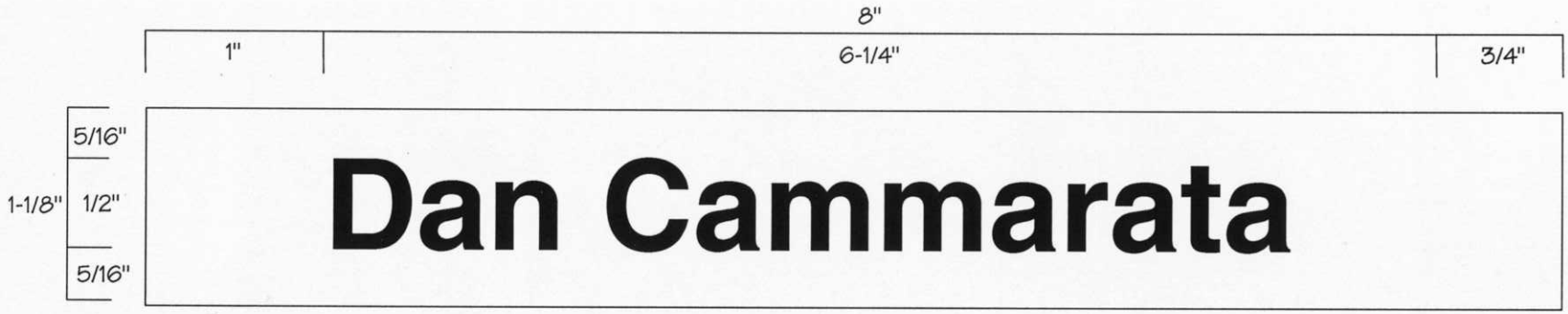
INSERT: 1-1/8" x 8" paper insert with laser printed copy.

COPY FOR INSERT: 1/2" Helvetica Medium, see Type 4.6 for insert details.

MOUNTING: Please see mounting options specifications.

University of Pittsburgh
Interior Signage

TYPE 4.5



Front View • Scale: 1" = 1"

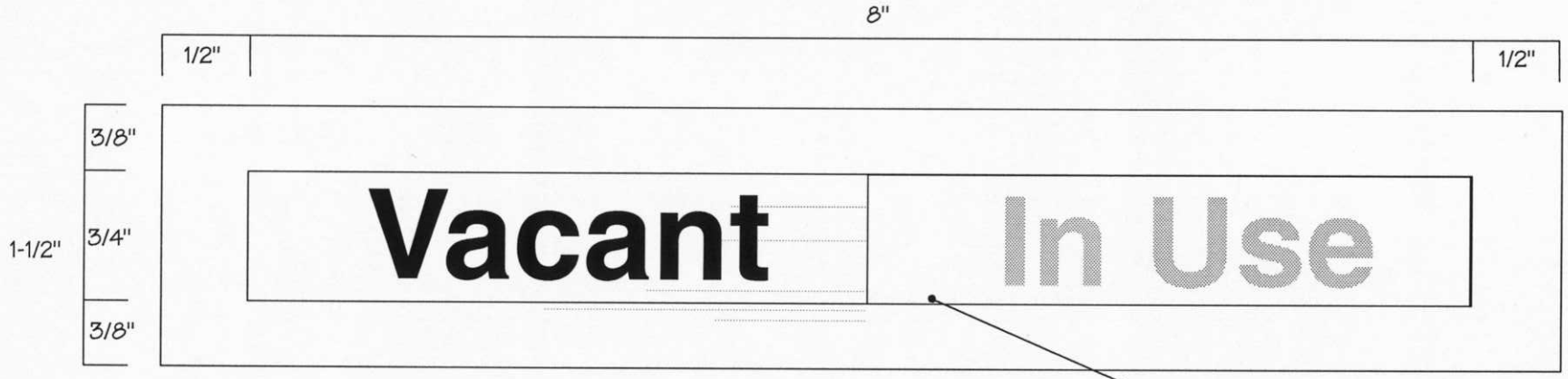
TYPE 4.6 • Changeable Paper Inserts

SIZE: 1-1/8" x 8"

INSERT: 1-1/8" x 8" white paper insert with laser printed copy.

COPY FOR INSERT: 1/2" [52 pt.] Helvetica Medium, upper & lower case. Maximum length of line is 6-1/4". Copy should be condensed if needed, no more than 75% in length. See drawing above for copy placement.

COPY COLOR: Black



Front View • Scale: 1" = 1"

TYPE 4.7 • 1 Line Slider

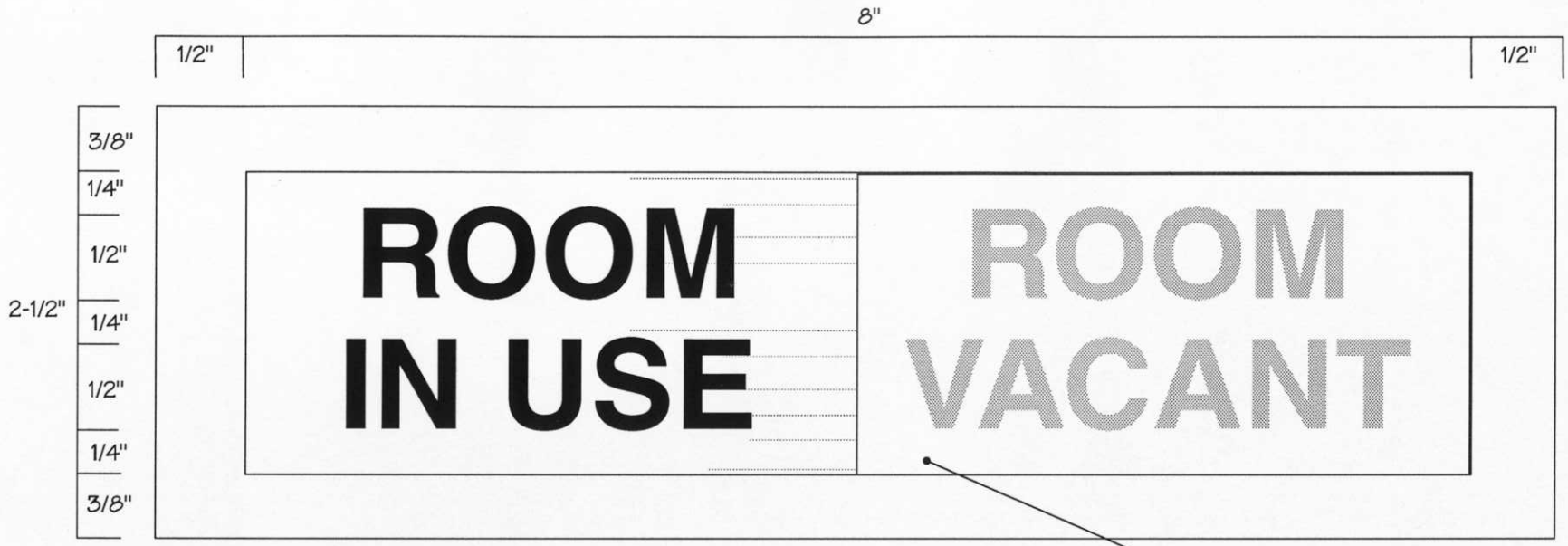
SIZE: 1-1/2" x 8"

SIGN CONSTRUCTION: .062" matte surface clear acrylic faceplate with subsurface printed border, .062" clear acrylic spacer fastened to a .060" reverse painted and subsurface printed backplate with 1/32" double sided vinyl tape. Slider insert is reverse painted.

COPY FOR INSERT: 1/2" Helvetica Medium, upper & lower case. Copy is subsurface printed on backplate and will be centered in area of window.

COLOR: Please see color options specifications.

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1" = 1"

TYPE 4.8 • 2. Line Slider

SIZE: 2-1/2" x 8"

SIGN CONSTRUCTION: .062" matte surface clear acrylic faceplate with subsurface printed border, .062" clear acrylic spacer fastened to a .060" reverse painted and subsurface printed backplate with 1/32" double sided vinyl tape. Slider insert is reverse painted.

COPY FOR INSERT: 1/2" Helvetica Medium, upper & lower case. Copy is subsurface printed on backplate and will be centered in area of window.

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1" = 1"

TYPE 5.1 • ADA Stairwell & Floor Sign

SIZE: 3" x 8"

BACKPLATE CONSTRUCTION: 1/8" Rowmark ADA Alternative engraving stock

RAISED LETTER CONSTRUCTION: 1/16" Rowmark routed letters inset into backplate 1/32". Rowmark material is adhered with self adhesive sheeting.

TYPESTYLE: 1" & 5/8" Helvetica Medium, upper case characters only.

BRAILLE: 1/4" Grade 2 translated Braille will be reverse engraved from within a field.

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1" = 1"

TYPE 5.2• In Case of Fire Elevator Sign

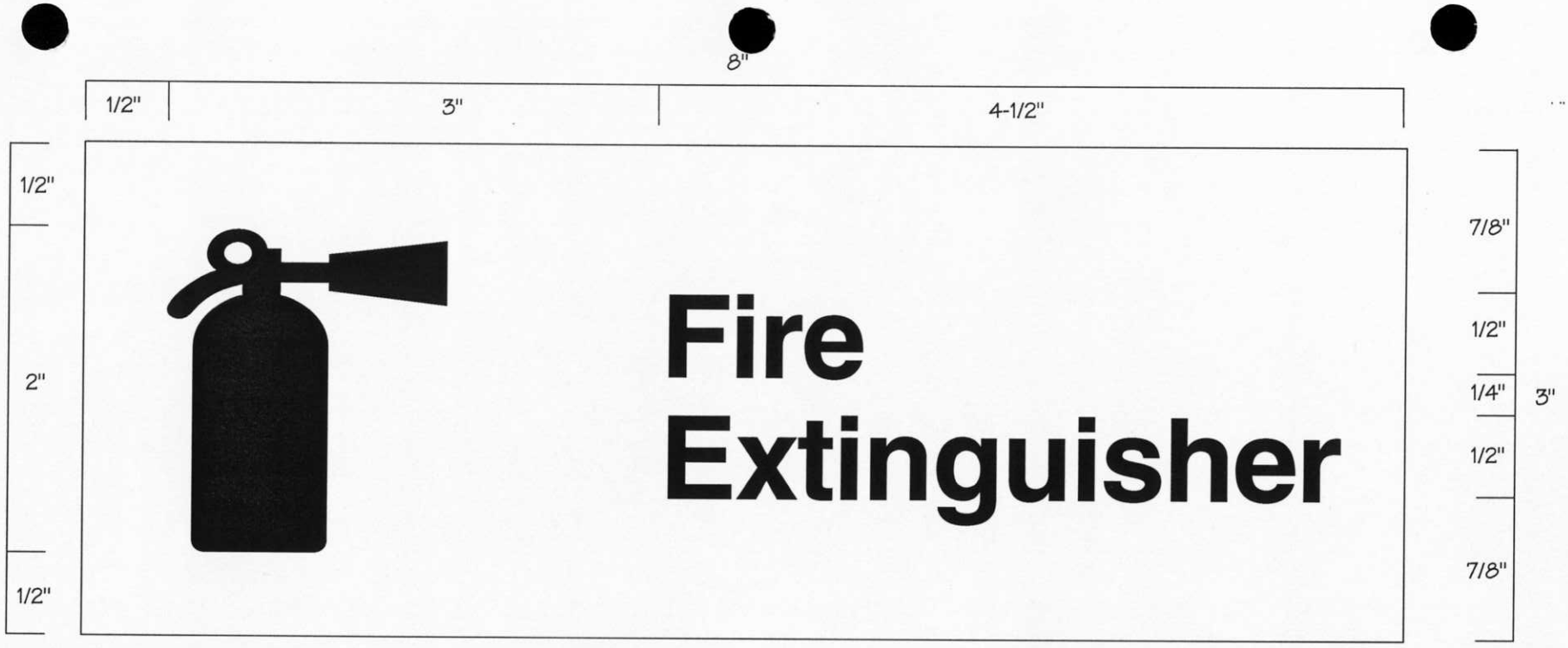
SIZE: 3" x 8"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 5/16" Helvetica Medium, upper & lower case characters.

SYMBOLS: 2" flame & stairs

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1" = 1"

TYPE 5.3 • Fire Extingisher

SIZE: 3" x 8"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 1/2" Helvetica Medium, upper & lower case characters.

SYMBOLS: 2" extinguisher

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1" = 1"

TYPE 5.4 • No Smoking

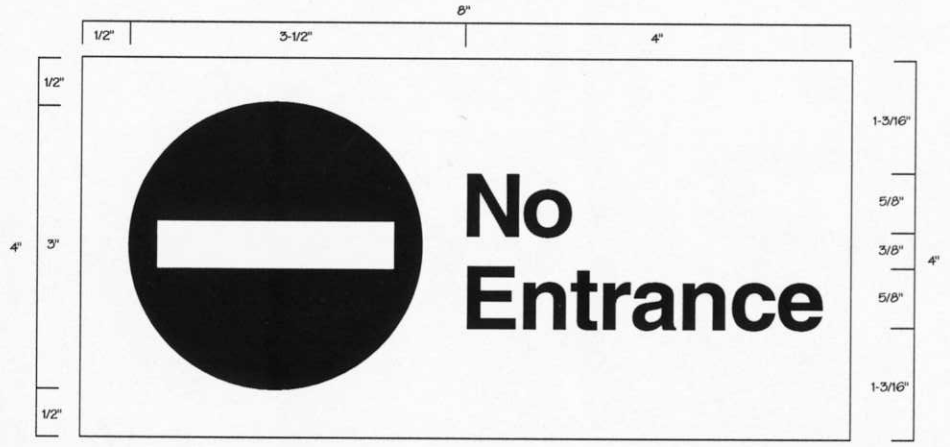
SIZE: 4" x 8"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 5/8" Helvetica Medium, upper & lower case characters. 1/4" Helvetica Medium, upper & lower case condensed to 80%

SYMBOLS: 3" no smoking symbol

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1/2" = 1"

TYPE 5.5 a • 3" Regulatory Symbol

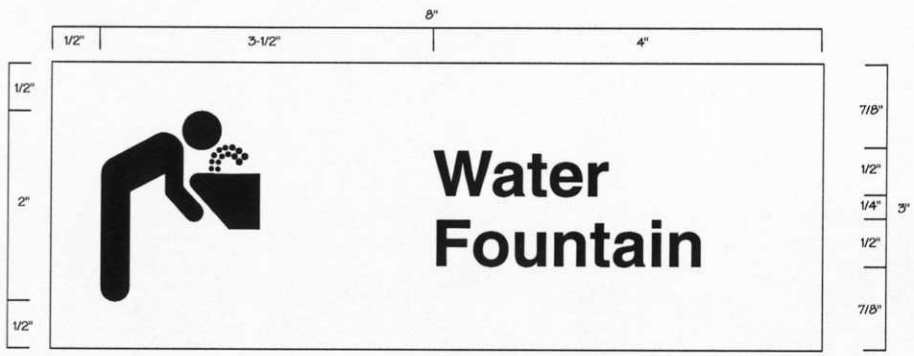
SIZE: 4" x 8"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 5/8" Helvetica Medium, upper & lower case characters. Copy size may be changed to fit area for copy, maintaining basic proportion and format.

SYMBOLS: 3" symbol

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1/2" = 1"

TYPE 5.5 b • 2" Regulatory Symbol

SIZE: 3" x 8"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 1/2" Helvetica Medium, upper & lower case characters. Copy size may be changed to fit area for copy, maintaining basic proportion and format.

SYMBOLS: 2" symbol

MOUNTING: Please see mounting options specifications.

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TYPE 5.5 a&b



Front View • Scale: 1" = 1"

TYPE 5.4a • No Smoking

CONSTRUCTION: Copy and symbol are reverse cut for installation on glass from white 4 mil self adhesive vinyl.

TYPESTYLE: 5/8" Helvetica Medium, upper & lower case characters. 1/4" Helvetica Medium, upper & lower case condensed to 80%

SYMBOLS: 3" no smoking symbol

COLOR: White

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1/2" = 1"

TYPE 5.6

SIZE: 8" x 8"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 5/8" Helvetica Medium

SYMBOLS: 4-1/2" access, 1-11/16" arrow

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1/2" = 1"

TYPE 5.7

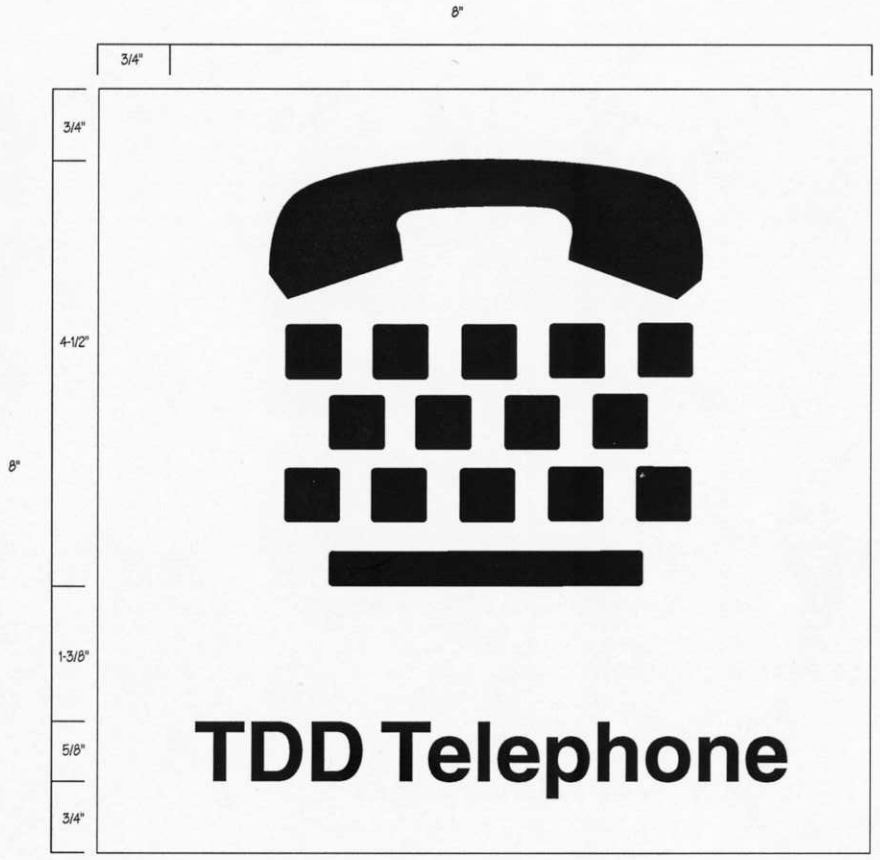
SIZE: 8" x 8"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 5/8" Helvetica Medium

SYMBOLS: 4-1/2" access

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1/2" = 1"

TYPE 5.8

SIZE: 8" x 8"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 5/8" Helvetica Medium

SYMBOLS: 4-1/2" access

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1/2" = 1"

TYPE 5.9

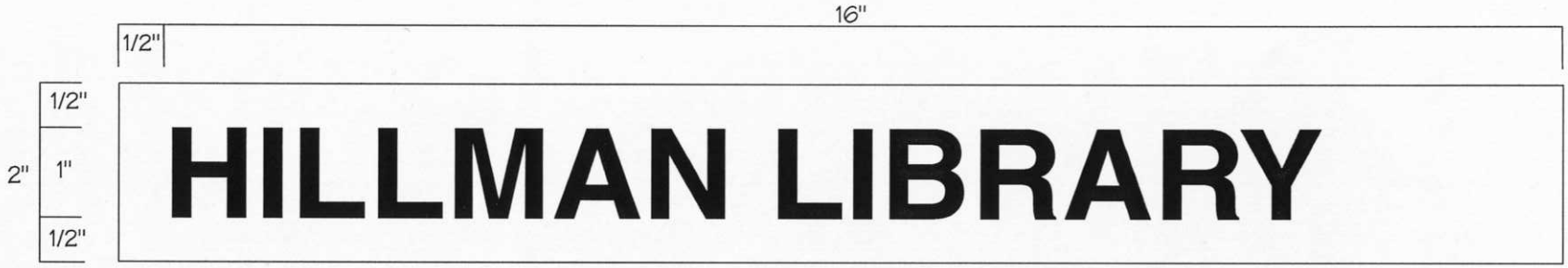
SIZE: 8" x 8"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 5/8" Helvetica Medium

SYMBOLS: 4-1/2" TDD Symbol, 1-9/16" arrow

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1/2" = 1"

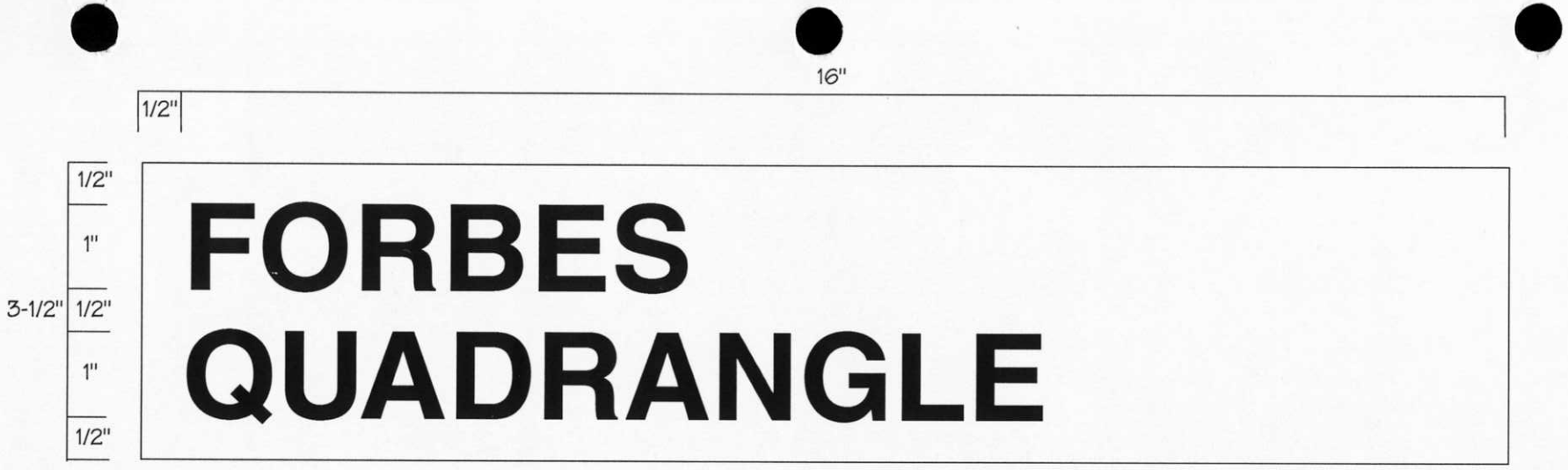
TYPE 6.1 • 1 Line Directional Header

SIZE: 2" x 16"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 1" Helvetica Medium, upper case characters. (16 characters per line maximum)

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1/2" = 1"

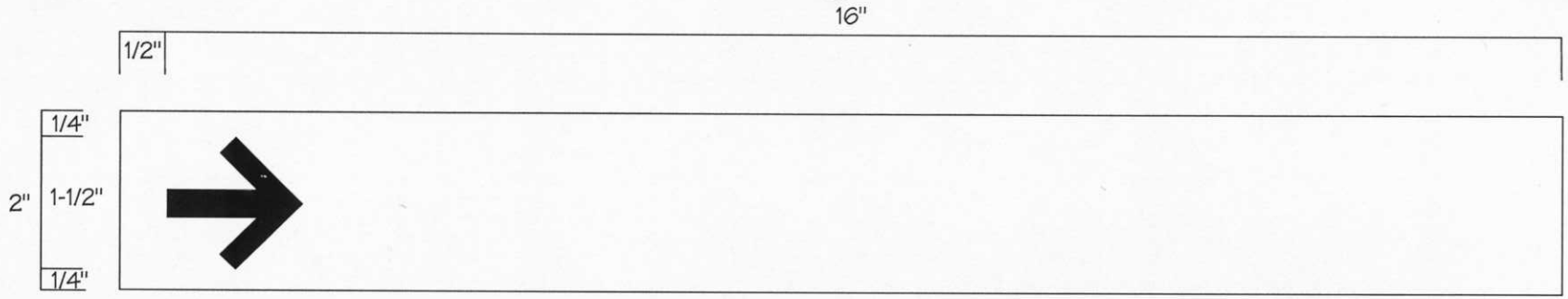
TYPE 6.2 • 2 Line Directional Header

SIZE: 3-1/2" x 16"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 1" Helvetica Medium, upper case characters. (16 characters per line maximum)

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1/2" = 1"

TYPE 6.3 • Directional Arrow strip

SIZE: 2" x 16"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

ARROW: 1-1/2"

COLOR: Please see color options specifications.

MOUNTING: Please see mounting options specifications.

TYPE 6.3 a
Right arrow

TYPE 6.3 b
Left arrow

TYPE 6.3 c
Up arrow

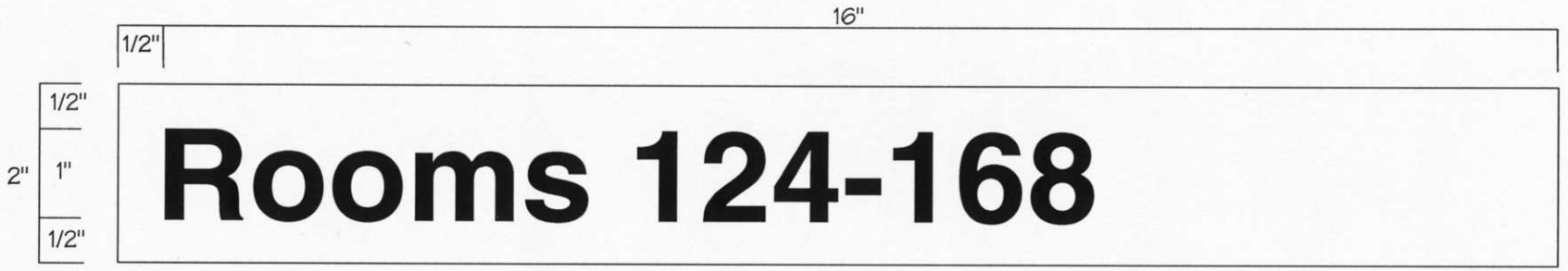
TYPE 6.3 d
Down arrow

TYPE 6.3 e
Right/Up arrow

TYPE 6.3 f
Right/Down arrow

TYPE 6.3 g
Left/Up arrow

TYPE 6.3 h
Left/Down arrow



Front View • Scale: 1/2" = 1"

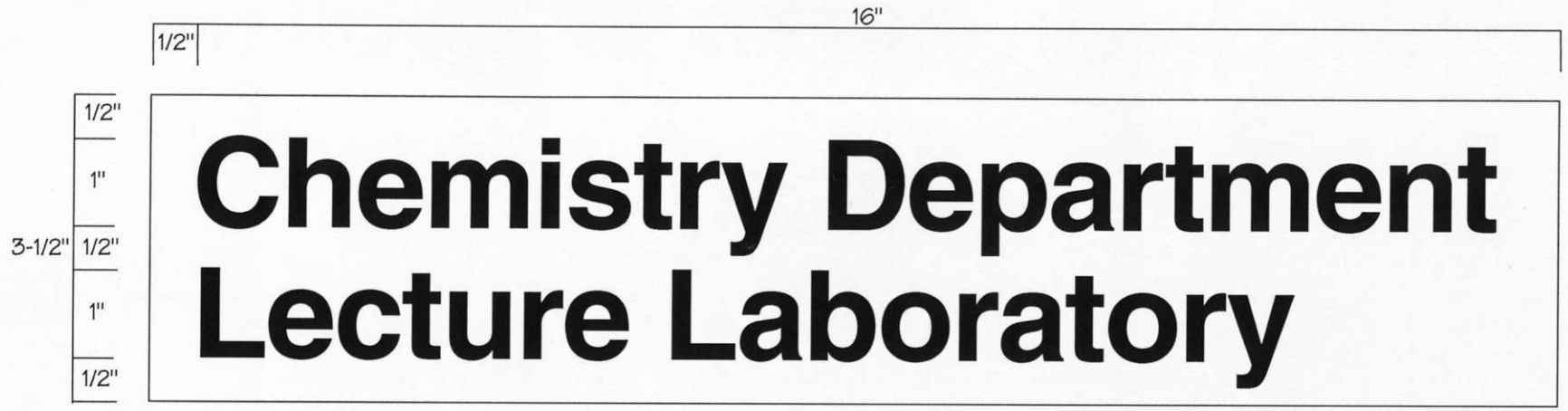
TYPE 6.1 • 1 Line Directional Copy Panel

SIZE: 2" x 16"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 1" Helvetica Medium, upper & lower case characters. (20 characters per line maximum)

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1/2" = 1"

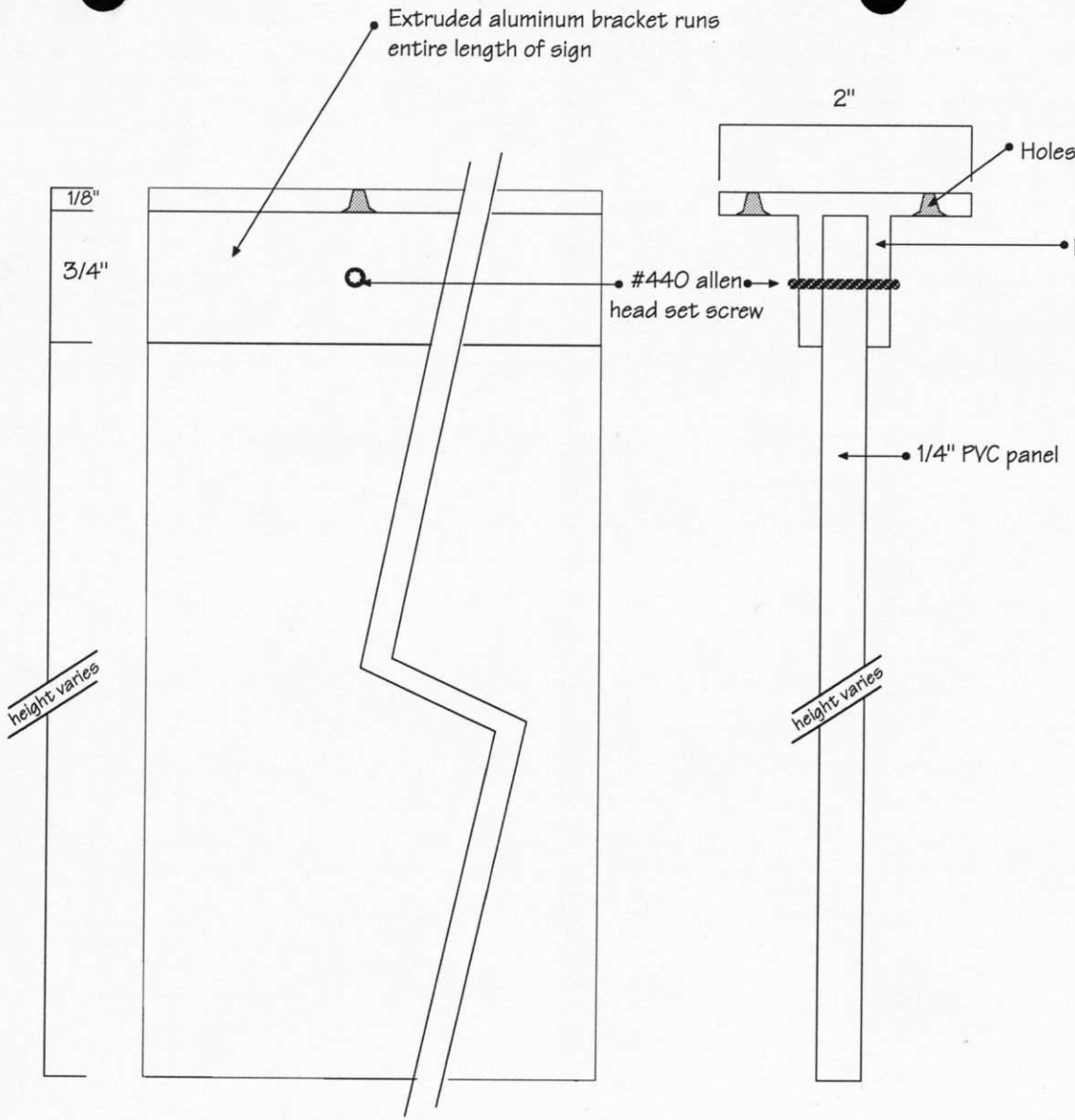
TYPE 6.5 • 2 Line Directional Copy Panel

SIZE: 3-1/2" x 16"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 1" Helvetica Medium, upper & lower case characters. (20 characters per line maximum)

MOUNTING: Please see mounting options specifications.



Front View • Scale: 1" = 1"

Side View

TYPE 7 CONSTRUCTION

SIGN CONSTRUCTION: 1/4" thick PVC panel surface painted both sides. Copy is computer cut from 4 mil vinyl and is surface applied.

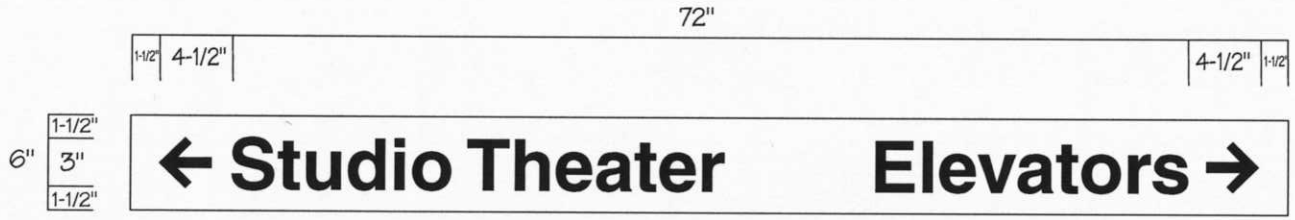
TYPESTYLE: Helvetica Medium, upper & lower case characters, size varies upon sign type.

ARROW: 2" or 3" in height

MOUNTING: Panel is mounted into extruded aluminum bracket and held in place with #440 allen head set screws. Bracket is mechanically fastened to ceiling, Set screws and mounting holes are set on 12" centers across width of sign.

University of Pittsburgh
Interior Signage

TYPE 7 CONSTRUCTION



Front View • Scale: 1" = 12"

TYPE 7.1 • 1 Line Overhead, Double Sided

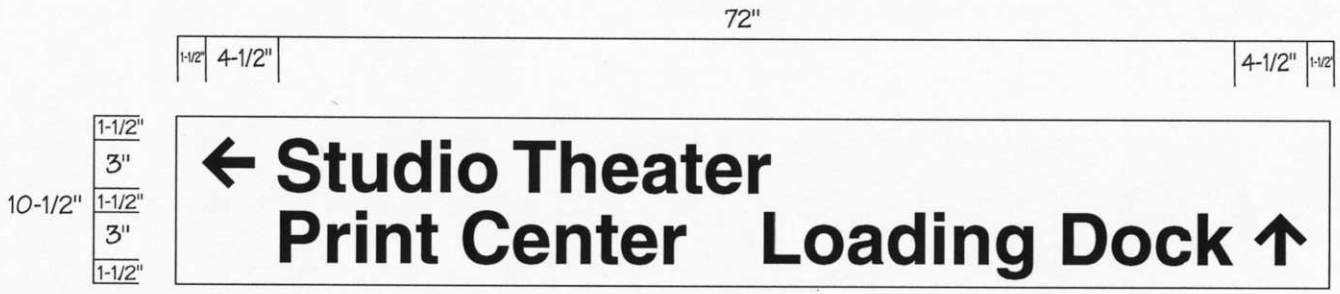
SIZE: 6" x 72"

SIGN CONSTRUCTION: 1/4" thick PVC panel surface painted both sides. Copy & arrows are computer cut from 4 mil vinyl and surface applied to panel.

TYPESTYLE: 3" Helvetica Medium, upper & lower case characters.

ARROW: 3" in height

MOUNTING: Panel is mounted into extruded aluminum bracket and held in place with hex head set screws. Bracket is mechanically fastened to ceiling, See Type 7 Construction detail for more information.



Front View • Scale: 1" = 12"

TYPE 7.2 • 2 Line Overhead, Double Sided

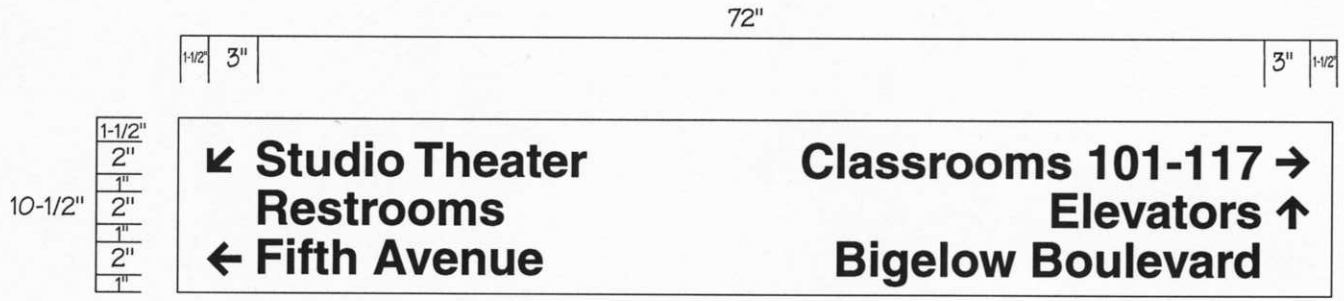
SIZE: 10-1/2" x 72"

SIGN CONSTRUCTION: 1/4" thick PVC panel surface painted both sides. Copy & arrows are computer cut from 4 mil vinyl and surface applied to panel.

TYPESTYLE: 3" Helvetica Medium, upper & lower case characters. Single lines of copy should be at the bottom edge of the sign.

ARROW: 3" in height, if both messages are for the same direction on either side of sign, use an arrow on the uppermost message.

MOUNTING: Panel is mounted into extruded aluminum bracket and held in place with hex head set screws. Bracket is mechanically fastened to ceiling, See Type 7 Construction detail for more information.



Front View • Scale: 1" = 12"

TYPE 7.2 • 3 Line Overhead, Double sided

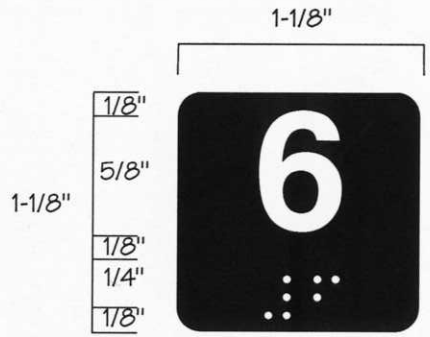
SIZE: 10-1/2" x 72"

SIGN CONSTRUCTION: 1/4" thick PVC panel surface painted both sides. Copy & arrows are computer cut from 4 mil vinyl and surface applied to panel.

TYPESTYLE: 3" Helvetica Medium, upper & lower case characters. Single lines of copy start at the bottom edge of the sign.

ARROW: 3" in height, if both messages are for the same direction on either side of sign, use an arrow on the uppermost message.

MOUNTING: Panel is mounted into extruded aluminum bracket and held in place with hex head set screws. Bracket is mechanically fastened to ceiling, See Type 7 Construction detail for more information.



Front View • Scale: 1" = 1"

TYPE 8.1 • Elevator ADA Car plate

SIZE: 1-1/8" x 1-1/8" with 1/8" radius corners

CONSTRUCTION: .060" zinc is etched .032" deep leaving raised characters and Braille.

TYPESTYLE: 5/8" Helvetica Medium, upper case characters or numbers only.

BRAILLE: 1/4" Grade 2 translated Braille

COLOR: Blackground of plate is black with satin finished characters.

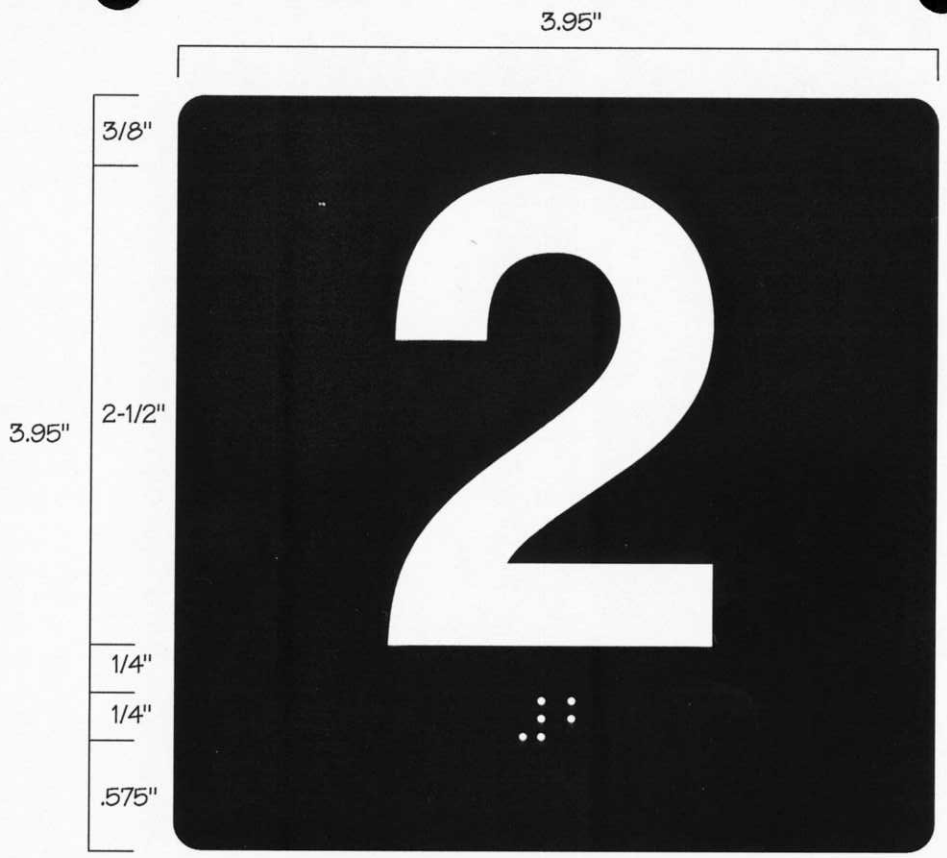
MOUNTING: 3M VHB adhesive.

Manufacturer Part No. C06

MANUFACTURER:
VisionMark, Inc.
2309 Industrial Drive
P.O. Box 4219
Sidney, Ohio 45365
800-323-2053
FAX 513-492-3108

SUPPLIERS:
VisionMark, Inc. (see above)

Bunting Inc.
409 West Warrington Avenue
Pittsburgh, PA 15224
412-481-0445
FAX 412-481-1506



Front View • Scale: 1" = 1"

TYPE 8.2 • Elevator ADA Jamb plate

SIZE: 3.95" x 3.95" with .146" radius corners
CONSTRUCTION: .060" zinc is etched .032" deep leaving raised characters and Braille.
TYPESTYLE: 2-1/2" Helvetica Medium, upper case characters or numbers only.
BRAILLE: 1/4" Grade 2 translated Braille
COLOR: Blackground of plate is black with satin finished characters.
MOUNTING: 3M VHB adhesive.
Manufacturer Part No. J02

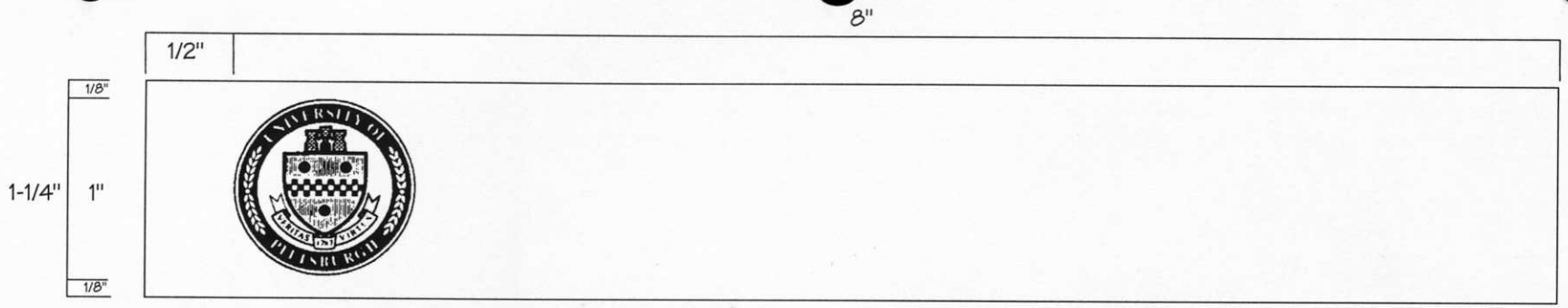
MANUFACTURER:
VisionMark, Inc.
2309 Industrial Drive
P.O. Box 4219
Sidney, Ohio 45365
800-323-2053
FAX 513-492-3108

SUPPLIERS:
VisionMark, Inc. (see above)

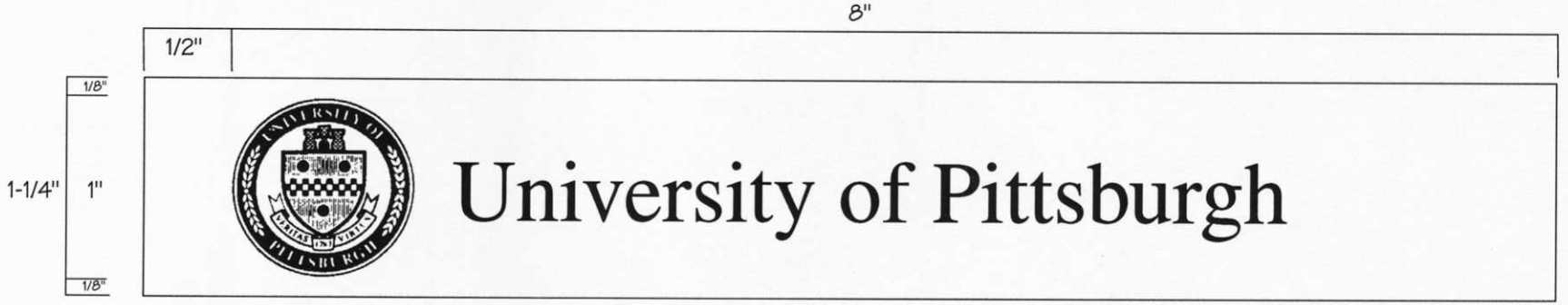
Bunting Inc.
409 West Warrington Avenue
Pittsburgh, PA 15224
412-481-0445
FAX 412-481-1506

University of Pittsburgh
Interior Signage

TYPE 8.2



TYPE 9.1a • Logo Seal Header



TYPE 9.1b • Seal & Logotype Header

Front View • Scale: 1" = 1"

TYPE 9.1 a&b • 8" logo headers

SIZE: 1-1/4" x 8"

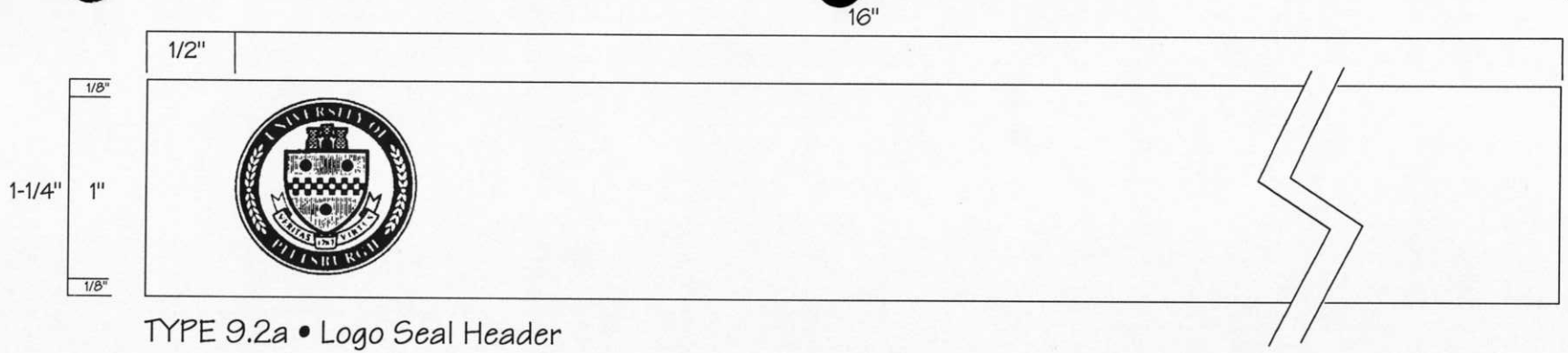
PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 3/8" Times New Roman, upper & lower case characters.

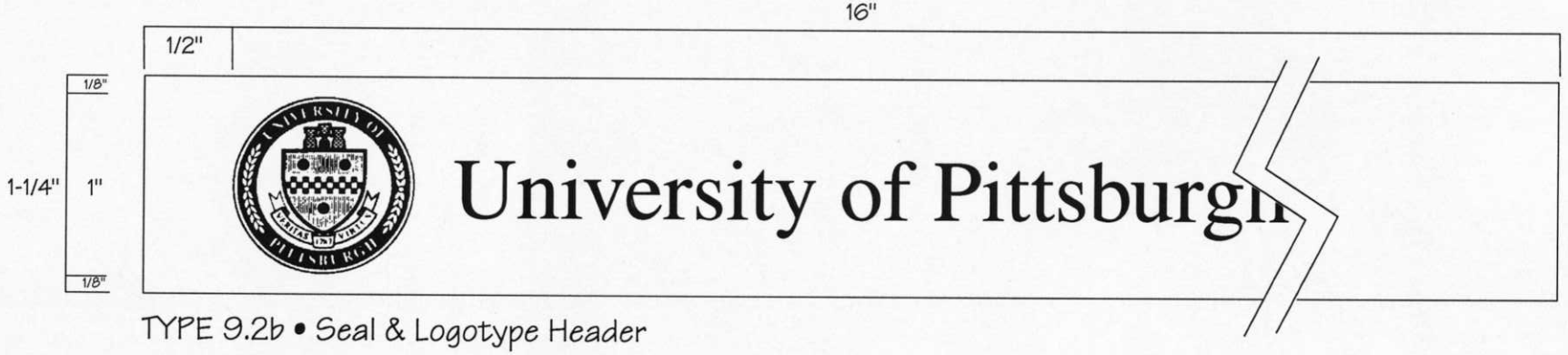
LOGO: 1" University Seal

COLOR: Please see color options specifications.

MOUNTING: Please see mounting options specifications.



TYPE 9.2a • Logo Seal Header



TYPE 9.2b • Seal & Logotype Header

Front View • Scale: 1" = 1"

TYPE 9.2a&b • 16" logo headers

SIZE: 1-1/4" x 16"

PLAQUE CONSTRUCTION: 1/8" matte surface clear acrylic with subsurface printed graphics and painted background.

TYPESTYLE: 3/8" Times New Roman, upper & lower case characters.

LOGO: 1" University Seal

COLOR: Please see color options specifications.

MOUNTING: Please see mounting options specifications.

DIVISION N
CLASSROOM AND LECTURE HALL DESIGN
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DIVISION N
CLASSROOM AND LECTURE HALL DESIGN

N.1 INTRODUCTION TO THE GENERAL PURPOSE CLASSROOM

A. The basic premise is that, regardless of the method of instruction being used, a classroom learning environment will allow students to see anything presented visually, to hear any audible presentation free from noises and distortions, and to be physically comfortable (air flow, temperature, furniture, etc.).

B. Three (3) categories of classrooms are described in this document. A general-purpose classroom is defined as a room designed to house 75 or fewer students, with at least 350 square feet and a minimum capacity of 20 student stations. Anything less than that, in terms of size or capacity, is defined as a seminar room. Classrooms designed for more than 75 students are considered lecture halls. Separate sections of guidelines have been prepared for each type of classroom; however, the lines between them are not absolute and require some interpretation based on individual facilities and applications.

C. These guidelines are not intended to establish standards for all classroom construction and renovation, but rather to serve as a guideline. The number of variables that must be considered in classroom design is almost infinite. They must be adapted to fit the local needs, mission, and individual preferences of each institution as well as conform to applicable state and local codes.

N.2 SITE AND SPACE RELATIONSHIPS FOR THE GENERAL PURPOSE CLASSROOM

A. Classrooms should be concentrated on the lower floors of buildings. This provides better student access and allows instructional support services to be provided more conveniently. A building with mixed functions (classrooms, offices, and/or laboratories) should have a classroom core that is separated from the other functions.

Classrooms should be located away from noise-generating activities taking place either outside or inside the building. To reduce external noise, it is important to consider sound separation from such areas as streets, parking lots, housing areas, plazas or other areas where students gather, recreation sites, athletic fields, trash pickup sites, and loading docks. To reduce internal noise, classrooms should not be located adjacent to building mechanical systems, elevators, restrooms, vending areas, etc.

B. Entrances/exits:

1. To reduce the impact of exterior noise and temperature differences, building entrances into general-purpose classroom areas should have two (2) sets of doors, one from the outside into a vestibule and a second from the vestibule into the building.

2. The principal determinant of the location of these entrances should be the flow of student traffic. Entrances should be close to classrooms so that students do not have to travel great distances through non-instructional areas to reach classrooms. It also should be recognized that a large number of students passing through hallways to exits represents a potential source of disturbance to classes in session.

3. In determining the size of entrances/exits, local building codes should not be the

sole criterion. It is important to plan for a flow of students between classes which can be double the capacity of the rooms serviced by an entrance/exit. It is unrealistic to assume that all of the students leaving will be gone before the students coming to the next class begin to arrive.

C. Entrances and exits in rooms:

1. Rooms having a capacity of fewer than 50 normally should have entrances/exits at the rear of the room. Rooms of 50-75 capacity should have two (2) entrances/exits preferably at the rear of the room.

2. Entrances and exits are to facilitate the easy passage of people with disabilities. The entrances should accommodate moving equipment in and out of the room.

3. Doors should be a minimum of three (3) feet wide and should have a vision panel in order to prevent injury when being opened. Vision panels are to be tempered glass and should be tinted to reduce light transmission. The glass area should not exceed 100 square inches. The base of the vision panel should be no more than 40 inches above the floor, and the top of the vision panel should extend at least 64 inches above the floor. Classroom doors should have a lever and/or panic bars with closers for people with disabilities.

4. Doors should be equipped with rubber bumper door silencers.

5. Doors should be located so as to minimize congestion problems in the hallway when classes are changing. When possible, doors should be recessed into the room so that the door does not swing into the hallway.

6. Kick plates shall be installed on the egress side of all doors.

7. Locks installed in the doors should be “classroom function” hardware, key or combination key pad operation. A key pad type should also have the lock and unlock “classroom function”.

D. Hallways:

The design of building housing classrooms should recognize that students will be in the hallways or public areas while classes are in session. Thus, some built-in or permanently affixed seating should be provided. Lacking seating, students will sit on the floor, which has the potential of interrupting the traffic flow through the hallways.

E. Vending Areas:

Vending areas should be as remote as possible from the classrooms. They should be located in an alcove or other similar locations so as to minimize the congestion factor resulting when students are using the machines.

F. Trash and Recycling Containers:

Trash and recycling containers should be located both in the vending area and in the classroom area.

G. Directory of Classrooms:

A directory of the location of classrooms should be provided at each entrance along with a directory of any other relevant function that may exist in the building. If there are multiple corridors leading away from a point of entry to a floor, directional signs should indicate the location of classrooms.

N.3 DIMENSIONS OF THE GENERAL PURPOSE CLASSROOM

A. Classrooms should be designed so that the length is approximately one and one-half times the width of the room. Rooms wider than they are deep normally present unacceptable viewing angles for projected materials and for information written on the chalkboard. With the increased use of projected materials, especially computer imaging, the shape and dimensions of classrooms are more critical than ever before.

B. The instructor area should be on the narrow wall of the room.

C. There should be no obstructions (such as posts) anywhere in the classroom. The front wall of the room behind the instructor area should have no protrusions into the room so that a chalkboard/markerboard can be installed across the entire wall of the instructor area.

D. Ceiling heights will vary depending upon the size of the room. The following are suggested minimum ceiling heights:

Capacity	Flat Floor	Sloped Floor
up to 20	10 feet	
21-49	10 feet	
50-79	12 feet	8 feet in rear, 12 feet in front

E. In general, sloped floors are appropriate only in larger general purpose classrooms. The incline of sloped floors should be no more than a 1:12 ratio. In addition, there should be an entrance at the lower end of the sloped floor so that equipment can be brought to the teaching station of the room and wheelchair access can be provided.

N.4 WINDOWS FOR THE GENERAL PURPOSE CLASSROOM

A. Considerations for rooms with windows:

Window treatments should be opaque and should be capable of eliminating outside light from reaching the projection screen(s).

1. **Venetian Blinds**: If Venetian blinds are used, the slats should have a non-reflective matte finish. Maximum light control is achieved when Venetian blinds are installed with channels to provide a light-tight abutment to the window frame. It should be noted, however, that Venetian blinds, even those with channels, will not provide sufficient room darkening when electronic projection is being used.

2. **Roller Blinds**: Opaque roller blinds offer significantly more light control than Venetian blinds, particularly if the roller blinds are installed with channels to prevent light leakage around the edges.

B. When windows are installed, particularly on the south side of the building, it is recommended that tinted glass with a low E rating be used. This will reduce the heat transfer from the outside to the inside of the room. Double or even triple, glazed windows will assist in reducing heat transfer as well as provide a barrier to exterior noised entering the room.

C. Even when windows are preferred in classrooms, the surface should be kept at a minimum. Window surfaces should be at the side of the room and not located in the front rear of the room.

N.5 FINISHES FOR THE GENERAL PURPOSE CLASSROOM

A. Color and Reflectance Values:

1. Selection of color and reflectance values of finish materials must be considered for all classrooms. In general, white surfaces should be specified only in unusual situations. Painted surfaces should be light in color.

2. Special care must be given to rooms where televised instructional activities will originate. Light blue and beige are good choices for these areas. In addition, finishes should be non-glare.

3. Reflectance value of paints, vinyl coverings, laminates, and other finish materials should be selected to enhance ambient illumination and the illumination at working surfaces. The following values are recommended:

Ceilings	70-90%
Walls	40-60%
Floors	30-50%
Desktops	35-50%
Chalkboards	20-30%

B. Floors:

1. The floor in the general classroom should be vinyl or rubber tile with a smooth surface. Carpeting, if used, needs to be factored into the overall acoustical characteristics of the room.

2. The floor covering should be a medium to light color and should contain some kind of subdued pattern of fleck to break the monotony and to improve the overall maintenance of the floors.

3. A four-inch base should be installed around the walls.

C. Walls:

1. A chair rail should be installed whenever movable seating is used in the room.

2. The finishes used in a classroom should be chosen with the room's acoustical characteristics in mind.

D. Ceilings:

Ceilings should be of a light color and non-reflective material.

N.6 ACOUSTICS FOR THE GENERAL PURPOSE CLASSROOM

A. Walls:

1. Walls in general-purpose classrooms should have a Sound Transmission Coefficient (STC) rating no less than 50.

2. Walls must extend to the floor above or to the roof construction, and not stop at the ceiling. This will reduce noise transmission as well as improve security.

3. Higher STC ratings and special wall-construction details must be included whenever classrooms are located adjacent to, above, or below restrooms, mechanical rooms, elevator shafts, athletic facilities, or other sources of high noise levels or where the classroom function generates a significant amount of noise.

4. Concrete masonry units may be used, but may have to be covered with another finish in order to provide proper acoustical treatment.

5. Folding walls are extremely undesirable and should not be used except under very extraordinary circumstances. It is difficult to develop a folding-wall design that is able to maintain adequate sound separation between classrooms.

6. Sound levels as generated by mechanical systems or other ambient noise measured at all points in a classroom at four feet above the floor must have an Noise Criterion (NC) rating of no more than 35.

B. Ceiling:

1. The surface of the ceiling must be designed to accommodate the required acoustical properties of the room. The area of the ceiling to be acoustical tile is a function of ceiling height.

Ceiling Height	% of Acoustical Title
10 feet	40-50
10 feet	50-60
12 feet	50-60

2. These numbers presume the use of Noise Reduction Coefficient (NRC) .55 -.65 tile in a ceiling suspension system. The acoustical tile should be arranged in the form of a U around the perimeter of the room, with the opening at the front and the rest of the ceiling a hard material such as gypsum board or plaster.

C. Mechanical Systems:

1. The mechanical system supporting general-purpose classrooms should generate a background noise of no more than NC 35. To achieve this, the system requires not only careful design, but competent installation, balancing, and a regular maintenance program once installed.

2. Factors that influence the design of a quiet operating system include air handlers or fans located away from the classrooms; low velocity or air within the room; and proper sizing an acoustical treatment of ducts, returns, and diffusers.

3. The air changes and circulation of air per ASHRA standards is a critical factor in instructional spaces. This must be achieved with effective control of HVAC system-generated background noise.

D. Utility Boxes:

When classrooms share a common wall, electrical receptacles or other utility boxes should not be installed back-to-back with similar receptacles in the next room. Off-setting the boxes will reduce sound transmission between rooms.

E. Window and Floor Treatments:

Window and floor treatments should be selected as an integral part of the acoustical treatment of the room.

N.7 LIGHTING AND LIGHTING CONTROLS FOR THE GENERAL PURPOSE CLASSROOM

A. The control of light in a general-purpose classroom has become increasingly important with the growing use of technology in teaching. While the correct lighting levels can be achieved through a variety of approaches, it is essential that classrooms have the full range of lighting possibilities, from a comfortable reading level to darkening sufficiently to allow for all types of projection of information while still permitting note taking.

B. Controls:

1. Switching should be kept simple, with the use in mind. Light switches should be clearly labeled as to function. Standardization among rooms is recommended.

2. Switching for the room lights should be provided at every entrance to the room. In addition, the room lights should be controlled from the teaching station as should lights that are capable of being dimmed.

3. To accommodate projection needs, room lights should be switched by zone from the front to the rear of the room, thus making it possible to reduce the lighting in the front of the room and maintain the normal lighting level toward the rear of the room.

4. Automated light control systems should provide for a manual override.

C. Ceiling Lighting:

1. The room lights should provide 50-60 foot-candles at each writing surface, including the teaching station. There should be an even level throughout the room with no bright spots or dark spots. Diffusers used in ceiling fixtures should be non-reflective.

2. It should be possible to reduce the lighting in the room to 5-10 foot-candles over the seating area with all direct light eliminated from the instructor and projection

screen areas. Provisions need to be made for a highly concentrated light source which allows the instructor to see notes.

3. Fluorescent lights should be three (3) lamps with two (2) lamps switched together and the center map switched separately. Dimmable fluorescent lights should not be used.

D. Chalkboard/Markerboard Lighting:

1. Illumination of the chalkboard/markerboard should be at a level of 75 foot-candles uniformly across the entire writing surface. Chalkboard/markerboard lighting may be necessary in rooms of more than a 50-student capacity. The lighting should be installed so it does not create bright spots or shadows on the surface of the board. Further, the lamps in the fixtures should not be directly visible to students sitting in the front rows of seating.

2. Chalkboard/markerboard lights should be switched in two (2) sections so that one (1) part of the board can be illuminated when one projection screen is being used.

3. Lights also should be mounted so as not to interfere with the effective use of the projection screens.

E. Other Considerations:

Emergency lighting and exit signs should conform to local codes and should be located so as not to produce ambient light on the projection screen or otherwise compete for visual attention. Emergency lighting should be controlled by a 60-minute timer switch.

N.8 ELECTRICAL AND COMMUNICATION SERVICES FOR THE GENERAL PURPOSE CLASSROOM

A. Electrical Services:

1. Electrical services should be protected from surges and spikes. Except in the case of very special needs, outlets should not be controlled by any switch that could be confused for a light switch.

2. Each room should have one (1) or more dedicated circuits on a breaker, not shared by any other room.

3. New construction or major renovations should make provision for a minimum of 20 percent, with a recommended 40 percent, future increase in the need for electrical services in the classroom area. This would include additional capacity in the breaker box for this future use.

4. The number of electrical outlets in the room will depend in part on special functions that many are assigned to the room. In general, rooms under 50 capacity should have a single duplex outlet in each side of the room, one (1) fourplex outlet in the rear wall of the room centrally located, two (2) duplex outlets in the front corners of the room, and one (1) fourplex outlet located in the center of the front wall.

5. In rooms of 50-75 capacity, there should be two (2) outlets evenly spaced in each side wall, three (3) fourplex outlets in the front wall, and two (2) fourplex outlets in the rear.

6. Outlets should be mounted 24 inches above the floor.

B. Telecommunications:

1. There should be one (1) dedicated telecommunications closet of adequate size per wing, per floor of a classroom facility. Attention should be given to the HVAC needs of these telecommunications closets because of heat generated by the equipment.

2. The conduits or cable tray from the telecommunications closet to each classroom should make provisions for voice, data, and video. The cable tray shall have divisions for each type of cable.

3. Telecommunications wiring shall be separated from the electrical circuit(s). The low-voltage services should be isolated from each other through separate conduit. These services include controls for slide projectors, audio, video data, and voice feeds. These circuits should not be tied to the ground.

4. Circuits should be clearly labeled at termination locations.

5. Classrooms will contain a secure media closet or cabinet to contain the electronic equipment and rack. The closet will be approximately 42" x 42" inside, lined with ¾" plywood or expanded metal and drywall with a lockable ¾" plywood door and 1¾" solid core wood outer door with mortise hardware.

N.9 FURNISHINGS AND EQUPMENT FOR THE GENERAL PURPOSE CLASSROOM

A. Instructor Area:

A sturdy 30" x 60" table or desk, or custom console should be placed at the front of the room as part of the instructor area. This area should also include either a tabletop or free-standing floor podium with a minimum surface of 24" d. x 30" w. There should also be a stool or chair available at the teaching station. This furniture should be coordinated with the other furniture in the room.

B. Student Stations: (See typical classroom layout plans for various seating types)

1. Movable Seating:

It is recommended that rooms under 50 capacity should have movable seating unless there are special considerations.

The tablet arms should contain at least 150 square inches of writing surface. While larger tablet arms are desirable, such factors as durability and stability also must be considered. Both the tablet arm and the chair should be durable and comfortable to use.

2. Tables and Chairs:

Tables and chairs are highly desirable because of the additional workspace provided to students. However, this arrangement does reduce the student seating capacity of the room. Tables used in classrooms should be 24-30 inches deep.

3. Fixed Seating:

   Rooms of 50-75 capacity should be evaluated as to the intended use in determining whether fixed or movable seating should be installed. However, if a floor is sloped, fixed seating should be used.

4. Left-Handed Seating:

   Both movable and fixed seating should contain a minimum of 10 percent left-handed tablet arms or should contain chairs designed to be used by either right- or left-handed people.

5. Wheelchair Stations:

   Stations for students in wheelchairs should be provided at approximately four percent of the capacity of the room. These stations should be available in the rear of the room and in the front of the room, assuming appropriate accessibility. To accommodate students in wheelchairs, a table 30 inches deep, 31 inches high, with a 29 inch clearance and 3 feet long should be provided.

C. Chalkboards/Markerboards:

1. General-purpose classrooms should have chalkboards/markerboards across as much of the front wall as possible, and should take into account viewing angles.

2. Chalkboards/markerboards should be mounted with the bottom edge of the chalk tray 36 inches above the finished floor. The boards should be four feet in height and have chalk trays under the full width of the board. Seams on the chalkboards/markerboards should be flush. The surface should provide maximum contrast with the chalk or marker being used.

3. There should be a tack strip above the board and map hooks attached to the top of the board.

D. Voice Reinforcement:

Voice reinforcement should be considered in rooms of 50-75 capacity. The decision should be based on outside noise factors, the acoustical characteristics of the room, and any special needs.

E. Projection Screens and Video Projection:

1. The need for multiple projection surfaces within classrooms is increasing as more technology is being used in instruction. The standard of a single screen mounted in the center of the front of the room, is no longer adequate.

2. Screens should be mounted side-by-side so as not to hinder access to light switches or other controls and maintain the optimum 45° viewing angle to seats.

A minimum of six running feet, preferably eight feet, of chalkboard should remain exposed when either one of the projection screens is in use.

3. Screens mounted parallel to the front of the room should be mounted with the top of the screen 10-12 inches out from the wall. This will allow the screen to clear any chalkboard/markerboard lights and the board.

4. The minimum size for a projection screen should be six (6) feet in width with a larger size if the room is more than 35 feet from front to back. The length of the screen should extend from the mounting location at or very near the ceiling to approximately three feet above the floor, or approximately the level of the chalk tray. The University Center for Instructional Development and Distance Education (CIDDE) has standard screen sizes and equipment specifications for various size classrooms.

5. The first row of seats should be no closer to the screen than one and one-half times the image width on the screen. The optimum is two (2) times the image width to the first row of seats.

6. The standard for the size of projection screens has changed with the introduction of electronic projection. Optical projection (films and slides) have very high-resolution images resulting in a formula of distance from the screen to the farthest viewer of six times the screen width (1:6). The image that fills the screen is clearly visible to everyone with normal vision in any seat in the room using this formula.

7. With the introduction of electronic projection, a new standard must be applied. The standard for these projection systems provides anywhere from 12.5-25 percent of the resolution of optical projection. This is particularly critical in computer image projection, which is often comprised of text. This lower resolution results in a loss of sharpness in edge definition. At marginal viewer distance, the letters tend to blur and fill in, resulting in reduced readability. Screens are to have tap tension.

8. Since the use of electronic projection is increasing rapidly, it is recommended that, the distance from the screen to be the farthest viewer should be revised to four times the screen width (1:4).

9. In a room where the farthest viewer is 40 feet from the screen, a screen 10-feet wide is required.

10. The top of the screen should subtend at an angle no greater than 35º from the horizontal from any seating position. However, some compromises may have to be made in the first few rows of seats to allow sufficient space for chalkboard/markerboard and a reasonable screen size, and yet not have the front seats too far from the front of the room.

N.10 OTHER SPECIAL CONSIDERATIONS FOR THE GENERAL PURPOSE CLASSROOM

A. Signage:

1. Signage in and around a classroom should be kept to a minimum and should be coordinated with other signs and with the general décor of the area.

2. When movable seating is used, a notice as to the capacity of the room should be prominently posted within the room. This will assist in maintaining the proper inventory of student seating in the room.

B. Environmental Issues:

1. The heating, ventilating, and air-conditioning (HVAC) system must provide adequate air changes per hour in conformance with current standards of the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE).

2. The temperature range should be maintained within 68-75º, with humidity at 50 percent, ±10 percent.

3. Acoustical considerations in determining volume of air-handling noise should include, in addition to the background noise level, any vibration considerations that would generate additional noise.

C. Tack Board:

There should be nothing larger than a tack strip above the chalkboard/markerboard or elsewhere inside the classroom. A tack board in the hall, convenient to each cluster of classrooms, should be used to post student announcements and other types of general information. In addition, a tack board or tack strip should be installed outside of each classroom in the immediate vicinity of the doorway so that grades and other class related items may be posted.

N.11 INTRODUCTION TO LECTURE HALLS

A. This document focuses on design and size characteristics of a lecture hall defined as a classroom with seating for 75 or more persons.

B. The three (3) fundamental requirements, to see visual material, to hear without noise or distortion, and to be physically comfortable, are of special concern in lecture halls. Larger lecture halls require more entrances and exits, larger projection screen images, greater voice amplification, more complex lighting and audiovisual control, special acoustical design, and greater control of the environment by the instructor. Problems which occur during a large lecture class are magnified to a greater degree as a result of decreased flexibility in the arrangement of the learning environment and the teaching strategies that can be used.

N.12 SITE AND SPACE RELATIONSHIPS FOR THE LECTURE HALL

A. Lecture halls should be located to facilitate the movement of large numbers of students to and from the lecture halls. Further, lecture halls should be located so that students can enter or exit the building without passing through major portions of the building that contain other classrooms or spaces for other functions.

B. Entrances/Exits:

1. The principal determinant of the location of these entrances should be the flow of student traffic to and from the building. Entrances/exits should be located as

conveniently as possible to these patterns of traffic.

2. In determining the size of the entrances/exits, building codes should not be the sole criterion. First, it is essential to recognize that large numbers of students will be passing through the entrance/exit areas in a concentrated period of time between classes. These considerations should include not only the number of students entering/exiting the lecture hall (roughly double the capacity of the room) but also the number of students who might be going to other locations within the building through the same entrance/exit. Second, this planning must recognize the two-way nature of the traffic flow. Students will enter and exit the building at the same time which can cause congestion unless entrances/exits are designed appropriately.

C. Lobby Area:

1. Lobby space is needed in conjunction with each entrance/exit of the lecture hall. This lobby space should be large enough to allow students to congregate without interfering with the normal traffic flow of students entering or leaving the facility.

2. Seating in the lobby area is needed, but it should be far enough from the entrance/exit to the lecture hall so as to avoid any noise interference caused by normal student interaction. Seating also should be designed with durability in mind and, whenever possible, should be integrated into the overall structure of the building, rather than being placed separately from the building.

3. The surface and finishes in the lobby area should consist of very durable materials because of the large volume of student traffic in the area. This should include the floors and walls.

4. The lobby area is one of the most visible and heavily used portions of the building. For this reason, the aesthetics of the lobby should be considered an important element in the design of the area, along with the need for durability.

5. Vending machines should not be located in the lobby area and should be as remote as possible if not completely eliminated.

6. Trash/recycling containers in the lobby area should integrate with the overall aesthetic treatment of that lobby area.

7. Restrooms are needed in the vicinity of the lecture hall, but in no case should there be a common wall between the restrooms and the lecture hall.

N.13 DIMENSIONS OF LECTURE HALLS

A. Large lecture halls (those seating more than 100 students) should be a modified fan-shape. Ideally, no student should be more than 45º off the center axis of the room. The depth of the room should not be greater than one and one-half times the width of the room, measured at the midpoint of the seating area (refer to page N-23).

B. If the lecture hall has a sloped floor, the incline should be no more than 1:12. If there is a difference of four (4) inches or less between each row, then the seating should be staggered to permit clear visibility to the front of the room.

Small lecture halls (under 100 – student capacity) may or may not have a sloped floor. If the floor is flat, a teaching station platform should be installed in the front of the room to improve sight lines between the instructor and the students. In most instances, a six-inch high platform is sufficient. The platform should be wheelchair accessible and be large enough to accommodate necessary instructor furniture and equipment.

C. Aisles in a lecture hall should be laid out to provide the maximum of prime viewing locations for the audience. Generally, this will mean no center aisle. Building codes must be consulted in determining the number of seats in a continuous row and the distance between rows allowed in the location where the lecture hall is being built.

D. There should be no posts or other obstructions anywhere inside a lecture hall that would obstruct the view from any seat.

E. Special attention should be given to the amount of space available at the instructor area for chalkboard/markerboard and for other visual presentations. This emphasis, particularly in large lecture halls, should be on the use of projection tools in the place of the chalkboard/markerboard in order to provide for maximum visibility to students throughout the lecture hall.

F. Ceiling heights will vary, depending upon the size of the room. The following are recommended minimum ceiling heights, based on the number of student stations within the lecture hall. Higher ceilings may be needed if the lecture hall will have video projectors that are ceiling mounted.

Capacity	Rear Ceiling Height	Front Ceiling Height
75-149	8 feet	12 feet
150-299	8 feet	15 feet
300 or more	8 feet	18 feet

G. Walls in the lecture hall, ideally should not be parallel, or have long smooth surfaces. These construction features relate to acoustics in the lecture hall.

N.14 ENTRANCES AND EXITS IN THE LECTURE HALL

A. At-grade access should be provided to the front area of large lecture halls which have sloped floors. This access is to facilitate entering/exiting of wheelchair users as well as the movement of equipment.

B. The principal entrances/exits for large lecture halls should be in the rear section of the room.

C. Entrances and exits should facilitate the easy access of people with disabilities.

D. Locks should be key-activated only with classroom function hardware.

N.15 WINDOWS FOR THE LECTURE HALL

Large lecture halls should be void of windows. In cases where lecture halls have windows, they should be treated with blackout blinds with rails on all sides.

N.16 FINISHES FOR THE LECTURE HALL

A. Floors:

It is recommended that the floors be covered with resilient tile.

If a concrete floor is used in the student seating area, it should be sealed and/or painted.

B. Walls:

Walls should be constructed of a durable material and include acoustical treatment where prescribed by an acoustical consultant.

C. Ceilings:

The single most important characteristic of the ceiling in a large lecture hall is its role in the overall acoustical treatment of the room. Other characteristics of the ceiling that should be considered are a light color and non-reflective material so as to remain neutral in the lighting scheme of the room.

N.17 ACOUSTICS FOR THE LECTURE HALL

A. Acoustical characteristics of a lecture hall are among the most critical elements in the design of the facility. Care must be exercised in isolating the facility from exterior noise as well as controlling the background noise level in the room, especially that generated by the mechanical systems. Ambient sound levels measured at four (4) feet above the floor at all points throughout the room must have a Noise Criterion (NC) rating of more than 35.

B. The mix of sound-reflectant and sound-absorbent materials must be carefully calculated to control reverberation without creating a sound-deadened room. It is strongly recommended that an acoustical consultant be included in the design team for lecture halls.

C. Walls:

Walls should have a Sound Transmission Coefficient (STC) rating of no less than 50. Walls must extend to the floor above or to the roof construction, and not stop at the ceiling.

D. Ceilings:

1. Ceilings should be sloped or stepped and primarily of a hard surface. If it is determined that some acoustical treatment is needed as part of the ceiling, it should be installed around the perimeter of the sides and rear in the form of a U, with the front and middle sections of hard-surfaced, sound-reflectant materials. Acoustical treatment normally will not exceed 40-50 percent of the ceiling surface.

2. Partial wall-surface treatments should be considered as an alternative to ceiling treatment. The back wall may need to be 50-100% covered with acoustical absorption materials.

E. Mechanical Systems:

1. The mechanical system should generate a background noise of no more than NC 15-20. The system requires careful design, competent installation and balancing, and a regular maintenance program once installed.

2. Factors that have been identified in the design of a quiet operating system include air handlers or fans located away from the lecture hall; low velocity of air within the lecture hall; and proper sizing and acoustical treatment of ducts, returns, an diffusers.

N.18 LIGHTING AND LIGHTING CONTROLS FOR THE LECTURE HALL

A. Lighting in large lecture halls is particularly critical element, because of the increase of educational technology in teaching. It is essential that the lecture hall have a full range of capabilities, from a comfortable reading level of light to a minimum level of light needed for note-taking during projection. It is essential that lighting controls be designed for use by instructors whose first concern is the communication of content rather than the operation of equipment.

B. Controls:

1. Controls for the house lights in lecture halls are needed at every entrance into the room. A complete set of controls should be available at the instructor area. The number of switches required to control the room should be kept at a minimum and should be clearly labeled. Standardization among lecture halls is recommended.

2. If the lighting controls are preset controls, then a manual override should be readily available. In addition, both the preset and the manual override should be clearly labeled and simple to use.

C. Ceiling Lighting:

1. A general lighting level of 50-60 foot-candles should be provided at all student stations within the room.

2. Lighting in the student and instructor areas should be on separate zones. It should be possible to switch zones of ceiling lighting from the front to the rear of the room so as to maintain full light level in the rear of the lecture hall while reducing the light level in the front when using various projection devices at the front of the room (such as overhead projectors). Light level at the screen is to be no greater than one (1) foot candle.

3. While zoning addresses one (1) type of lighting control, dimming also will be needed. For certain types of projection, it should be possible to reduce the lighting level to 5-10 foot-candles over the student stations, with no lighting onto the walls, the instructor area, or projection screen.

4. Fluorescent lights should be three (3) lamps with two (2) lamps switched together and the center lamps switched separately. Dimmable fluorescent lights are not be used.

5. A work light must be provided in the instructor area with care given that the light does not spill onto the projection screen. Provision for lighting must also be made for a person who is providing sign language interpretation to hearing-impaired students.

D. Chalkboard/Markerboard Lighting:

Lighting providing 75 foot-candles of uniform light across the writing surface, chalkboards/markerboards. This lighting should be designed so as to avoid any bright spots or dark spots on the writing surface. If the lecture hall is designed with a large amount of chalkboard/markerboard, the lights over the writing surface should be able to be switched on and off in sections to allow for the illumination of a portion of the board while one (1) projection screen is in use. Care should be taken in selection and installation to insure that lamps in the fixtures are not directly visible to students sitting in the front row of seats.

E. Other considerations:

Emergency lighting, aisle lighting, and exit signs should conform to local codes. Insofar as possible, these should be located so as not to interfere with the quality of the image on the projection screens or provide visual distraction to the audience. Lighting should be controlled by a 60-minute timer switch.

N.19 ELECTRICAL AND COMMUNCATION SERVICES FOR THE LECTURE HALL

A. Electrical Services:

1. It is essential that lecture halls be provided with ample electrical power to meet present-day needs as well as have additional power available for future applications. It is recommended that a minimum of 20 percent, and ideally as much as 40 percent, expansion in electrical service be made available at the time of new construction or major renovations.

2. Electrical services should be protected from surges and spikes.

3. Each lecture hall should have a minimum of two (2) dedicated 20 amp circuits with separate breakers controlling the service exclusively to the lecture hall. One (1) of these should feed the front portion of the room and the second, the media closet.

4. The front of the lecture hall should be equipped with a minimum of four (4) duplex outlets distributed evenly across the instructor area. In addition, two (2) duplex outlets should be located in each of the other walls. At least two (2) fourplex outlets should be located in the media closet. If a ceiling mounted video projector is to be used, electrical service is needed at the projector and controlled at the instructor area.

B. Telecommunications:

1. Voice, video and data services should be provided from a telecommunications closet to the lecture hall. It is recommended that all of these services serve the front of the room and the media closet, or media cabinet.

2. It is recommended that video, data, and electrical services be provided in the ceiling of the room to facilitate the installation of a video projector. To accommodate current technology, that termination box should be at a distance from the principal projection screen one and one-half times the width of the projection screen, or as recommended by the University's Media Specialist.

3. Although the specific location of conduits or cable trays will vary depending on the design of the lecture hall, in general connections are needed: from the instructor area to the media closet, from the instructor area and media closet to the video projector, if it is ceiling mounted, from the front of the instructor area to the podium. If it is anticipated that the instructor podium be movable, then connections should be provided at the right, left, and center of the instructor area. Some provision for telecommunication and electrical outlets in the student seating area may be desirable to accommodate computers, recording devices, response systems, etc.

4. Projection enclosure for video project, is to be located at the rear of the classroom. The enclosure will have adequate ventilation. Entire enclosure will be constructed with heavy wire fabric or expanded metal to provide security. Give the amount of equipment installed, doors will have mortise locks.

5. See insert -- Cable Schematic riser.

N.20 MEDIA CLOSET FOR THE LECTURE HALL

A. Lecture halls will contain a secure media closet to contain the electronic equipment and rack. The closet will be approximately 48" x 48" inside, lined with ¾" plywood or expanded metal and drywall with a lockable ¾" plywood door and 1¾" solid core wood outer door with mortise hardware.

B. There will be a monitor of the house audio system, including voice-amplification system in the media closet or instructor's console. The closet and/or console should include controls for audio, lights, screens, and other projection equipment.

C. The media closet will have adequate ventilation, through the top of the closet. The ceiling will be constructed of heavy welded wire fabric 4" x 4" x12, or expanded metal to also provide security.

D. Security is a major concern, given the amount of equipment installed in media closets and consoles. Doors will have mortise locks or equipment.

N.21 FURNISHINGS AND EQUIPMENT FOR THE LECTURE HALL

A. Instructor Area:

1. Media needs dictate the installation of a teaching podium or console at the front of the room that serves as the master control center for the room. Instructors in wheelchairs should be able to access any controls provided. In addition, a free-standing podium with a 24" d. x 30" w. surface should be provided with a light and microphone.

2. The podium should have a variety of communication and control capabilities, including electrical outlets; voice, video, and data outlets; controls for the lights

and the projection screen(s); controls for the voice amplification system, including a microphone; and controls for equipment built into the room and media closet.

3. The dimensions of the podium for a lecture hall should be 24 inches to 36 inches deep with the width determined by the equipment and controls to be housed. The height should be no more than 42 inches from the floor and coordinated with the height of the chalk/marker tray.

4. Size and placement of the podium are critical. Neither the podium nor the faculty member standing at the podium should block students' view of the projection screen(s) or the chalkboard/markerboard. An overhead projector should be able to be positioned close to the podium and at a sufficient distance from the screen to provide an acceptable image size.

5. If the podium is to contain equipment that is permanently housed in the room, it should be constructed of materials and using methods that provide the maximum security for the equipment housed within the podium.

6. The chair or stool for the instructor should be of adjustable height in order to make it convenient for the instructor to use all types of teaching devices.

7. A voice communications device should be located either in the podium or in the immediate vicinity of the teaching station.

B. Student stations:

1. Fixed seating:

a. It is recommended that rooms seating more than 75 have fixed seating. There may be special occasions when a small lecture hall, 75-100 students, would best be served by the use of movable seating. This is the exception, however, and will present operational problems because of the difficulty of keeping a large number of movable seats in reasonable order.

b. Whenever possible, it is recommended that continuous tables with fixed chairs be installed in lecture halls. This provides the student with the maximum work area.

c. When fixed chairs with tablet arms are used, the tablet arm should have a minimum of 150 square inches of writing surface. The arm also should fold to facilitate passage of students through the rows of seats. Fixed tables and chairs attached directly to the floor should have exposed bolt heads covered.

d. Since the number of seats in each row and the relationship of this number to the aisles are often covered by code requirements, these should be consulted in determining the layout of a room.

2. Left- Handed Seating:

A minimum of ten percent left-handed tablet arms is needed.

3. Wheelchair Stations:

Seating for mobility-impaired students should be provided in lecture halls at approximately four percent of the capacity of the room. To accommodate students in wheelchairs, a table 30 inches deep, 31 inches high (with 29 inches clearance), and 36 inches wide is recommended.

C. Chalkboards/Markerboards:

1. Chalkboard/markerboards shall be provided in the instructor area of large lecture halls. While instructors using large lecture halls should be encouraged to use the overhead and other projection devices, there are occasions when a chalkboard/markerboard is essential to effective use of the room.

2. Chalkboard/markerboards shall be mounted with the bottom edge of the chalk/marker tray 36 inches above the finished floor. In a room which has a raised teaching platform, the distance should be from the bottom of the chalkboard/markerboard to the teaching platform, not to the floor.

3. Chalkboards/markerboards should be four (4) feet in height and have chalk trays under the full width of the board. Seams of the boards should be flush, and, in the case of chalkboards, the surface should provide maximum contrast with the chalk or marker being used.

4. It is recommended that tack strips and map hooks be installed above the chalkboard but that no tack board be included as part of the instructor area in lecture halls.

D. Audio:

1. Voice Reinforcement:

a. Voice Reinforcement should be installed in lecture halls. The microphone and volume control for the amplification system should be easily accessible. Other settings, such as tone and balance, should be available only to a technician.

b. It is recommended, where technically feasible, that a wireless microphone be installed to allow the instructor the maximum flexibility of movement throughout the lecture hall.

2. Program Reinforcement:

a. Unless a technician is assigned permanently to support instruction in the lecture hall, a program reinforcement system separate from the voice amplification system should be installed to handle other sound sources. The system should be capable of amplifying the soundtrack of films, audiotape, and other audio sources such as compact discs, videotape, video discs, and voice coming in via telephone lines. Distribution from the system can be fed into speakers properly mounted and spaced to provide total coverage within the lecture hall.

b. The sound system also should be wired into at least two (2) locations in

the lecture hall to provide for students with hearing-impairments.

E. Projection Screen:

1. Lecture halls require multiple screens, the number dictated by the design of the facility and by the special uses for the facility. The minimum recommended number of screens is two. These should be mounted above the chalkboard/markerboard if the design of the lecture hall permits. The screens should be placed in such a way that at least six feet of chalkboard/markerboard is exposed when the screen is in use.

2. Screens should be motorized with rocker switches located both in the front of the room or console.

3. Screens are to provide acceptable picture quality up to 45º on either side of the center line of the room. No seating in a lecture room should be more than 45º off the center line.

4. Optical projection (films and slides), have very high-resolution images, resulting in a formula of instance from the screen to the farthest viewer of six times the screen width (6W).

5. With the introduction of electronic projection, however, a new screen-size standard must be applied. Electronic projection systems provide anywhere from 12.5-25 percent of the resolution of optical projection. This is particularly critical in computer-image projection, which is often comprised of text. This lower resolution results in a loss of sharpness in edge definition. At marginal viewer distance from the screen, the letters tend to blur and fill in, resulting in reduced readability.

F. Video and Data Projection Equipment:

1. Lecture halls will contain the capability of projecting both video and data.

2. Equipment will be coordinated through the University's Center for Instructional Development and Distance Education (CIDDE).

N.22 OTHER SPECIAL CONSIDERATIONS FOR THE LECTURE HALL

A. Storage/Preparation Area:

Considerations should be given to providing secure storage in the immediate vicinity of a lecture hall where instructors can keep materials needed on a repeated basis as well as provide space for the preparation of lecture materials.

B. Signage:

Signage in and around a lecture hall should be kept at an absolute minimum and should be incorporated into the lobby and the lecture hall when the facility is designed.

C. Environmental Issues:

1. The heating, ventilating, and air-conditioning (HVAC) system must provide

adequate air changes in conformance with current American Society of Heating, Refrigeration, and Air conditioning Engineers (ASHRAE).

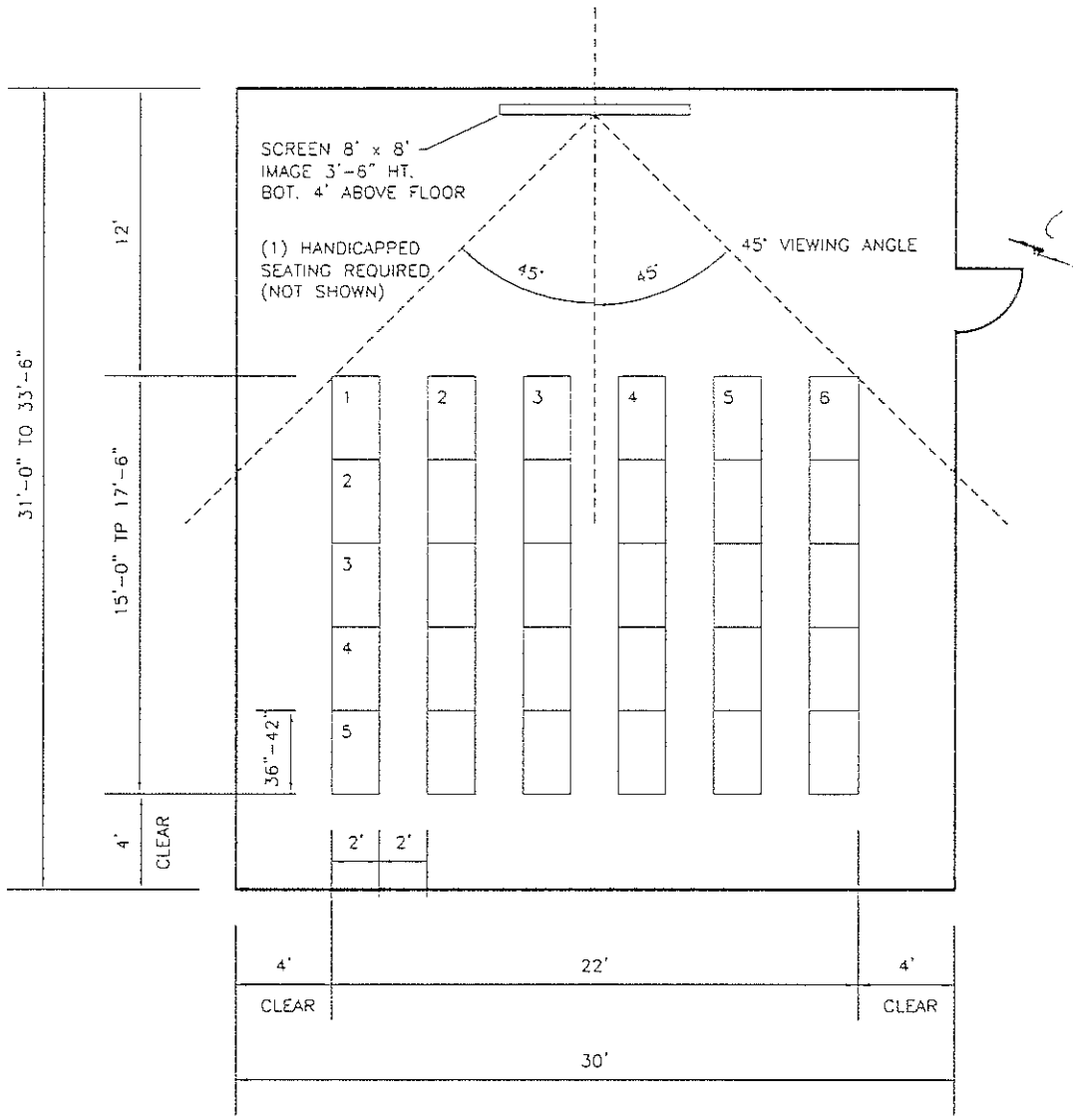
2. The temperature range should be maintained within 68-75º, with humidity at 50 percent, plus or minus 10 percent.

3. Each lecture hall should have a temperature-sensitive monitoring device within it and that device should be tied into a central monitoring system.

4. Acoustical considerations in determining the volume of air-handling noise should include not only the background noise level by any vibration considerations that would generate additional noise.

END OF DIVISION

CLASSROOM 25 TO 30 CHAIR–DESK/TABLET ARM SEATING

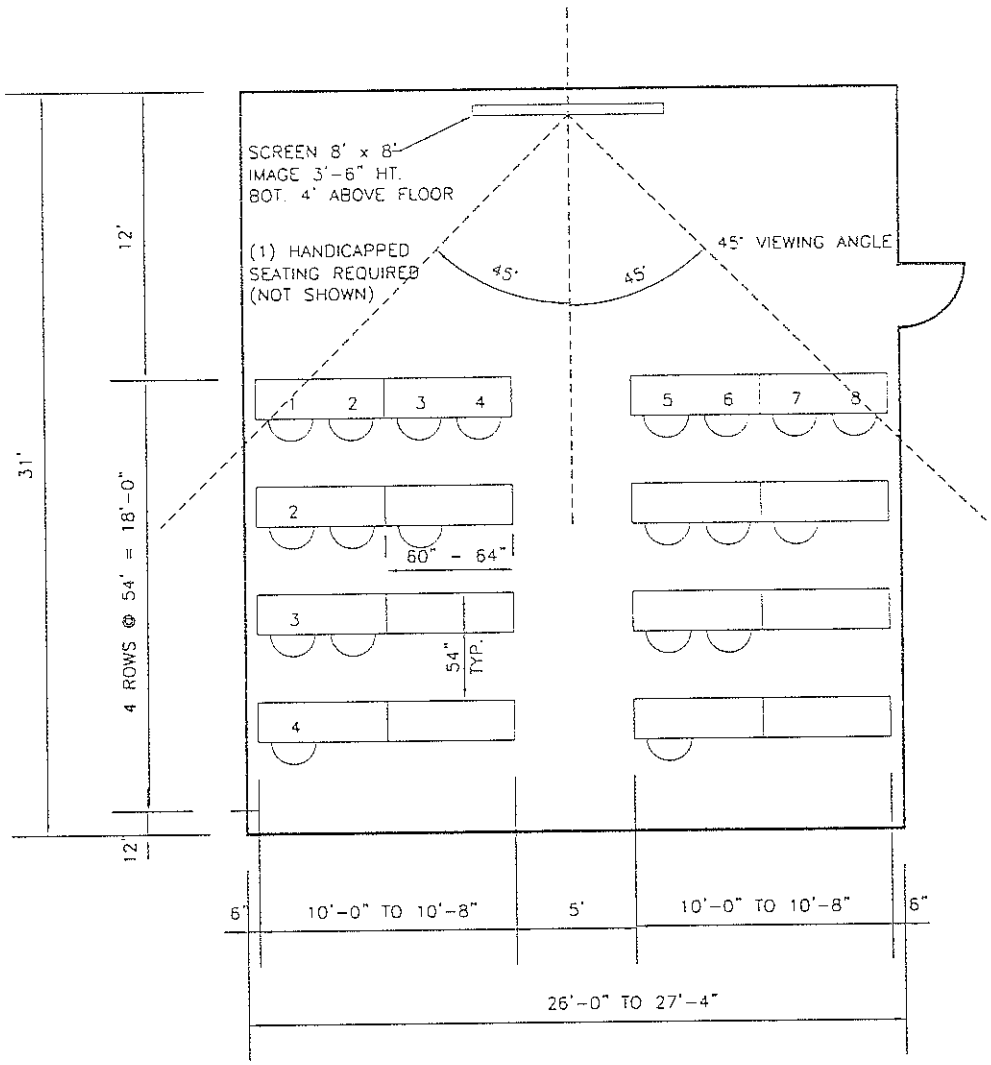


PLAN

SCALE: 1/8" = 1'–0"

25 TO 30 SEATS CHAIR–DESK/TABLET ARM
330 TO 385 SQ. FT. SEATING AREA = 11 TO 15.4 SQ. FT. PER SEAT
930 TO 1005 SQ. FT. ROOM AREA = 31 TO 40 SQ. FT. PER SEAT
CEILING HT. 10'–0" TO 12'–0"

CLASSROOM 25 TO 32 TABLE & CHAIR SEATING

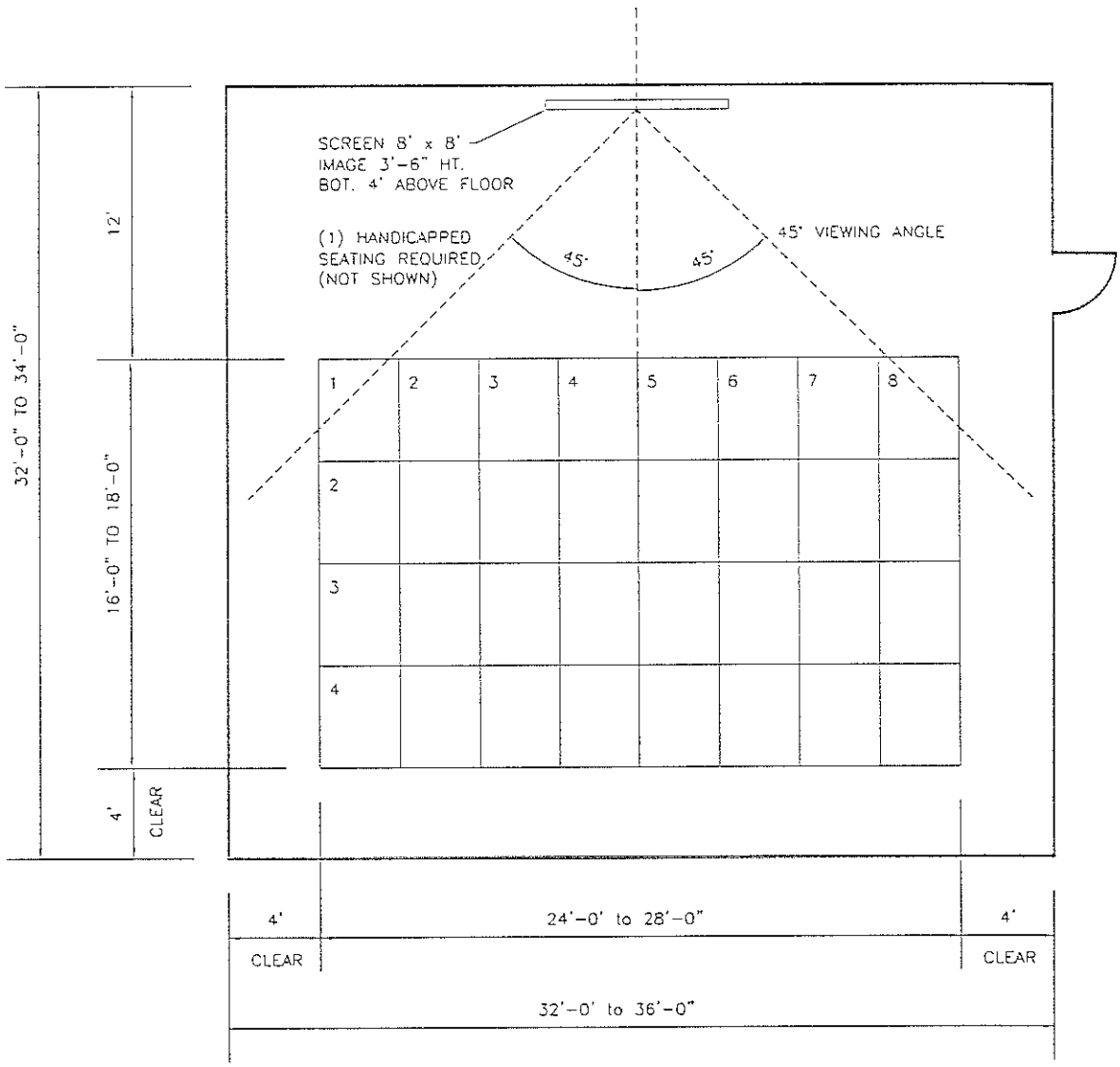


PLAN

SCALE: 1/8" = 1'-0"

25 TO 32 SEATS — TABLE WITH CHAIRS
360 TO 385 SQ. FT. SEATING AREA = 11.25 TO 15.5 SQ. FT. PER SEAT
805 TO 850 SQ. FT. ROOM AREA = 25 TO 34 SQ. FT. PER SEAT
CEILING HT. 10'-0" TO 12'-0"

CLASSROOM 25 TO 32 CASTER CHAIR/TABLET ARM SEATING

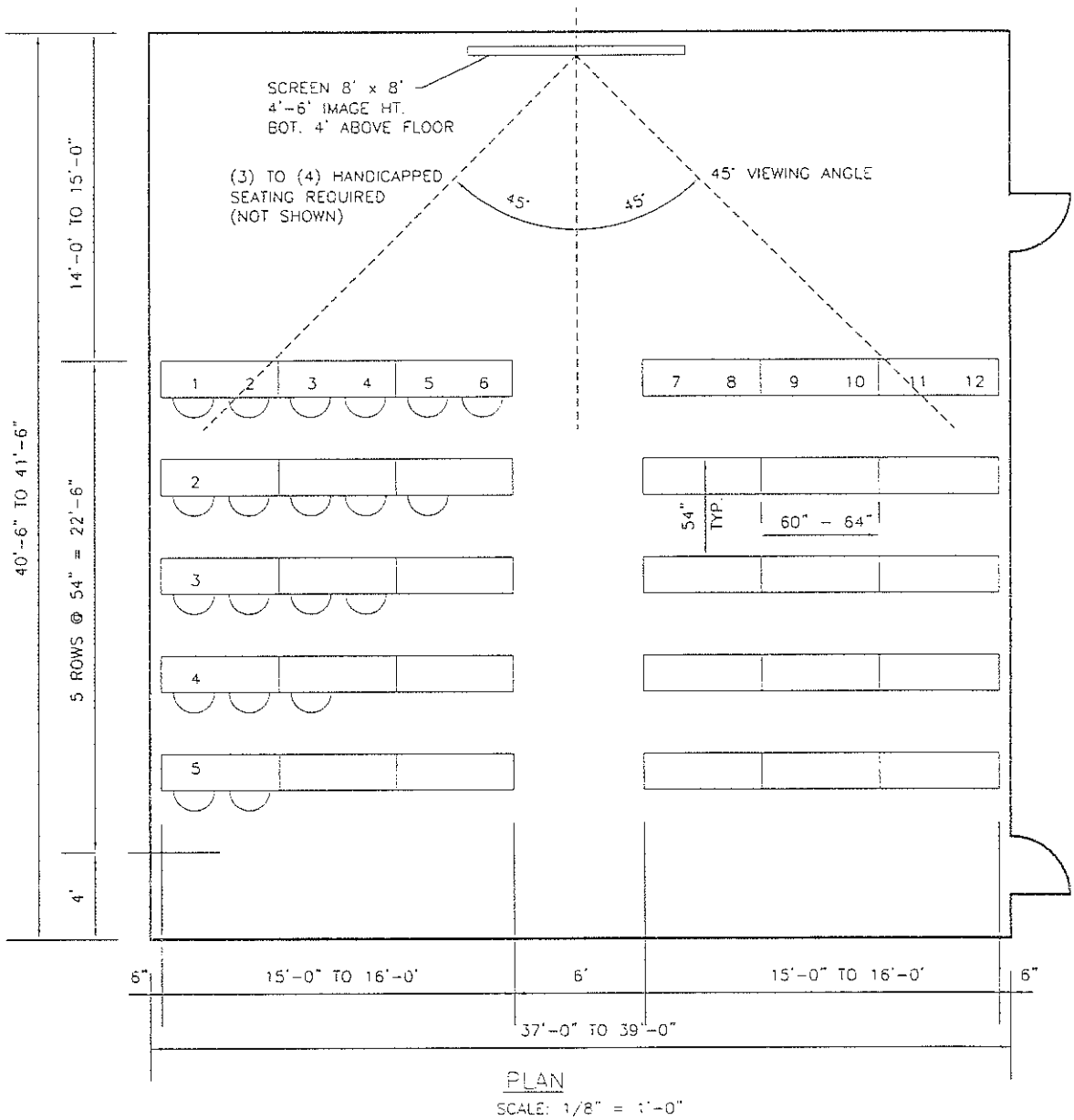


PLAN

SCALE: 1/8" = 1'-0"

25 TO 32 SEATS- CASTER CHAIR TABLET ARM
510 TO 650 SQ. FT. SEATING AREA = 12 TO 20 SQ. FT. PER SEAT
1025 TO 1225 SQ. FT. ROOM AREA = 32 TO 49 SQ. FT. PERSEAT
CEILING HT. 10'-0" TO 12'-0"

CLASSROOM 60 TABLE & CHAIR SEATING

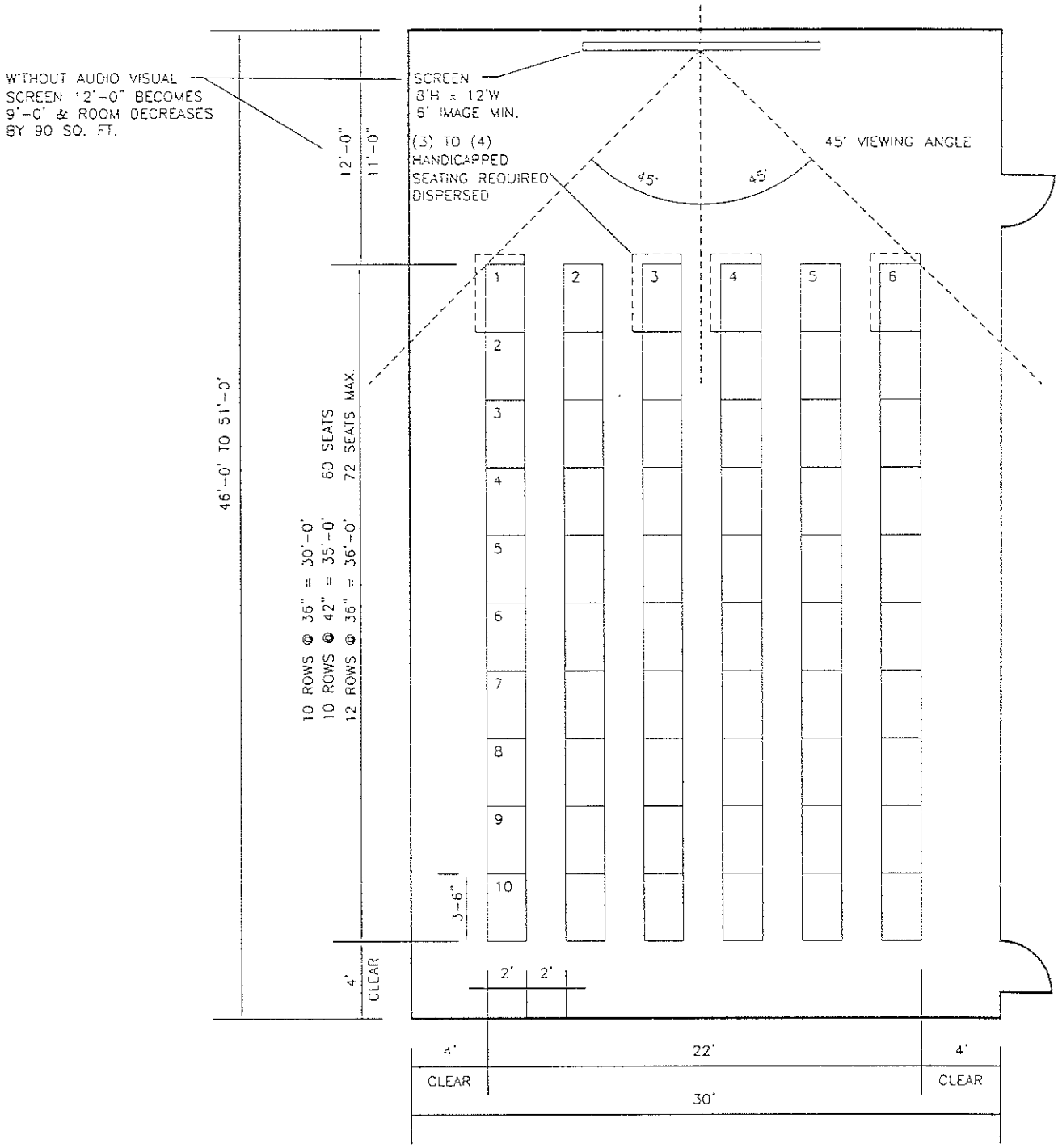


PLAN

SCALE: 1/8" = 1'-0"

60 SEATS TABLE WITH CHAIRS
675 TO 720 SQ. FT. SEATING AREA = 11.25 TO 12 SQ. FT. PER SEAT
1500 TO 1620 SQ. FT. ROOM AREA = 25 TO 27 SQ. FT. PER SEAT
CEILING HT. 10'-0" MIN. TO 12'-0"

CLASSROOM 60 TO 72 CHAIR–DESK/TABLET ARM SEATING

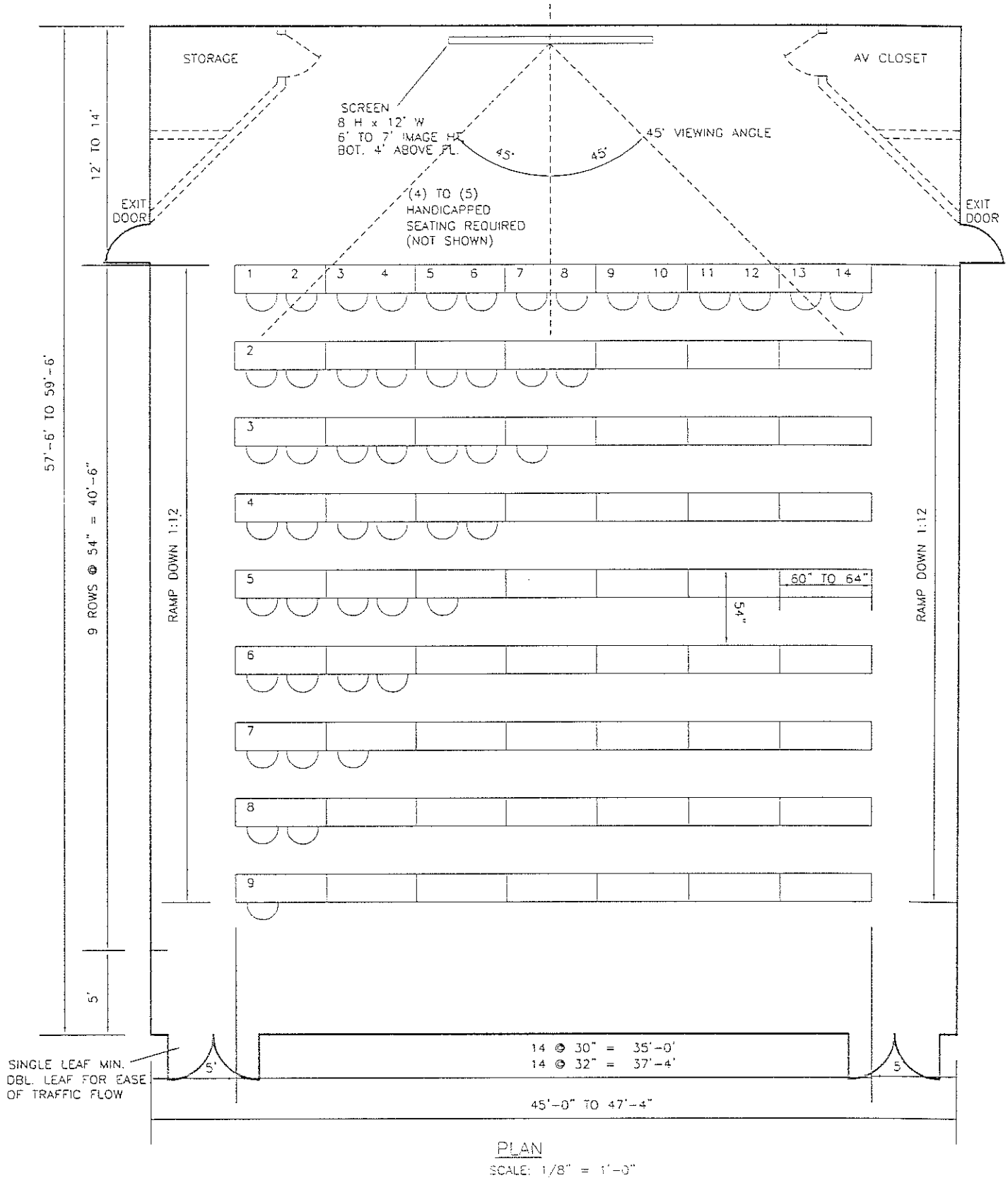


PLAN

SCALE: 1/8" = 1'-0"

60 TO 72 SEATS CHAIR–DESK/TABLET ARM
660 TO 770 SQ. FT. SEATING AREA = 11 TO 12.8 SQ. FT. PER SEAT
1380 TO 1530 SQ. FT. ROOM AREA = 19 TO 25.5 SQ. FT. PER SEAT
CEILING HT. 12'-0" MIN.

CLASSROOM 120 TO 126 TABLE & CHAIR SEATING

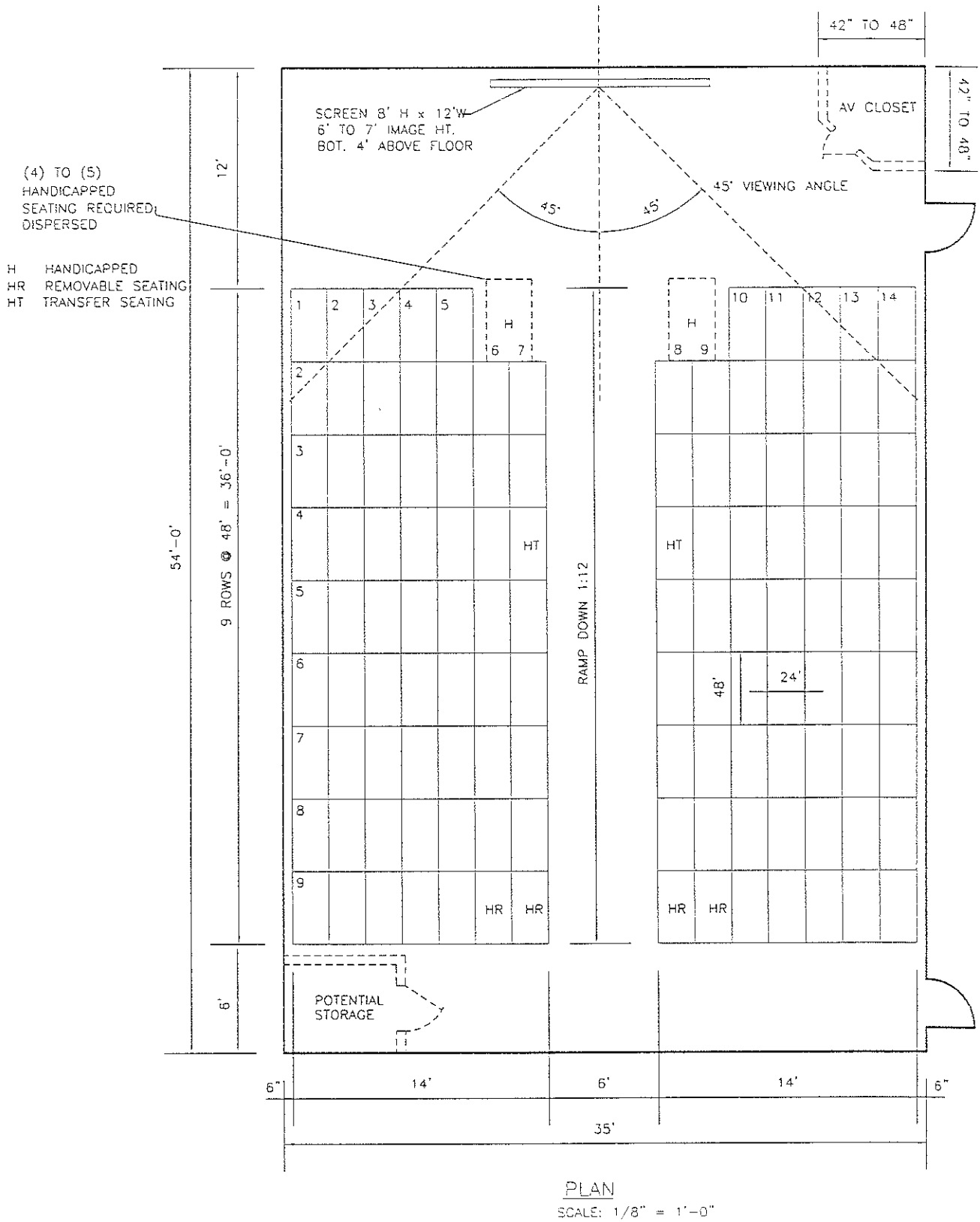


PLAN

SCALE: 1/8" = 1'-0"

120 TO 126 SEATS TABLE WITH CHAIRS
1420 TO 1515 SQ. FT. SEATING AREA = 11 TO 12.6 SQ. FT. PER SEAT
2590 TO 2820 SQ. FT. ROOM AREA = 20.5 TO 23.5 SQ. FT. PER SEAT
CEILING HT. 13'-0" MIN. @ FRONT

CLASSROOM 120 TO 126 AUDITORIUM/TABLET ARM SEATING

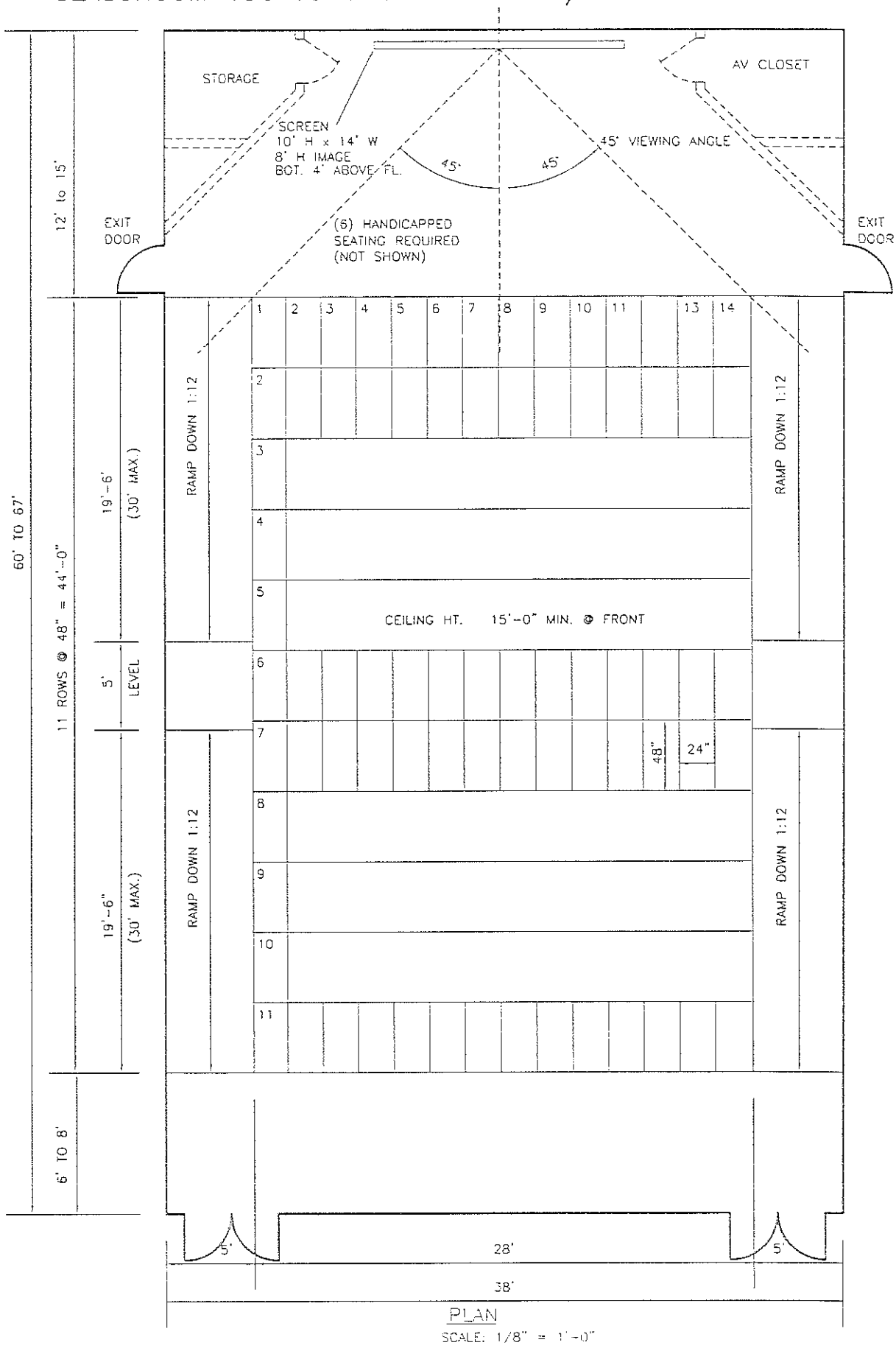


PLAN

SCALE: 1/8" = 1'-0"

120 TO 126 SEATS AUDITORIUM/TABLET ARM
48" BACK TO BACK PERMITS PASSAGE OF SEATED PERSON
1008 SQ. FT. SEATING AREA = 8 TO 8.4 SQ. FT. PER SEAT
1890 SQ. FT. ROOM AREA = 15 TO 15.75 SQ. FT. PER SEAT
CEILING HT. 13'-0" MIN @ FRONT

CLASSROOM 150 TO 154 AUDITORIUM/TABLET ARM SEATING

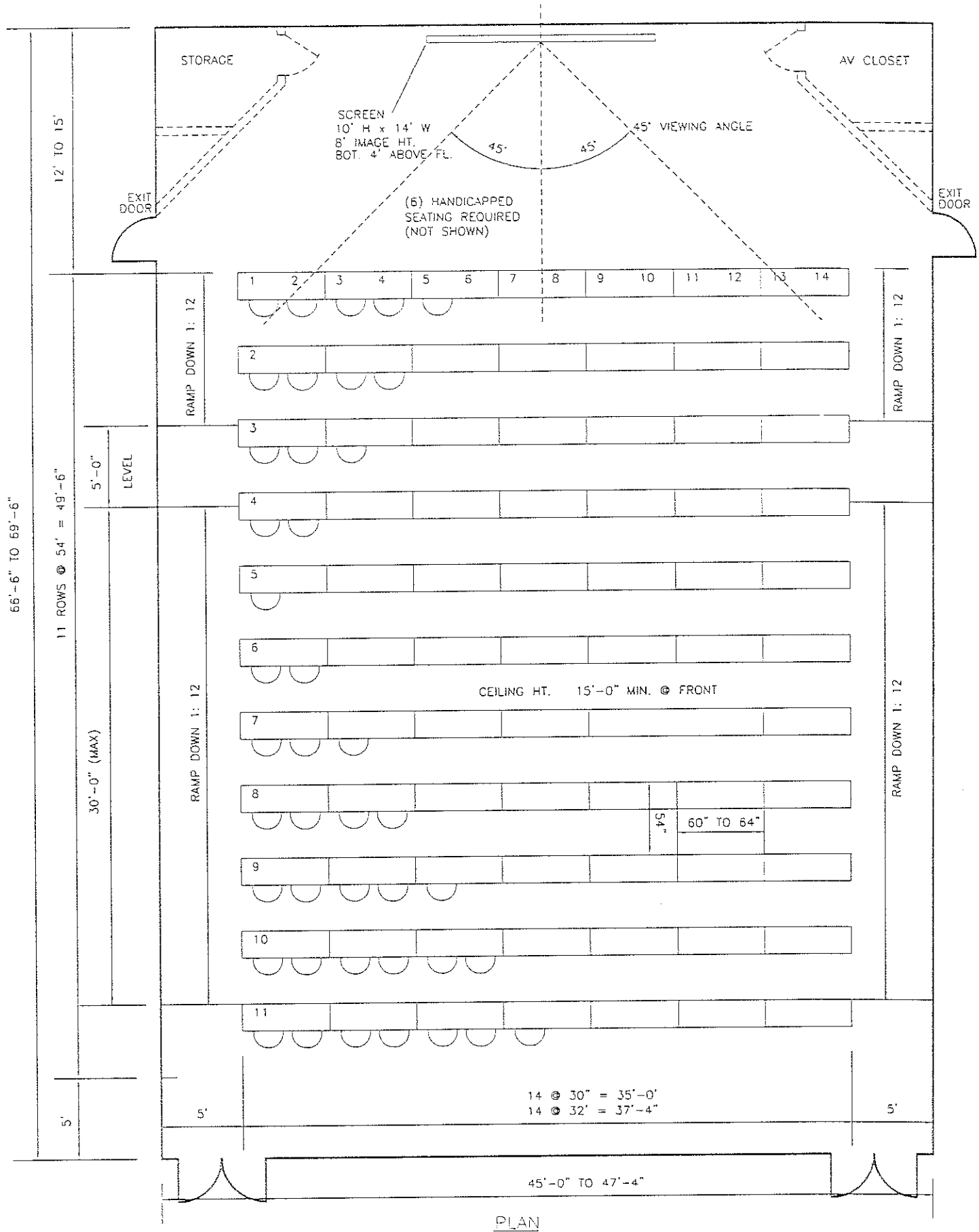


PLAN

SCALE: 1/8" = 1'-0"

150 TO 154 SEATS AUDITORIUM/TABLET ARM
1232 SQ. FT. SEATING AREA = 8 TO 8.2 SQ. FT. PER SEAT
2280 TO 2545 SQ. FT. ROOM AREA = 15 TO 17 SQ. FT. PER SEAT

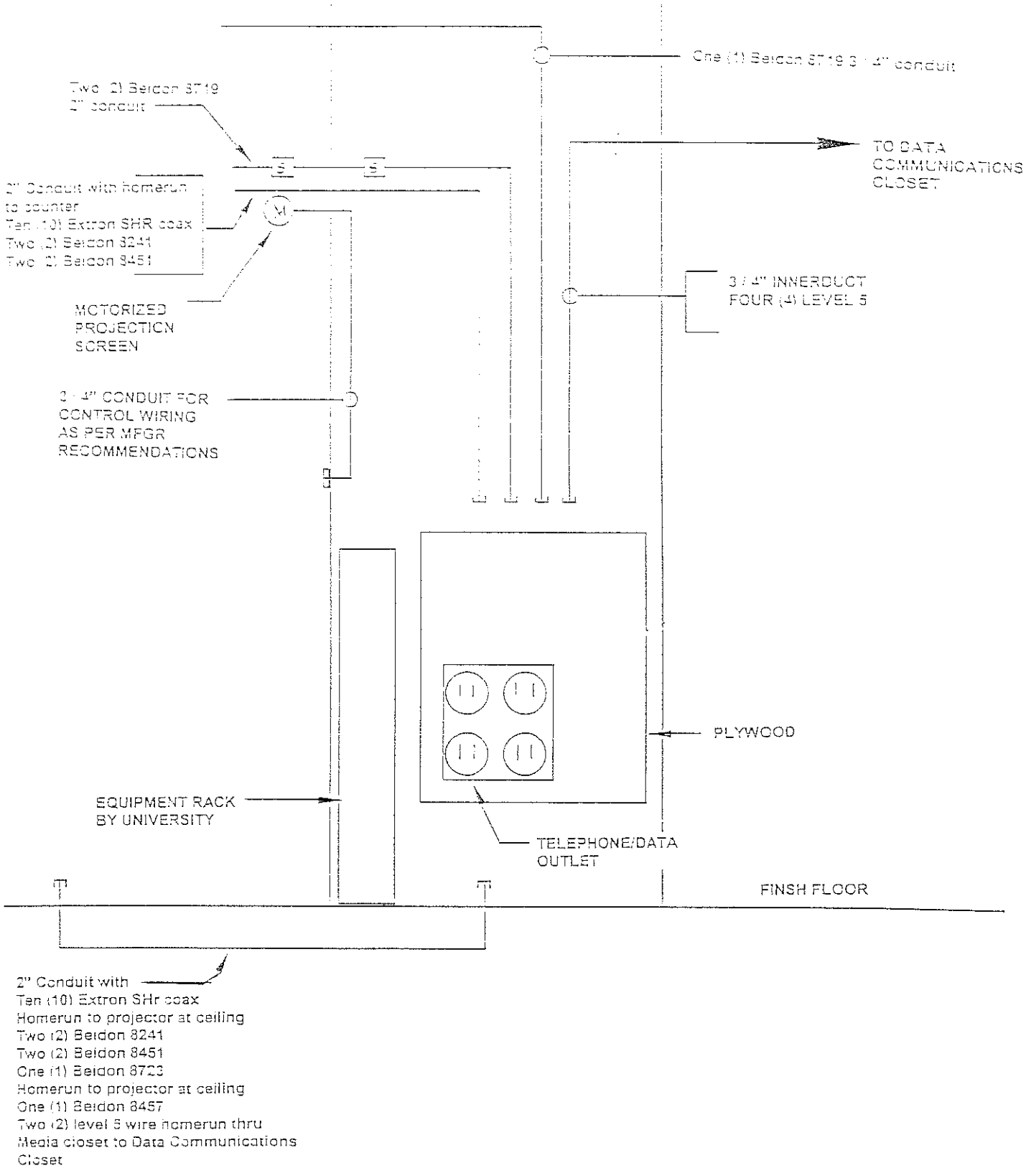
CLASSROOM 150 TO 154 TABLE AND CHAIR SEATING



PLAN

SCALE: 1/8" = 1'-0"

150 TO 154 SEATS TABLES WITH CHAIRS
1730 TO 1845 SQ. FT. SEATING AREA = 11 TO 12.3 SQ. FT. PER SEAT
2990 TO 3290 SQ. FT. ROOM AREA = 19.4 TO 22 SQ. FT. PER SEAT



AUDIOVISUAL RACEWAY & CABLE SCHEMATIC

University of Pittsburgh Professional Design Manual

DIVISION P
LABORATORY DESIGN STANDARDS

Index

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Division P
Laboratory Design Standards
Section P.1: Applicability of the Laboratory Standards

A. General

1. The following are general guidelines established as minimum criteria to be used by professionals for design of research and teaching laboratories located in University of Pittsburgh-owned buildings or leased facilities used by University of Pittsburgh faculty and/or researchers.

2. It is acknowledged that depending on their proposed use, some of the needs of individual laboratories may differ from others and these Standards are not expected to cover all issues or conditions that arise in the process of designing each individual laboratory. Rather, the purpose of the Standards is to address the laboratories' most common issues and needs, with the understanding that conditions unique to each project must be addressed and resolved during the design process with the input of the laboratory Users and other University entities as applicable.

3. It is expected that from time to time these Standards will need to be revised or updated. Responsibility for issuing and updating the Laboratory Design Standards resides in the University of Pittsburgh, Office of Facilities Management. Requests for revisions must originate from the University Head of the Department requesting the revision, it must be sent in writing to the Associate ice Chancellor—Facilities Management for consideration, and it must include the requested change, justification, an assessment of the additional costs/savings (if any) and other advantages (added safety, security, energy conservation, etc.) resulting from the proposed revision of the Standards.

4. These Standards are not designed to supersede the laboratory equipment manufacturers' installation requirements for specific pieces of equipment. The Professional shall design and specify the commissioning of the laboratory equipment to comply with the installation recommendations of the manufacturer of the specific equipment to be housed in the lab. If there is a conflict between the manufacturer's recommendations and the requirements of these Standards, the Professional shall bring this issue to the Project Manager's attention for resolution during the design stage of the project.

B. Definitions

1. For the purposes of these standards, a laboratory shall be defined as an area of a facility with the intended purpose to manipulate laboratory chemicals, biological, animals, or radioactive materials for research, teaching, or diagnostics activities. These criteria are not intended to be applied to research, teaching or diagnostic activities that are void of the hazards listed above, such as "computer labs".

2. The terms "Project Manager" and "PM" throughout the text, refer to the University Office of Facilities Management Project Manager or the UPMC Project Manager responsible for the implementation of the laboratory project.

3. EH&S is the University Office of Environmental Health and Safety.

4. Throughout the standards, **"shall"** and **"must"** are used to designate features which are essential, while **"should"** is used to designate features which are recommended but which are not pre-requisites for design approval by the University.

5.  Paragraphs which are followed by this symbol indicate the University's ongoing commitment to sustainable practices.

Section P-2

A. General

Division P-1, Sections A and B, "Applicability of the Laboratory Design Standards" is hereby made part of this Section by reference.

The following are general guidelines established as minimum design criteria for research and teaching laboratories at the University of Pittsburgh. These criteria are not all inclusive but are intended as basic parameters for laboratory design. See Sections D, E and F of these Standards for specialty usage laboratories such as research animal spaces, Bio-safety Level 3 (BSL3) laboratories, lasers and magnets.

A.1. Laboratories shall be fully enclosed by walls and doors and separated from egress paths, general offices, receiving areas and other areas where there is ready access to the public and public thoroughfares.

A.2. Laboratory equipment shall not be installed or utilized in **egress** corridors.

A.3. EH&S recommends that laboratories be designed with a minimum of 50 square feet per laboratorian. Consideration should also be given for ample storage space for consumable lab supplies and allow space for the variety of waste collection containers needed. Depending on the laboratory, these may include laboratory trash, broken glass, sharps, recycling containers, used oil, medical waste, chemical waste and/or radioactive waste.

A.4. Laboratories shall be designed with adequate work counter and equipment space, and access to adequate electrical service. Extension cords and multi-outlet devices are not permitted as part of standard lab design.

A.5. All penetrations in walls, floors and ceilings shall be permanently sealed around openings for fixtures, conduits, and utility lines to separate the lab from interstitial space and for pest control.

A.6. Lounge, locker, and toilet facilities shall be located outside the laboratory.

A.7. Food and drink are prohibited in laboratory areas. This principle must be considered when designing laboratories and associated work stations and offices.

A.8. Laboratories using compressed gases should have dedicated areas for cylinder storage and be equipped with devices to secure cylinders in place.

A.9. Laboratory design shall comply with ADA requirements.

B. Walls, Floors, and Ceilings

B.1. Penetrations in walls, floors and ceilings for electrical, plumbing and other considerations shall be completely and permanently sealed.

B.2 Perimeter walls shall be of solid construction, covered with a surface that is smooth and cleanable and coated with a chemical resistant finish.

B.3 Floors shall be covered with a material that is slip resistant, smooth and cleanable.

B.4 In labs using bio-safety level 2 or higher agents, ceilings shall be covered with a material that is smooth and cleanable.

C. Doors

C.1 Doors to laboratories shall be fitted with latching hardware and have a minimum fire rating of 20 minute construction.

C.2 Laboratory doors shall be automatically self-closing. Depending on the amount of large equipment to be used in the lab, consideration should be given to the provision of doors with side panels that would provide clearance for large pieces of equipment.

C.3 If security locks are required on doors leading to exit access, only University approved security locks meeting with applicable Codes shall be installed. Security locks shall allow the doors to be readily opened from the laboratory side at all times without the need for keys or cards or the need to use both hands to operate the latching mechanism.

C.4 Doors shall be posted with a room number for ease of identification and allow space adjacent to the jamb for a hazard warning sign to include a list of significant hazards and emergency contact information as required by the University, and also “AUTHORIZED PERSONNEL ONLY” at all lab entries.

C.5 Each door from hallway into lab should have a view panel to prevent accidents from opening the door into people on the other side and to allow individuals to see into the laboratory in case of an accident or injury. Consideration should also be given to the provision of bottom door seals to keep corridor dust from infiltrating into lab spaces.

D. Windows

D.1 It is recommended that windows in laboratories be inoperable and/or sealed in a shut position.

D.2 If windows in laboratories are capable of being opened, they shall be provided with insect screens. It is recommended that these windows remain in the closed and locked position.

E. Casework and Furniture

E.1 Fixed or movable laboratory equipment and/or furniture shall not interfere with minimum aisle clearances required by Code. Lab benches shall not impede emergency access to exits.

E.2 Bench-tops shall be impervious to water and resistant to moderate heat, organic solvents, acids, bases and chemical disinfectants at a minimum. Countertops should incorporate a lip to help prevent run-off onto the floor. All countertop surface penetrations such as electrical conduits, plumbing pipes, etc. shall be completely and permanently sealed to prevent liquids from running down these elements.

E.2 Bench-tops or associated back-splashes shall be installed tight-to-wall and sealed at the wall/bench junction.

E.2.1 If the case work is movable, it is recommended that ample space be provided to allow for frequent relocation of casework as needed for thorough cleaning.

E.3 Spaces between cabinets, casework, fixed furniture and other equipment shall be easily accessible for cleaning and decontamination.

E.4 Drawers shall be equipped with "catches" which prevent the drawers from being pulled out of the cabinet during normal operation.

E.5 If shelves are accessible from opposite sides, a toe-guard or center birm shall be provided to prevent pushing stored items off shelf at opposite end.

E.6 In most applications, storage cabinets with doors are preferred over open shelving.

E.7. Chairs within the lab, especially those for bench-work shall be covered with a material that is impervious to liquid and easily decontaminated by liquid disinfectant.

E.7.1 Chairs shall be adjustable to minimize repetitive stress injuries.

E.8. Each laboratory must be equipped with a sink that has hot and cold running water dispensed from a mixing faucet. This sink must be connected to the building plumbing system by direct connection. Provision should be made for disposable hand towels and liquid soap stored in dispensers which protect these items from contamination.
NOTE: Other features of the hand washing station may be required in certain laboratories utilizing potentially infectious or hazardous materials. Hand washing sinks for particularly hazardous chemicals, biological or radioactive agents may need elbow or electronic controls.

E.9. Sink faucets and hose bibs that are intended for use with attached hoses should be provided with back siphon prevention devices.

E.10. Laboratory sinks shall have lips that protect sink drains from spills

F. Utilities

F.1. Electrical power

F.1.1 All electrical outlets, circuits, and controls must be of sufficient number, size, and capacity (amps) to account for intended uses in the laboratory and to eliminate the need for extension cords and multi-plug assemblies.

F.1.2 All circuit breakers, switches, panels, and controls servicing the laboratory shall be properly labeled and covered, and shall be located outside the laboratory. All panels shall be equipped with integral Transient Voltage Surge Suppression TVSS).

F.1.3 Illumination must be adequate for all activities. It is recommended that minimum 70 foot candles of light be provided at all work surfaces. 

6.1.3.1 Lighting shall be equipped with control mechanisms (occupancy sensors) to turn off portions of lab space not in use, particularly in large shared lab space. 

F.1.4 All life safety systems supporting the laboratory and other critical lab components as determined by the User shall be supported with emergency

power. Provide a minimum of one fixture on normal/emergency power near the exit of each lab space.

F.1.5 Outlets providing emergency power shall be clearly labeled and red in color.

F.1.6 Electrical outlets within 6 feet of water sources shall be equipped with Ground Fault Circuit Interrupters (GFCI). All outlets controlled by a GFCI shall be labeled accordingly.

F.1.7 All fume hood exhaust fans and -80 degree freezers shall be on emergency power.

F.1.8 Each bio-safety cabinet shall be on a dedicated circuit.

G.2 Fire Protection/Prevention

G.2.1 All new laboratory facilities shall be equipped with wet sprinkler systems. Sprinklers shall also be provided in significant renovation projects that involve construction or demolition of walls.

G.2.1.1 Sprinkler heads shall be positioned according to NFPA Guidelines.

G.2.1.2 Fixed equipment shall be positioned to allow for at least an 18 inch clearance between the tops of fixed equipment/furniture and the level of the sprinkler. Exceptions are made at the perimeter of the room.

G.2.2 A portable fire extinguisher of appropriate class as determined by the use of the laboratory, shall located within 75 feet of the furthest distance of the laboratory or 10 feet of any approved flammable material storage room.

G.2.3 If the User indicates the presence of flammable liquids in vessels larger than 1 gallon in size or intends to store more than 10 gallons of flammable liquid in the laboratory, an approved flammable material storage cabinet with the appropriate fire rating shall be provided.

G.2.3.1 Flammable material storage cabinets shall not be located in egress corridors or public areas. Their placement as base cabinets for chemical fume hoods is NOT recommended, but may be accepted if other alternatives are lacking.

G.2.3.2 It is generally recommended that flammable material storage cabinets not be vented. An approved flammable material storage cabinet has bung covers over each ventilation port, is equipped with a positive latching mechanism on the doors, and is labeled “flammable”.

G.2.3.3 Upon User request or as requested by EH&S based on exposure data, flammable material storage cabinets can be vented with EH&S approval. Approved venting utilizes the ports on the cabinet and the duct must have fire resistive qualities equal to or greater than the cabinets. Non-metallic duct material cannot be used for venting. The vent should be threaded into the upper port with the lower port opened and flame arrestor intact. The cabinet should not be altered in any other manner.

G.2.4 All new lab facilities shall be equipped with audible and visible signaling devices connected to the building's emergency alarm system. Environmental chambers where evacuation or other alarms cannot be heard shall be equipped with strobe lighting or additional alarms.

H. Plumbing

H.1 Each laboratory should be equipped with an emergency eyewash station or emergency eye, face and body wash. EH&S recommends a dual nozzle eye, face and body wash, which is counter-mounted near the hand sink. A mixing valve or the provision of tepid water from emergency equipment is required. It is typically not recommended that overhead full body showers be installed within research and teaching laboratories at the University, unless a very large quantity of corrosive liquid is anticipated to be stored and/or utilized.

H.1.1 GENERAL GUIDELINES

H.1.1.1 All plumbed emergency equipment shall be provided with potable water.

H.1.1.2 All plumbed emergency safety equipment shall be installed with a mixing valve to provide tempered water to avoid additional discomfort of user

H.1.1.3 All plumbed emergency equipment shall be accessible and capable of activation.

H.1.1.4 Only plumbed emergency equipment is acceptable at the University. Bottled water sources are not approved eye wash or emergency shower devices.

H.1.2 EMERGENCY SHOWERS

H.1.2.1 Emergency showers are not only needed in limited areas in a typical academic research environment due to small chemical volumes in use. One per floor or one per ballroom lab is typical. Consult with EH&S and refer to User Chemical Information List for hazards that create a need for additional showers.

H.1.2.2 Install full body emergency showers in common or central areas outside the laboratory. Emergency showers outside the laboratory can be equipped with floor drains.

H.1.2.3 Emergency showers within the laboratory are not typical, but when installed within a laboratory, a floor drain is prohibited.

H.1.2.4 Emergency showers must be installed in a manner to easily achieve annual testing.

H.1.2.5 Emergency showers will provide water flow as specified by national codes and standards.

H.1.3 EYE WASHES (AND HAND-HELD EYE, FACE AND BODY WASH UNITS)

H.1.3.1 The University recommends eye, race and body wash units near all locations where hazardous materials are handles. A general rule of a 10-15 second travel distance is applied from source of hazard to eye, face and body wash unit.

H.1.3.2 The unit must have a dual eye nozzle.

H.1.3.3 The unit should be installed at the counter-top in the lab with a retractable hose, as allowable by design.

H.1.3.4 The unit must achieve hands free operation. By definition, this means that the unit operates continuously upon an activation step (until the unit is turned off by separate motion.)

H.1.3.5 The unit must have end caps over the nozzles to prevent contamination that easily release upon unit activation.

H.1.3.6 The unit should be installed near a sink or drain (non-floor drain) to make it conducive to the required weekly testing by the user.

H.1.3.7 Water pressure from the unit should achieve a vertical flow 6-12 inches in height upon operation.

H.2 It is recommended that floor drains not be installed within laboratories, particularly those using hazardous chemicals or BSL3 agents.

H.3 When ice machines are requested by the User, they shall be installed per Health Codes with an indirect drain connection. Ice machines within labs must be labeled as "NOT FOR HUMAN CONSUMPTION".

H.4 Ice machines and other plumbed equipment are not recommended for installation in egress corridors.

H.5 Heating, Ventilation and Air Conditioning Systems

H.5.1 All laboratory ventilation shall be "single pass air" and must not re-circulate to other areas of the building.

H.5.2 As a general principle all laboratories should have air flow which is negative to the surrounding corridors, offices and other public spaces. Supply and exhaust diffusers shall be positioned to ensure air flow and air change rates are adequate within the room. In general, laboratories must maintain a minimum air flow of 6-10 air changes per hour. Occupancy sensors shall be used to decrease the air flow to 4 air changes per hour when the laboratory is not occupied. In an unoccupied mode, the air flow may be reduced to 4 air changes in select situations. The Professional shall consult with the Project Manager regarding this matter.

H.5.3 Each laboratory should be equipped with a supply vent, located in a manner which directs supply air away from the face of biological safety cabinets, fume hoods, incubators and other primary containment devices.

H.5.4 In the design of outside air intakes, consideration must be given to continuous operation and adverse weather. Rain and snow must be baffled out of the system. Also, consideration must be given to sources of air contamination such as vehicle exhaust, smoking areas, and building exhausts.

H.5.4.1 Air intake shall be separated as far as practical from points of exhaust.

H.5.5 Each laboratory should be equipped with an exhaust diffuser which sufficiently provides the necessary ventilation rates. Exhaust diffusers should be placed to minimize dead spaces (voids of air circulation) and maximize ventilation.

H.5.6 All air exhausted from laboratories shall be discharged to the outside clear of the building via exhaust stacks on the roof. All exhausted air must pass through a heat recovery system. Each heat recovery installation shall be reviewed by the University mechanical engineer to determine the feasibility of the application.

H.5.7 In general the capacity of the exhaust system fan motor and drive should be 15% greater than capacity of the supply air steam.

H.5.8 For new construction and/or major renovations, a process water cooling loop through a heat exchanger shall be provided to serve all lab equipment requiring cooling. Process cooling shall be served via heat exchanger off of the central cooling system. Smaller renovations shall have localized heat exchanger connected to the central chilled water system. Any lab equipment requiring chilled

water for cooling as outlined above shall have a backup source of cooling (dx unit, city water, etc.)

H.5.9 The installation of devices that are interconnected with the exhaust air flow and are intended to purge the laboratory air in the event of a chemical related emergency is only recommended in very limited instances, as required by the volume or specific type of chemicals proposed for the laboratory. Professionals shall review any intended use of this feature with the PM, EH&S and the User to justify the installation of such an enhancement. If it is determined that there is a legitimate need for this feature, the Professional shall locate the activation device near the exit door from the lab and shall specify a sign to be installed adjacent to the activation device stating the following:

"EMERGENCY EXHAUST"

WARNING: Emergency use only. Activation during normal lab operations may lead to unsafe ventilation conditions.

I. HVAC Equipment

I.1. Biological safety cabinets and chemical fume hoods shall be located away from doors, away from room supply ventilation, operable windows and remote from heavily traveled laboratory areas.

I.2. Biological safety cabinets and chemical fume hoods should not be used as the sole source of room exhaust.

I.3. Autoclaves require specialized exhaust to remove heat and moisture, a floor drain with an indirect plumbing connection to the autoclave, electricity, hot and cold water, and steam. Additional specifications are available from EH&S regarding autoclaves.

I.4. Chemical Fume Hoods

I.4.1 All chemical fume hoods shall produce sufficient capture and containment of hazardous chemicals generated under proposed conditions of use. Existing fume hoods shall maintain 80 to 100 feet per minute with an 18" sash opening. All new installations of chemical fume hoods shall be commissioned to the ANSI/ASHRAE 110 Standard to verify chemical containment. This commissioning test takes into account tracer gas control under both static and dynamic conditions considering cross drafts, make-up air provisions, and laboratory layout and lab traffic. With this commissioning, containment of chemical emissions can be achieved with hood flows as low as 60 fpm; however face velocities exceeding 150 fpm are likely to cause turbulent air flows and loss of containment.

I.4.2 Where interior cup sinks are requested by the user, the lip of the cup sink shall be elevated to prevent spilled material from entering cup sinks.

I.4.3 EH&S strongly advises against fire protection systems within chemical fume hoods and associated exhaust ductwork.

I.4.4 EH&S recommends a review of intended chemical use for each fume hood installation to determine if a dedicated hazard exhaust system is required per

guidelines set forth in the International Mechanical Code, Section 510.2, or if other hazardous vapors may be emitted through the duct system.

I.4.4.1 It is recommended that base cabinets below chemical fume hoods be of standard construction or be equipped to store acids or bases. The storage of flammable chemicals below chemical fume hoods is not recommended; however, if it is requested by the user, it is recommended that these cabinets not be vented in concurrence with the National Fire Protection Association.

I.4.4.2 All new chemical fume hoods shall be equipped with an indicating, monitoring device which signals a local audible alarm should the average face velocity drop below 60 feet per minute of existing fume hoods, or 20% below the accepted face velocity for new fume hoods (commissioned per ANSI/ASHRAE 110)

I.4.4.3 The noise level at the face of the fume hood should not exceed 55 dBA.

I.4.4.4 All chemical fume hoods shall have a documented certification post installation and prior to initial use, which verifies the appropriate average face velocity. Initial certification and associated documentation should be the responsibility of the installer. The monitor must be calibrated by the installer prior to initial use.

I.4.4.5 Combination sashes are not recommended.

I.5.5 Point of Use Exhaust Systems

I.5.5.1 Points of use exhaust systems such as flexible duct or “snorkel” tubes shall be installed according to manufacturers’ recommendations. Air flow volumes must be adequate to create a face velocity near the point of vent placement that effectively captures gas or vapor emissions. When manufacturer specifications are unavailable, the minimum face velocity is typically in the range of 60 to 100 feet per minute, one foot from the emission source. Higher or lower face velocities (air volumes) may permit effective capture depending on the distance from the exhaust tube and the direction and rate of the emission release.

I.5.6 Biological Safety Cabinets

I.5.6.1 HEPA-filtered air from TYPE A2 biological safety cabinets can be re-circulated into the laboratory in BSL-1 and BSL-2 labs provided volatile chemicals will not be used in the biological safety cabinet.

I.5.6.2 For certain applications, it may be recommended that the biological safety cabinet be equipped with an indirect or canopy connection exhausted from the room. Consult with EH&S to determine the appropriate class and type of biological safety cabinet.

I.5.6.3 In special instances the biological safety cabinet may possess a hard ducted connection to exhaust volatile chemicals from the biological safety cabinet. Consult with EH&S to determine the appropriate class and type of biological safety cabinet.

I.5.6.4 Piped gas and piped air are not recommended within biological safety cabinets. Should the User request piped gas to the biological safety cabinet, approval from the EH&S is required prior to installation. If approved, the gas line shall be equipped with an emergency shut-off valve exterior to the biological safety cabinet but accessible to the biological safety cabinet user.

I.5.6.5 Any other utilities supplied to the biological safety cabinet shall be installed under the biological safety cabinet.

I.5.6.6 Biological safety cabinets shall not be installed as an integral part of the lab's air supply and exhaust system in such a manner that fluctuations of the room supply and exhaust cause the biological safety cabinet to operate outside design parameters for proper containment.

I.5.6.7 All biological safety cabinets shall be installed and tested in accordance with National Science Foundation (NSF) Standard 49.

I.5.6.8 All biological safety cabinets shall be certified according to NSF Standard 49 by an accredited biological safety cabinet technician post installation and prior to initial operation by the User. Additional specifications regarding biological safety cabinets are available from Environmental Health and Safety

I.6 Gas Service

I.6.1 Gas service provided to the laboratory shall be commissioned for the necessary purity and flow rate prior to operation.

I.6.2 All laboratories shall be provided with adequate securing devices for all empty and full compressed gas cylinders. These securing devices may be a strap, chain or other tether secured to non-mobile equipment or wall surface. A User-provided approved base is also acceptable.

I.6.3 All laboratories using Health Hazard 3 and/or 4 gases shall be provided with approved gas cabinets. Exceptions can be made for storage and use of small lecture cylinders within certified chemical fume hoods. A maximum quantity of H3 or H4 gas per lab shall be based on the International Fire Code, Chapter 27 "Hazardous materials – General Provisions".
Gas cabinets shall be:

I.6.3.1 Constructed of not less than 12 gauge (2.5 mm or 0.097 in.) steel, coated to prevent corrosion and provided with a self-closing and self-latching cylinder access door;

I.6.3.2 Provided with a noncombustible safety window (6.4 mm or 0.25 in. wire-reinforced safety glass or equal) that allows viewing of equipment controls and provided with self-closing access port(s) or windows of sufficient size that allow hand access to equipment controls;

I.6.3.3 Provided with an approved automatic sprinkler;

I.6.3.4 Provided with makeup air inlets that allow air circulation throughout the cabinet when the access port(s) or windows are closed;

I.6.3.5 Provided with exhaust ventilation that ensures the cabinet is at negative pressure in relation to the surrounding area and an average velocity of air flow at the face of open access ports or windows of 200 fpm (1.02 m/s) with a minimum of 150 fpm (0.75 m/s) at any measurement point.

I.6.3.6 Provided with gas detection and/or ventilation monitoring to signal both an audible and visual alarm in the event of gas leakage and/or drop in velocity below the limits outlined above.

I.6.4 For information on storage and use requirements for pyrophoric and/or flammable gases, please refer to the University of Pittsburgh Safety Manual issued by EH&S.

I.7 Lab Equipment

I.7.1 Refrigerators shall be labeled to indicate if it is safe for storage of flammable liquids, or to indicate the presence of biohazards or/and radioactive materials.

I.7.1.1 Refrigerators should not be modified to accommodate storage of flammable materials.

I.7.1.2 In most instances, explosion-proof refrigerators are not necessary in research applications. Refrigerators equipped for flammable material storage are more likely for temperature sensitive User materials.

I.7.2 EH&S and applicable codes do not require specially fabricated cabinets for acid storage. If requested by the User due to acid volumes, such cabinets are available and endorsed.

I.7.3 First aid kits are not required or recommended within labs. Designers should avoid first aid kits on equipment lists.

I.8. Materials Handling

I.8.1 Loading Docks:

Building loading docks serving laboratory facilities shall have sufficient room to maneuver pallets and other material safely and a CAMPUS phone shall be placed near the loading area.

I.8.2 Chemical Storage Rooms:

Rooms designed to store corrosive chemicals shall be properly ventilated and shall have non-pervious, one piece chemical resistant floor coverings with covings to the wall and also chemical resistant wall surfaces.

I.8.3 Compressed gas cylinders Storage:

I.8.3.1 Gas cylinders shall be stored in a well ventilated, dry location, at least 20 feet from highly combustible materials. Such enclosures shall serve no other purpose, shall

operate at negative pressure in relation to the surrounding area, and shall have self-closing doors that are constructed of at least 12 gauge steel. In certain applications, sensors connected to alarms that notify occupants of a hazardous condition may be required. Such detection and alarm systems shall be considered.

I.8.3.2 Emergency power shall be provided for exhaust ventilation, gas-detection systems, emergency alarm systems, and temperature control systems.

I.8.3.3 Storage areas shall be secured against unauthorized entry.

I.8.3.4 Compressed gas cylinders shall be protected from external heat sources such as flame impingement, intense radiant heat, electric arc, or high temperature steam lines

I.8.3.5 Adequate space shall be made available for the segregation of gases by hazard class. Flammable gases shall not be stored with oxidizing agents.

I.8.3.6 Liquefied fuel-gas cylinders shall be stored in an upright position so that the safety relief device is in direct contact with the with the vapor space in the cylinder at all times.

I.8.3.7 The heating of flammable gas storage areas shall be indirect heat, such as by air, steam, hot water, etc.

I.8.3.8 Restraints shall be included for the storage of all compressed gas cylinders whether empty or full.

I.8.4 Cryogenic Liquid Tanks:

I.8.4.1 Cryogenic liquid tanks shall be placed in such a manner that their controls could not accidentally be manipulated and such that they may be secured to prevent unauthorized access. The position of valves and switches for emergency shutdowns shall be accessible to authorized personnel only and clearly labeled.

I.8.4.2 Critical vent areas should be covered, or pointed down (i.e. Dewar necks and pressure reliefs)

I.8.4.3 Cryogenic liquid tanks should be placed away from below grade areas where dense vapors may collect and away from glass doors or windows

I.8.4.4 Un-insulated pipes or vessels shall be positioned and/or identified to prevent inadvertent contact with an unprotected part of the body.

I.8.5 Storage of Flammable and Combustible Liquids

Note: In the following section all referenced 'Classes' and 'liquids' are flammable liquids and flammability classifications as applied by the National Fire Protection Association.

I.8.5.1 An approved <u>flammable liquids storage cabinet</u> is required when:

I.8.5.1.1 The aggregate volume of Class I and Class II liquids in an individual fire area not in safety cans exceeds 10 gallons.

I.8.5.1.2 The aggregate volume of Class I and Class II liquids in an individual fire area in safety cans exceeds 25 gallons.

I.8.5.1.3 The aggregate volume of Class IIIA liquids exceeds 60 gallons

I.8.5.1.4 The aggregate volume of Class IIIB liquids exceeds 220 gallons. This applies only to mechanical areas containing hydraulic oils, lubricating oils, etc.

I.8.5.2 When a cabinet is provided, it shall be used for the storage of a flammable and combustible materials not in immediate use.

I.8.5.3 Flammable Material Storage Cabinets must be:

I.8.5.3.1 UL/FM approved and marked in conspicuous lettering:

"FLAMMABLE – KEEP FIRE AWAY"

I.8.5.3.2 Limited so that the maximum quantity of Class IA liquids is 30 gallons within the cabinet.

I.8.5.3.3 Un-vented. If venting is required or requested, EH&S must be contacted for a specific evaluation and guidelines.

I.8.5.3.4 Equipped with self-closing and self-latching doors if purchased after 2005. If the cabinets were purchased prior to 2005 and came equipped with self-latching door mechanisms, it is recommended that this safety device be maintained as operational.

I.8.5.4 A maximum of three (3) flammable material storage cabinets shall be located within a single fire area.

I.8.5.5 Approved Flammable Liquid Storage Rooms are constructed and utilized in compliance with the following guidelines:

I.8.5.5.1 For all containers of Class I and Class II liquids with a capacity greater than 5 gallons.

I.8.5.5.2 For any quantity of Class III liquids exceeding 330 gallons (the maximum capacity of 3 flammable liquids cabinets).

I.8.5.5.3 Walls, floors and ceilings must be constructed of non-combustible materials and have a fire-resistive rating of not less than one hour. In many cases, a 2 hour rating may be necessary.

I.8.5.5.4 Doorways must be provided with non-combustible liquid-tight raised sills or ramps to contain spilled material.

I.8.5.5.5 Approved fire doors must be provided, and kept closed and latched at all times (or arranged to close automatically in case of fire).

I.8.5.5.6 The entrance to the room should be labeled in accordance with NFPA 704 – Identification of the Hazards of Materials for Emergency Response Consult EH&S.

I.8.5.5.7 Proper ventilation must be provided. Storage and other materials should not obstruct the exhaust ventilation.

I.8.5.5.8 Heating is restricted to low pressure steam or hot water.

I.8.5.5.9 Lighting and electrical service must be properly rated for the materials being stored and/or dispensed in the room. Electrical wiring and utilization equipment for Class I liquid storage shall be Class I, Division 2, and electrical wiring and utilization equipment in inside storage rooms used for the storage of Class II and Class III liquids shall be suitable for general purpose.

I.8.5.5.10 The room should be kept free of compressed gasses and all combustible materials such as empty boxes, Styrofoam shipping containers, plastic supplies and materials, and trash containers.

I.8.5.5.11 As applicable, automatic detection and suppression systems are required in new or renovated rooms. Depending on stored quantities, a secondary supplemental fire suppression system may be needed.

I.8.5.5.12 A carbon dioxide (CO_2) type fire extinguisher must be provided within 10 ft. of the door entrance external to a flammable liquids storage room.

I 8.5.6 Dispensing of Class I liquids

I 8.5.6.1 If dispensing of Class I liquids to or from containers less than or equal to 5 gallons (20 L) in capacity is requested by the user, validate the availability of a certified chemical fume hood or a flammable liquid storage room constructed and equipped to meet the International Fire Code requirements for dispensing Class I flammable liquids.

I.8.5.6.2 If dispensing of Class I liquids to or from containers greater than 5 gallons (20 L) in capacity is requested by the User, a flammable liquid storage room constructed and equipped to meet the International Fire Code requirements for dispensing Class I flammable liquids shall be provided. The Professionals and the PM shall consult with EH&S for additional interpretation.

I.8.5.7 Rooms Requiring Fire-Rated Enclosure

I.8.5.7.1 Flammable Liquid Storage Rooms shall be constructed in compliance with the current International Fire Code and the following guidelines:

I.8.5.7.1.1 Walls, floors and ceilings shall be constructed of non-combustible materials and have a fire-resistive rating of not less than one hour. For rooms utilized to dispense containers of 5 gallons or more, a minimum 2 hour rating is necessary.

I.8.5.7.1.2 Doorways shall be provided with non-combustible liquid-tight raised sills or ramps to contain the contents of spilled material from the largest anticipated container size.

I.8.5.7.1.3 Approved fire doors shall be provided with self-closing devices and positive latching mechanisms (or be arranged to close and latch automatically in case of fire).

I. 8.5.7.1.4 The entrance to the room shall be labeled in accordance with NFPA 704 – Identification of the Hazards of Materials for Emergency Response.

I.8.5.7.1.5 Proper ventilation shall be provided. Storage and other materials should not obstruct the exhaust ventilation.

I.8.5.7.1.6 Heating is restricted to low pressure steam or hot water systems.

I.8.5.7.1.7 Lighting and electrical service shall be properly rated for the materials being stored and/or dispensed in the room. Electrical wiring and utilization equipment for Class I liquid storage shall be Class I, Division 2, and electrical wiring and utilization equipment in inside storage rooms used for the storage of Class II and Class III liquids shall be suitable for general purpose.

I.8.5.7.1.8 Compressed gasses and combustible materials such as empty boxes, Styrofoam shipping containers, plastic supplies and materials, and trash containers shall not be designed for storage in flammable liquid storage rooms.

I.8.5.7.1.9 Automatic detection and suppression systems are required. Depending on stored quantities, a secondary supplemental fire suppression system may be needed. A secondary supplemental fire suppression system is required in dispensing rooms.

I.8.5.7.1.10 A carbon dioxide (CO_2) type fire extinguisher shall be provided within 10 ft. of the door entrance external to the flammable liquids storage room.

J. Considerations for Radioactive Materials Use

J.1 General

The design of laboratories involving the use of radioactive materials requires the participation of the University of Pittsburgh's Radiation Safety Office (RSO). It is the PM's responsibility to bring into the design process an RSO representative from the very early stages of design. Based on the quantity and type of radioactive materials to be used in the laboratory, the RSO will determine the level of safety required and specify any additional laboratory design requirements accordingly.

J.1.1 Two issues shall be considered in the design of these laboratories:

1) Protection of the laboratory worker and
2) Protection of persons outside the facility.

J.1.2 To avoid unnecessary exposure, the amount of movement of radioactive material shall be minimized inside and outside the laboratory. This is achieved by locating the areas where the radioactive materials will be used in as close proximity to each other as feasible.

J.1.3 All surfaces of the radioactive laboratory and radioactive materials' storage areas shall be finished with materials that can be easily decontaminated.

J.1.4 Coat hooks shall be provided within the laboratory as close as possible to the exit, so that laboratory personnel can remove potentially contaminated laboratory clothing prior to leaving the facility.

J.1.5 Desks and study facilities should not be located in areas where radioactive materials are to be handled.

J.2 Security:

J.2.1 Areas where radioactive materials are used or stored shall have restricted access. See 3.3 for security locks' requirements.

J.2.2 Access to areas where radioactive materials are stored (refrigerators, cabinets, etc.) shall be restricted by locks or other security means.

J.2.3 Rooms designed to contain a gamma irradiator are subject to increased security controls regarding access and security response.

J.3 Storage of radioactive materials:

J.3.1 Although small amounts of radioactive wastes may be stored in the laboratory, provisions shall be made for the accumulated waste from multiple laboratories, as applicable. This would be a designated storage area, separate from the laboratory and from other waste storage areas. Radioactive wastes cannot be co-mingled with chemical, biological or household waste.

J.3.2 Appropriate shielding shall be provided for radioactive storage locations if required by the RSO. If shielding is required, radiation shielding shall be approved by the RSO.

Section P-3

A. Applicability

A.1 Division P-1, Sections A and B, "Applicability of the Laboratory Design Standards" is hereby made part of this section by reference.

A.2 The Professionals are hereby informed that the University of Pittsburgh and the Association for Assessment and Accreditation of Laboratory Animal Care International (AAALAC) **must** comply with the physical requirements set forth in the "Guide for the Care and Use of Laboratory Animals" promulgated by the National Research Council in 1996. It is the Professional's responsibility to follow these guidelines in the design, construction and renovation of University's research animal spaces.

A.3 In addition, the University's minimum Standards and Procedures described in this section apply to the design, construction and renovation of research animal spaces.

A.4 For requirements that are mandatory in these Standards, requests for variances shall be submitted in writing to the Project Manager (PM), to be forwarded to the University Division of Laboratory Animal Resources (DLAR) for review and approval.

B. Corridors

B.1 Corridors shall be wide enough to facilitate the movement of personnel and equipment. Corridors 6-8 ft wide can accommodate the needs of most facilities.

B.2 Floor-wall junctions shall be designed to facilitate cleaning.

B.3 In corridors leading to dog and swine housing facilities, cage-washing facilities and other high-noise areas, double-door entry or other noise traps should be considered.

B.4 Water lines, drainpipes, electric-service connections and other utilities shall be accessible through access panels or chases in corridors outside the animal rooms. Fire alarms, fire extinguishers and telephones shall be recessed or installed high enough to prevent damage from the movement of large equipment.

C. Animal Room Doors

For safety, doors should open into animal rooms; however, if it is necessary that they open toward a corridor, recessed vestibules should be provided. Doors that open inward are required for animal holding rooms and animal procedure rooms at bio-safety levels 2 and 3. Doors with viewing windows are preferable for safety and other reasons.

C.1 Doors shall be large enough (approximately 42"x 84") to allow the easy passage of racks racks and equipment.

C.2 Self-closing doors equipped with recessed or shielded handles, threshold sweeps and and kick-plates are preferred.

D. Floors

D.1 Floors shall be moisture-resistant, nonabsorbent, impact-resistant and relatively smooth, although textured surfaces might be required in some high-moisture areas and for some species (such as farm animals).

D.2 Floors shall be resistant to the action of urine and other biologic materials and to the adverse effects of hot water and cleaning agents.

D.3 Depending on their use, floors should be monolithic or have a minimal number of joints.

D.4 If the use of the room requires that the floor be waterproof, the provision of a waterproofing membrane under the floor shall be considered. The Professional shall consult with the User to determine the need for a waterproof floor (except as noted in E.2 below).

E. Floor Drainage

E.1 Where floor drains are used, the floors shall be sloped as required to allow for rapid removal of water and drying of surfaces. Floor drains are not essential in all animal rooms, particularly those housing rodents. Also, drains are not necessarily required on all rooms where a waterproof floor is installed.

E.2 Rooms that require a floor drain shall also have a waterproof floor.

F. Walls

F.1 Walls shall be smooth, moisture-resistant, nonabsorbent and resistant to damage from impact. They shall be free of cracks, of unsealed utility penetrations and of imperfect junctions with doors, ceilings, floors and corners.

F.2 Surface materials shall be capable of withstanding cleaning with detergents and disinfectants and the impact of water under high pressure. Curbs, guardrails and/or bumpers shall be provided to protect walls and corners from damage.

F.3 If the use of the room requires that the walls be waterproof, the provision of a waterproofing membrane under the finished wall surface or other means of waterproofing the walls shall be considered. The Professional shall consult with the User to determine the need for waterproof walls.

G. Ceilings

G.1 Ceilings shall be smooth, moisture-resistant and free of imperfect junctions. Surface materials shall be capable of withstanding cleaning with detergents and disinfectants. Exposed plumbing, ductwork and light fixtures are not acceptable unless the surfaces can be readily cleaned. Ceilings of plaster or fire-proof plasterboard shall be sealed and finished with a washable paint.

G.2 Generally, suspended ceilings are not acceptable unless they are fabricated of impervious materials with a minimum of seams and free of gaps. In certain cases, "security-type" suspended ceilings may be required to prevent the ingress of animals into the ceiling cavity.

H. Storage Areas

H.1 Adequate space shall be provided for storage of equipment, supplies, food, bedding and refuse. Corridors used for passage of personnel or equipment shall not be used as storage areas.

H.2 Bedding and food shall be stored in a separate area, in which materials that pose a risk of contamination from toxic or hazardous substances are not stored. Refuse storage areas shall be separated from other storage areas.

H.3 If required by program needs, refrigerated storage, separated from other cold storage shall be provided for carcass storage and animal-tissue waste; this storage area shall be kept below 7 degree C (44.6 degrees F) to reduce putrefaction of wastes and animal carcasses.

I. Heating, Ventilating and Air Conditioning (HVAC)

I.1 Of particular concern in the commissioning and final approval of newly constructed or renovated research animal spaces are heating, ventilation and air conditioning (HVAC) criteria. HVAC systems shall be designed for reliability, ease of maintenance and energy conservation.
Air from animal housing and animal support spaces shall be single pass air and cannot be re-circulated.

I.2 Design professionals should consider split systems to prevent total system shutdown. Final redundancy factors for a specific facility will be developed in consultation with the University's DLAR and Department of Environmental Health and Safety (EH&S) for each system.

I.3 Each HVAC system shall be capable of maintaining dry- bulb temperatures to plus or minus two degrees Fahrenheit of an established set point. Final set point will be provided by DLAR. The established set point and ranges of available set points shall be consistent with species specifications, but is typically 72 plus or minus 4 degrees Fahrenheit.

I.4 Recommended Dry-Bulb temperatures for common laboratory animals are as follows:

Animal	Dry-Bulb Temperature C	F
Mouse, rat, hamster, gerbil guinea pig	18-26	64-69
Rabbit	16-22	61-72
Cat, dog, nonhuman primate	18-29	64-84
Farm animals and poultry	16-27	61-81

The relative humidity shall be maintained within a pre-determined range identified for the species housed. Typically 40-45% with a +/ - 5% variance is used. Humidity must not exceed a range of 30 – 70 percent at any time throughout the year for any animal holding room. Thermostatic and humidification controls shall be provided for each research animal room.

In general, the following room occupancies are designed under negative pressure relative to the corridor: quarantine, housing of animals exposed to hazardous materials (such as BSL-2 agents or chemical hazards), procedure rooms, and housing of non-human primates. In general, the following

room occupancies are designed under slight positive pressure relative to adjacent corridors: surgery, clean equipment storage, and transgenic animal housing. Directional air flow for rooms designated as pathogen free animal housing will be pre-determined by DLAR in conjunction with the Users during the design process.

All of the spaces referenced in 9.8 above, shall be designed with adequate ventilation rates typically between 12 to 15 air changes per hour. In rare instances, 10 air changes per hour can be accepted for specified areas. The Professional shall review this issue with the Project Manager (PM) and the Division of Laboratory Animal Resources (DLAR) and obtain approval before reducing the number of air changes below 12 per hour.

J. Power and Lighting

J.1 In the event of power failure an alternative or emergency power supply shall be available to maintain critical services (i.e. the HVAC system) or support functions (i.e. freezers, ventilated racks, isolators, etc.), in animal rooms, operating suites and other essential areas.

J.2 Light fixtures, timers, switches and outlets shall be properly sealed to prevent vermin and pest entry. The need for the provision of a time-controlled lighting system shall be reviewed with the Users, to ensure a uniform diurnal lighting cycle.

J.3 Light bulbs or fixtures shall be equipped with protective covers to ensure the safety of the animals and personnel.

J.4 Moisture-resistant switches and outlets and ground-fault interrupters shall be used in areas with high water use, such as cage-washing areas, certain animal holding rooms where wash-downs are common and aquarium-maintenance areas.

K. Additional Approval Process for New or Renovated Animal Facilities

K.1 Design Phase

Besides the approvals described in the Professional Design Manual for regular projects, early during the design phase of the animal facility project, the PM will bring into the design process a representative from the DLAR, as needed, to provide specific recommendations and information, as well as criteria to be followed. Criteria shall be obtained from approved codes and recognized industry or national standards. The PM will also provide the DLAR with the opportunity to attend design meetings as needed and to review progress documents.

During the project design development phase, the Professional shall submit an airflow diagram to the PM, to be forwarded to EH&S and the DLAR for approval. The diagram needs to include pressure flow patterns within animal areas, as well as their relationship to adjoining corridors and areas.

If possible, computational flow dynamics should be employed to evaluate air flow patterns within animal rooms design and for caging systems planned, so as to avoid drafts and “dead air” spaces that could adversely affect animal health.

K.2. Construction Phase

K.2.1 Prior to the occupancy of a new or renovated area for animal research, approval is required by the University's Institutional Animal Care and Use Committee (IACUC). IACUC is the University Committee in charge of approving all animal facilities renovations or new construction prior to occupancy.

K.2.2 The PM will interact with the IACUC representative as established in the Facilities Management Project Management Manual dated January 2007 and as required to obtain timely approval of the animal facility prior to occupancy. The PM is responsible for gathering and forwarding to the Committee representative all the information required in the IACUC Required Information for New Construction or Renovations form included here as Exhibit 1. Some of this information will be provided by the Commissioning Agent.

K.2.3 The Professional shall also provide required information to the PM in a timely manner and shall work with him/her to obtain IACUC approval prior to building occupancy.

K.2.4 The Professional shall incorporate the following paragraph in the project specifications: "The Contractor shall ensure adequate pest control during new construction, including the prevention of infiltration by native rodents and flying insects".

EXHIBIT 1

IACUC REQUIRED INFORMATION FOR NEW CONSTRUCTION OR RENOVATIONS

A. GENERAL INFORMATION:

BUILDING NAME	APPROX. SQ. FT. OF ANIMAL CARE AND USE SPACE	APPROX. SQ. FT. OF SUPPORT SPACE	SPECIES HOUSED	SITE SUPERVISOR

Date of Completion: _____

If Renovation,
Describe:_____
_____

Has the project been approved by the Department of Environmental Health and Safety, Office of Radiation Safety, and Attending Veterinarian as described in "Guidelines for Quality Control of Major Renovation and/or New Construction of Research and Teaching Laboratory Space at the University of Pittsburgh" Y / N
If no, please explain
_____

B. HVAC SYSTEM SPECIFICS:

Summarize the heating, ventilation and air conditioning (HVAC) information for each animal room/facility in the HVAC Data Table I and II.
Who performed the ventilation measurements: _____
When were measurements taken: _____
Method used (hot wire anemometer, velometer, etc.) _____

Provide a diagram of the ventilation system supply and exhaust lines. Diagram should show: 1) service to each room, 2) if any supply or exhaust lines come from a common trunk line, 3) if exhaust lines are direct to roof or go to filter or mixing chamber,.

Provide information on supply or exhaust fan system redundancy:

Provide information on heating system (electric, gas, steam, other) and any system redundancy:

Provide information on the humidification system:

How is Temperature and Humidity monitored: _____
How are T/H over range and under range events reported:

How is pressure gradient between rooms/hallway monitored:

Describe any special ventilations systems (i.e. Bio-containment cubicles, anesthetic gas scavenger systems, chemical fume hoods).

ROOM LOCATION	TYPE (HOOD, DUCT, ETC.)	DESIGN CRITERIA (i.e. 100 fpm face velocity)	EFFICACY MONITORING (annual face velocity, etc.)

B. Illumination Specifics:

Describe the lighting system in Table III.

C. Noise:

Describe the facility design features and other methods used to control, reduce, or prevent excessive noise in the animal facility.

D. Construction:

Describe the finishes throughout the animal facility for floors, walls, ceilings, and doors.
Floors: _____
Walls: _____
Ceilings: _____
Doors: _____

Describe the general arrangement of the animal facilities (conventional, clean/dirty corridor, etc.)

_____
_____

Note specialized types of available animal housing spaces such as barrier or hazard containment animal cubicles or facilities designed specifically to house certain species of animals such as pens for dogs, pigs, sheep, NHP, etc.

_____
_____
_____
_____

Note if emergency power is provided for the animal facility and if so, what electrical services it maintains in the event of primary power failure.

_____
_____
_____

Describe storage facilities for cages, equipment, supplies, and flammable or hazardous agents and materials.

_____
_____
_____

Describe for each cage sanitation area its location, the traffic flow patterns (soiled to clean or in and out) within the facility, and kinds of equipment (tunnel washer, bottle washer, rack washer, etc.). If cage sanitation is done elsewhere, state location and how cages are transported to the site.

_____
_____
_____
_____

F. Operation

Water Systems:
If using other than direct city water, describe water source and treatment methods._____

Sewer System:
If using other than direct city sewer hook up, describe sewage systems._____

Transportation:
Describe how animals or caging systems will be received at this location:

Describe circumstances in which animals or caging equipment are transported in common use corridors or elevators having the potential to come in contact with individuals not associated with the animal care and use program.

Security:
Describe procedures for maintaining security in animal housing areas such as perimeter fencing, gates, entry way access control, cameras, or night patrols and provide the department with responsibility.

Describe any fire protection systems.

Division P-1, Sections A and B, "Applicability of the Laboratory Design Standards" is hereby made part of this Section by reference.

A. Physical Construction and Layout

A.1. Isolation of the BSL3 Containment

A.1.1. Location: Consideration shall be given to the location of the BSL3 containment within the building to minimize risk of exposure:

A.1.1.1. Locate away from exterior building envelope walls

A.1.1.2. Locate away from high-traffic public areas, such as cafeterias, emergency rooms, etc.

A.1.1.3. Locate adjacent to or nearby mechanical rooms to minimize lengths of containment ducts.

A.1.2. Separation: Separate BSL3 Containment from common areas that are open to unrestricted traffic flow within the building and corridors available to normal traffic flow of laboratory personnel.

A.1.3 Restricted Access Via Airlock: Restrict access to the BSL3 Containment to unauthorized personnel by separating from public by a series of two separate, self-closing, lockable doors (recommend automated controlled access system, e.g. key card or equivalent) that are interlocked with manual emergency overrides to prevent both doors from being open at the same time.

A.1.4. Consideration for Access by Maintenance and Auxiliary Personnel: All access to critical mechanical equipment (ventilation ducts, fans, piping, compressor monitors or gas supplies, etc.) must be provided outside of the BSL3 Containment. If access to critical mechanical equipment must be maintained inside the BSL3 Containment, access panels shall be supplied inside the laboratory to allow access to such mechanical equipment and must be appropriately labeled for the purpose. The access panel must be hinged (piano- type hinge) and gasketed with gas-tight gaskets to ensure an appropriate seal for both containment and decontamination procedures.

A.2. Physical Construction of BSL3 Containment: The BSL3 Containment shall be constructed so that it can be sealed to permit gas decontamination and fumigation (e.g., formaldehyde gas) and to effectively contain aerosols and airborne organisms within BSL3 Containment. No compromise of the integrity of the containment of the BSL3 laboratory is allowed.

A.2.1. Walls:

For BSL3: To prevent release of agent into any adjacent spaces, walls of appropriate construction and finish (to facilitate cleaning and withstand routine chemical disinfection) shall be provided, that extend the FULL height from finished floor to the floor slab above, The facility shall be designed to essentially be leak-free when negatively pressurized to 0.5 in WG and checked with smoke and soap solution. **For ABSL3:** Non-load-bearing masonry, concrete or equivalent is recommended and above requirements for BSL3 must also be met. **For ABSL3 rooms** in which the walls will serve as a primary biocontainment barrier, the walls shall be sufficient to withstand pressure decay test to 2"

WG with integral cove base to floor and must extend the FULL height from finished floor to the floor slab above.

NOTE*: The room integrity test requirements for facility commissioning will vary depending on the intended use of the facility. These test criteria should be decided upon by EH&S prior to or during the initial phase of facility design. The rooms shall be designed and constructed to allow non-destructive pressurization testing of the spaces.*

A.2.2. Ceilings: shall be reinforced steel frame and gypsum, filler primer and paint finish to prevent release of agent into any adjacent spaces.

A.2.3. Floors: shall be monolithic and slip-resistant. Continuity of seal to be maintained between the floor and wall (a continuous cove floor finish up the wall is required).

A.2.4. Joints and Seams: shall be permanently sealed to prevent passage of air and liquid. All joints between fixed cabinetry and the floor or wall must be smooth-coved and sealed to ensure maximum cleanability.

A.2.5. Penetrations: shall be sealed with a smooth finish or nonshrinking sealant at the BSL3 Containment barrier (or capable of being sealed) to facilitate decontamination and cleaning and to assure isolation of the BSL3 Containment (e.g., light fixtures, fire sprinklers, electrical and telecommunication conduits, water and utility lines, HVAC ductwork, utility access panels, condensate return lines, air supply lines, etc.)

A.2.6. Interior Surfaces, Coatings and Finishes: shall be smooth, continuous, and impermeable to liquids, detergents, disinfectants, and decontamination gases normally used in the laboratory. Scratch, stain, impact, and heat resistant are preferred.

A.2.7. Windows: Windows in BSL3 Containment perimeter are prohibited, with the following exception: observation windows that are inoperable and sealed in the shut position, located on an internal building wall that are made of tempered, break resistant glass and have sloped interior windowsills.

A.2.8. Airlock Doors: Shall be self-closing, lockable and shall provide restricted access (via keycard system--preferred), adequate size to allow passage of all anticipated equipment, made of solid finish construction, and interlocked with manual emergency overrides to prevent both doors from being open at the same time.

A.3. Casework and Furniture in the BSL3 Containment

A.3.1. Bench Tops: shall be impervious to water and resistant to moderate heat, organic solvents, acids, alkalis and chemicals used to decontaminate the work surfaces and equipment; capable of containing spillage of materials (e.g. with marine edges, drip stops, and backsplashes that are installed tight to wall and sealed at wall-bench junction); and continuous (i.e. with no open seams).

A.3.2. Casework and Fixed Lab Furniture: shall be designed and installed in such a way as to facilitate cleaning and decontamination of all exposed and adjacent surfaces.

A.3.3. Movable Lab Furniture: Chairs and other furniture in BSL3 Containment should be covered with material that can be easily decontaminated and prevents the absorption of liquids.

A.4. Personal Hygiene, Safety and Waste Disposal Facilities in the BSL3 Containment

A.4.1. Change Room and Shower Facility: A shower facility should be provided for exit from the BSL3 Containment area and is required for ABSL3 facilities. Provide clothing change area to separate personal clothing from laboratory clothing dedicated to that zone. Provide storage space (lockers preferred) within the clothing change area for personal clothing.

A.4.2. Laundry Hamper: Adjacent to exit door on "dirty side" of BSL3 Containment, provide space for laundry hamper for used/soiled laboratory clothing to be autoclaved prior to laundering.

A.4.3. Hand Washing Facilities: A tempered-water, hands-free or automatically operated hand washing facility shall be provided near the exit door of each primary BSL3 Containment module. Soap dispensers and paper towel dispensers shall be immediately accessible to the hand-washing sink so paper towels may be obtained via hands free method.

A.4.4. Emergency Eyewash: Emergency eyewash facilities shall be provided in the BSL3 Containment in accordance with laboratory activities and applicable regulations (i.e., ANSI Z358.1).

A.4.5. Emergency Shower: Every effort should be made to limit the quantities of hazardous chemicals within the laboratory. When this is not possible, emergency shower equipment shall be provided in the BSL3 Containment in accordance with laboratory activities and applicable regulations (i.e. ANSI Z358.1.) Consider floor drain issue on a case-by-case basis.

A.4.6. Biowaste Storage: Provide space for support stands for biological waste bags. If necessary due to volume or other need, provide refrigerated space for lockable, closed storage for biological waste.

B. Laboratory Services and Utilities

B.1. Lighting and Illumination: Illumination shall be adequate for all activities, avoiding reflections and glare that could impede vision; 70 ft.-candles of light at work surface level (metric) minimum maintained at work surface is recommended. All fixtures shall be vapor-tight, moisture-proof, enclosed, and/or gasketed light fixtures that are surface mounted and installed flush against the ceiling to prevent dust accumulation and minimize penetrations into the room. If possible, fluorescent light ballasts and starters should be located outside BSL3 containment area.

B.2. Gases: Compressed gas cylinders supplying carbon dioxide, nitrogen and other gases shall be stored outside the BSL3 Containment, and manifold piping shall be used to provide the gases inside the BSL3 Containment. Air and gas lines shall be protected by in-line HEPA filters and backflow prevention.

B.3. Electrical System

B.3.1. Emergency Backup Power: Provide emergency backup power as required for life safety systems as well as essential systems and equipment in the BSL3 Containment, such as certain lighting, HVAC systems, Biosafety Cabinets, and security systems.

B.3.2. Power Distribution Panels: Separate power and lighting distribution panels shall be provided for the BSL3 Containment, located outside BSL3 Containment.

B.3.3. Electrical Conduit and Wiring: All outlets, fixtures, junction boxes and conduit in BSL3 shall be surface mounted and installed per Section 1.2 to minimize penetrations.

B.3.4. Interlocks: The entryway airlocks, pass boxes, and double-door sterilizers of the BSL3 Containment shall be protected with electrical interlocks so that both doors cannot be opened simultaneously.

B.4. Security Systems for BSL3 Containment: Building security systems integrated with laboratory safety and monitoring systems (e.g., cardkey access) shall be provided as needed.

B.5. Communications Systems: BSL3 Containment shall be equipped with a voice communication system between containment zone and support area (e.g., telephone, intercom, etc.). In addition, a communication system shall be provided for electronic transfer of information and data from laboratory area to outside laboratory perimeter (e.g. fax machine, computer, etc.). Consider a clearly marked "panic button" to activate alarm under emergency conditions and summon help.

B.6. Plumbing System

B.6.1. Backflow Prevention: Provide supply and wastewater services with backflow prevention (i.e., in addition to premises isolation).

B.6.2. Piping: Piping shall be surface mounted per Section 1.2, clear of walls to allow access for maintenance and cleaning.

B.6.3. Water Supply Shut Off Valves: Water supply shut off valve shall be located outside of BSL3 Containment perimeter. In addition, it is also recommended that a water shut-off valve to BSL3 Containment be located inside the BSL3 Containment perimeter.

B.6.4. Drains:

B.6.4.1. Separation of Drains and Related Piping: Drains and associated piping from BSL3 Containment shall be separated from other laboratory areas (i.e. go directly to main collector for sanitary sewer and connected to an effluent sterilization system, if necessary) and void of potential cross- connections.

B.6.4.2. Floor Drains: Floor drains should not to be provided, except when essential. Consider temporary floor drain caps and/or devices to maintain seal and prevent drain traps from going "dry."

B.6.4.3. Cleanouts: All cleanout plugs for the drains in the BSL3 Containment shall be located within the BSL3 Containment.

B.6.4.4. Autoclave Chamber Condensate: must be located and drain within the BSL3 Containment, unless the autoclave is equipped with a condensate decontamination cycle prior to discharge.

B.6.5. Vent Lines: BSL3 Containment plumbing vent lines shall be equipped with HEPA filters and be independent of noncontainment plumbing vent lines.

B.6.6. Waste Liquid Effluent (Bio-Waste) Sterilization System: Liquid effluent (bio-waste) sterilization system should be considered for BSL3 Containment. (Required for BSL3-Ag Containment.)

B.7. Vacuum System: Central building vacuum systems are not permitted to be extended into the BSL3 Containment because of problems associated with contamination of pipelines and exhaust air. Rather, individual vacuum pumps or a vacuum system dedicated to the BSL3 Containment, which are also properly protected with liquid disinfectant traps and HEPA filters, shall be provided.

B.8. Heating, Ventilation and Air Conditioning (HVAC) Systems

B.8.1. HVAC Control Systems: HVAC control system(s) shall be installed to prevent positive pressurization of the BSL3 Containment. The supply and exhaust fans shall be interlocked to prevent positive pressurization in the event of exhaust fan failure or exhaust isolation damper closure. This system must control airflow rate to the BSL3 Containment to remain reasonably constant for 24 hours per day.

B.8.2. Monitoring and Alarms: Visual monitoring devices (gauges) and audible alarms that are audible inside and outside the BSL3 Containment shall be installed, to indicate and confirm that directional inward airflow is provided at the BSL3 Containment entry.

B.8.3. Single Pass Air/No Recirculation: The HVAC system shall be designed to utilize 100 % outside, single-pass air.

B.8.4. Directional Airflow: shall be inward to the BSL3 Containment and shall remain unchanged under all conditions (e.g., from areas of least potential hazard toward toward areas of greatest potential hazard and from less contaminated to more contaminated spaces).

B.8.5. Exhaust - Air Change Rates: The ventilation system shall exhaust air from BSL3 Containment at a minimum of 10 to 12 air changes per hour (ACH) for 24 hours per day.

B.8.6. Pressure Differential of BSL3 Containment: BSL3 Containment shall be kept negative with respect to adjacent corridors and laboratories.

2.8.6.1. Recommendations to create this infiltration include a 15 percent differential between exhaust and supply or sufficient exhaust to create an 0.05 inch water column differential between the laboratory and the access area.

B.8.7. Dedicated Air Exhaust:: A separate exhaust system shall be provided for BSL3 Containment areas for isolation purposes.

B.8.8. Dedicated Air Supply: A separate supply system should be provided for BSL3 Containment areas for isolation purposes.

B.8.9. Redundant Air Supply and Exhaust:: Fully redundant exhaust fans (in parallel) are required, while redundant supply fans are recommended.

B.8.10. HEPA-Filtered Exhaust:: HEPA filtration of exhaust is required; ducted exhaust shall be discharged through an accessible, redundant, HEPA filter. The redundant HEPA filters shall be provided in parallel, including appropriate bubble-tight isolation dampers to allow complete isolation of either filter for certification or gas decontamination while the other filter and exhaust system remain operational.

B.8.11. HEPA-Filtered Supply: HEPA filtration of supply is not required, but should be considered, especially if warranted by research activity or if the BSL3 Containment is served by the common building supply.

B.8.12. HEPA Filters and Pre-Filters: Each housing shall include HEPA filters with minimum particulate removal of 99.97% for particles of 0.3 µm. A monitoring device, such as a magnehelic gauge or equivalent electronic device must be provided to monitor pressure drop across the filters. Coarse pre-filters must also be provided and it is recommended to locate them at the containment room in a manner that facilitates change-out by lab personnel within containment for autoclave decontamination.

B.8.13. HEPA Filter Housings: HEPA filter exhaust housing and associated ductwork shall include sampling and injection ports to allow for appropriate leak testing in place (inlet test sections are recommended) and shall be equipped with bubble-tight isolation dampers and housings suitable for gas decontamination and testing. Consideration should be given to inlet test section Supply and Exhaust HEPA filter housings to be designed for structural stability (no structural change at applied pressure of 1000 Pa [4" wg]).

B.8.14. Location of HVAC Equipment: All HVAC equipment shall be located outside the BSL3 Containment envelope for ease of maintenance, testing, replacement of filters and other servicing.

B.8.15. Ductwork: Exhaust ductwork shall be sealed airtight, independent from other laboratory zones, accessible from outside the BSL3 containment zone, and under negative pressure until the air is discharged outside the building. Ductwork shall withstand 10% loss of pressure at 1000 Pa (4" wg) over a 30-minute period, including all joints and seams and shall be constructed of a material able to withstand routine chemical disinfection.

B.8.16. Isolation Dampers: Supply and exhaust ducts for BSL3 laboratories shall be supplied with 100% shut off dampers (gas-tight, bubble-tight) to ensure the capability of laboratory isolation during emergency situations as well as gas decontamination without compromising the rest of the building. The dampers shall automatically activate to prevent positive pressurization of the containment spaces (i.e., supply dampers close upon loss of exhaust) and must also reopen with appropriate sequence to avoid positive pressurization.

B.8.17. Emergency Shutdown: Provide manual control device that allows the shut down of supply and exhaust fans and closing of isolation dampers on supply and exhaust ducts to BSL3 Containment to fumigate room with disinfecting gas.

B.8.18. Air Backflow Prevention: Air supply and exhaust ducts penetrating the containment barrier shall be provided with backflow prevention devices, to prevent backflow of contaminated air (consider HEPA filtration).

B.8.19. Supply Vents and Diffusers: Supply vents and diffusers shall be directed away from the face of Biosafety Cabinets, fume hoods, and incubators.

B.8.20. Supply – Outside Air Intake: Outside air intakes shall be separated as far as practicable from the points of exhaust with respect to prevailing wind patterns of the geographical area.

B.8.21. Biological Safety Cabinets (BSC)

B.8.21.1. BSCs and other primary containment devices are required in the BSL3 Containment.

B.8.21.2. Only biological safety cabinets listed in the latest edition of the *National Sanitation Foundation (NSF) Standard 49* (Class II Laminar Flow Biohazard Cabinetry) shall be installed.

B.8.2.1.3 A Class II, Type A2 cabinet with an exhaust canopy or thimble connection for discharge into the building exhaust system is recommended where work will consist primarily of microbiological work, using only minute or trace amounts of volatile hazardous chemicals,.

B.8.2.1.4. A Class II, Type B2 cabinet is recommended where applications could include work with more than minute quantities of volatile chemicals, or work with chemicals for which the physical properties or hazards are unknown or are known to present special hazards,. These cabinets provide 100% exhaust with no recirculation into the room or BSC. The cabinet should be interlocked with the building exhaust system to prevent pressurization of the cabinet.

B.8.2.1.5 Each BSC shall be on an independent electrical circuit and shall be connected to emergency power.

B.8.21.6. BSCs shall not be installed as an integral part of a room(s) supply and exhaust system in such manner that fluctuations of the room supply and exhaust air cause the biological safety cabinets to operate outside their design parameters for containment.

B.8.21.7. It is recommended that BSCs or fume hoods not be used as the sole source of room exhaust.

B.8.21.8. BSCs shall be located away from doors, from room supply louvers, and from heavily traveled laboratory areas.

B.8.21.9. Follow manufacturer's recommendations for required clearance to permit cleaning and testing of filters.

B.9. Fixed Laboratory Equipment

B.9.1. Autoclave (Decontamination Equipment:): A method for decontaminating all wastes generated within the BSL3 located in the containment barrier shall be provided. A dedicated double-door (pass-through) autoclave with interlocking doors that is located and sealed on BSL3 containment barrier is recommended. The autoclave area requires

overhead exhaust, floor drains (to BSL3 waste drains), electricity, hot/cold water, steam, heating, ventilation, and air conditioning (HVAC), and drain, waste, and vent (DWV).

B.9.1.1. Exhaust: High air velocity exhaust canopies shall be installed above each autoclave door. The exhaust from an autoclave contains a significant amount of moisture. Thus, filtration of this exhaust, when necessary, shall be through a moisture-resistant (hydrophobic) filter such as a Pall 0.2 micron filter or equivalent. Note that filtration of moist exhaust through a cold filter housing containing a paper HEPA filter will result in the destruction of the HEPA filter and a break in integrity.

B.9.1.2. Drain: Drain must be located inside the BSL3 containment laboratory with a bioseal between the BSL3 containment and the non-containment area or covered with a HEPA filtered cabinet.

B.9.2. Continuous Flow Centrifuges (and other equipment with potential to produce aerosols): Laboratory equipment with potential to produce aerosols shall be contained in devices that exhaust air through HEPA filters before discharge into the laboratory (or vented to the outside if it is dispersed away from occupied areas and air intakes.)

B.9.3 Disinfectant Fogging Machine: Consider providing facilities outside of BSL3 Containment to facilitate activation of portable disinfectant fogging machines inside BSL3 Containment area. (110V duplex power outlet inside airlock with switch outside.)

B.10. Systems Identification: All systems serving a BSL-3/ABSL-3 containment facility shall be clearly, permanently labeled with a biohazard symbol and identified as serving BSL-3/ABSL-3, including all conduit, plumbing and drain systems, HVAC equipment and ductwork, and panel boxes.

Division P-1, Sections A and B, "Applicability of the Laboratory Design Standards" is hereby made part of this Section by reference.

A. Laser Lab Design

A.1 All Class 3b or Class 4 lasers that are not imbedded in a Class 1 laser system should be installed in a properly designed laboratory.

A.1.1 Warning signs shall be posted at all entrances to the room.

A.1.2 Entryway warning lights or a lighted sign indicating when the laser power is on shall be installed on the exterior of the room.

A.1.3 Reflective materials and surfaces shall be minimized.

A.1.4 The room housing the laser shall be capable of being locked (but shall maintain egress to prevent entrapment of occupants).

A.1.5 Windows and doorways shall be capable of being covered with non-combustible coverings.

A.1.6 A carbon dioxide fire extinguisher shall be provided in the room.

A.1.7 For Class 4 lasers with an unenclosed beam path, entry way curtains or the entrance door must be interlocked with the laser's power supply (unless the intended use of the laser would be adversely affected) and an emergency shutoff/panic button shall be installed in an immediately accessible area within the room, preferably near the entrance.

B. Magnet Lab Design

B.1 Magnet Locations

B.1.1 NMR and MRI magnets shall be located in areas with restricted access to the public.

B.1.2 No work stations shall be designed or placed within the 5 gauss field of a magnet. The 5 gauss line should not extend into public thoroughfares or building egress routes.

B.1.3 Magnetic fields must remain within the limits of the room or occupied area realizing that normal wall, ceilings and floor materials do not block static magnetic fields. In the case of an NMR magnet, the strongest magnetic fields may occur at the bottom and top where shielding is less, which means that consideration must be given to occupied areas above and below the magnet.

B.1.4 At least one magnetically compatible fire extinguisher should be mounted immediately external to magnet rooms.

B.2. Room Size

B.2.1 For NMR magnets, the magnet room must be large and high enough to accommodate the helium cloud resulting from a quench (loss of superconducting field). During a quench, one half of the helium volume (between 40 and 100 liters for most NMR magnets) will boil off and be violently ejected from the helium vent on top of the magnet within one minute. This vapor cloud will seek the highest point in the room as it warms and expands up to

700 times in volume. During the next few minutes the remaining helium will boil off. Nothing can be done to stop a magnet quench once it begins.

B.2.2 An NMR magnet room should always be sized so that space between the ceiling and the level of seven feet in the room is large enough to contain the initial volume of helium gas released from a quench. There must be adequate exhaust ventilation in the room of at least 10 air changes per hour.

B.2.2.1 An NMR magnet room shall have adequate ceiling heights to allow for cryogen transfer into top-filling cryogenic magnets.

B.2.3 For MRI units which utilize larger volumes of cryogens or for NMR magnets or in smaller rooms, helium vent pipes hard-ducted to the helium quench valve or automated exhaust fans tied to oxygen monitors shall be installed.

B.2.4 Supplemental ventilation, oxygen alarms and emergency procedures shall be established when magnets are installed in below grade pits. These are particularly important for NMR magnets because liquid nitrogen vapors will collect in low areas and expand to create an oxygen deficient environment.

B.3 Signage

B.3.1 Approved signage shall be posted at all entrances to NMR magnet rooms prohibiting entry by unauthorized personnel and conspicuously warning of magnetic fields.

B.3.2 A visible indicator demarcating the 5 gauss line shall be installed after magnet start up. A permanent floor marking is recommended.

B.4 Commissioning of Magnets and Laser Labs and start-up of Equipment

B.4.1 During the design phase of these laboratories, the Professional shall consult with the lab User, the PM, the representative from EH&S and the manufacturer of the equipment and develop specification requirements for commissioning of the labs, emphasizing coordination issues between the Commissioning Agent and the equipment start-up contractor, as applicable.

B.4.2 Because of the significant hazard posed by liquid nitrogen vapors in below grade NMR labs, only experienced personnel should be allowed in the room during start-up.

UNIVERSITY OF PITTSBURGH

STANDARD SITE CONSTRUCTION DETAILS

GATEWAY®
On Call. On Time. On Target.

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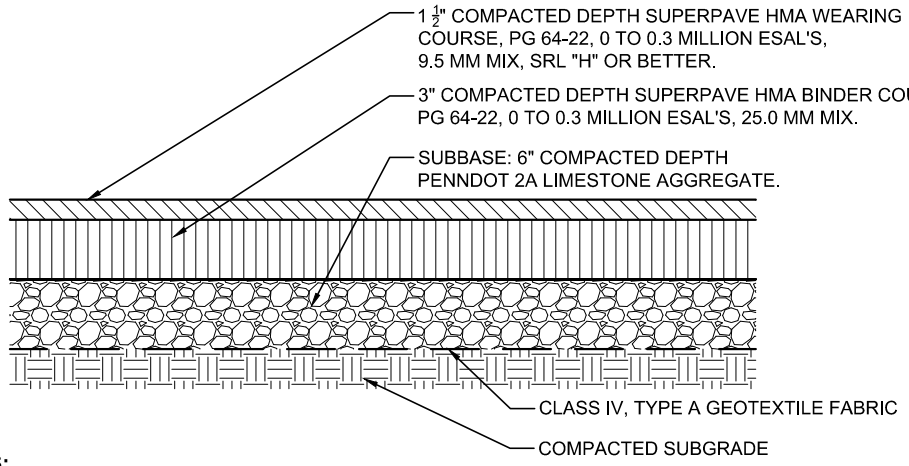
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STANDARD SITE CONSTRUCTION DETAILS

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NOTES:

1. ONCE THE FINAL WEARING COURSE OF BITUMINOUS PAVING IS PLACED, THE CONTRACTOR SHALL SEAL THE GUTTER LINE WITH PG 64-22 ASPHALT CEMENT BY OVERLAPPING 3" ONTO THE WEDGE CURB AND EXTENDING 9" ON TO THE CARTWAY IN ACCORDANCE WITH PENNDOT. PUBLICATION 408.
2. SUBGRADE DRAINS MAY BE REQUIRED WHERE UNDERGROUND WATER IS ENCOUNTERED.
3. CONSTRUCTION MATERIALS AND INSTALLATION SHALL CONFORM TO PENNDOT PUBLICATION 408 UNLESS OTHERWISE INDICATED.
4. SUBBASE SHALL BE COMPACTED TO 70% RELATIVE DENSITY PER ASTM D4253 AND ASTM D4254.
5. SUBBASE SHALL BE COMPACTED TO VISUAL NON-MOVEMENT PRIOR TO PLACEMENT OF FABRIC AND SUBBASE.

01	STANDARD DUTY ASPHALT PAVEMENT (PRIVATE)
SH 1	

University of Pittsburgh
FACILITIES MANAGEMENT

Professional Stamp

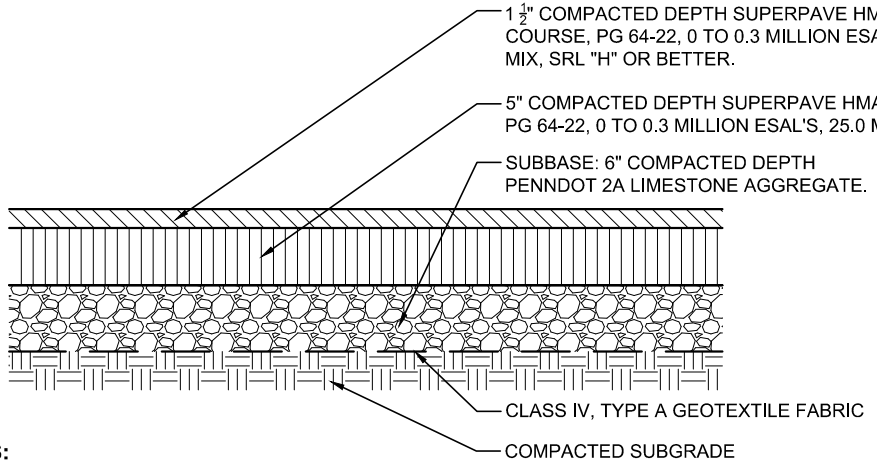
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STANDARD DETAILS	X5887
	Issue Date: MAY 2016

Drawing Description:
STANDARD DUTY ASPHALT PAVEMENT (PRIVATE)

UNIVERSITY OF PITTSBURGH STANDARD DETAILS

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NOTES:

1. ONCE THE FINAL WEARING COURSE OF BITUMINOUS PAVING IS PLACED, THE CONTRACTOR SHALL SEAL THE GUTTER LINE WITH PG 64-22 ASPHALT CEMENT BY OVERLAPPING 3" ONTO THE WEDGE CURB AND EXTENDING 9" ON TO THE CARTWAY IN ACCORDANCE WITH PENNDOT. PUBLICATION 408.
2. SUBGRADE DRAINS MAY BE REQUIRED WHERE UNDERGROUND WATER IS ENCOUNTERED.
3. CONSTRUCTION MATERIALS AND INSTALLATION SHALL CONFORM TO PENNDOT PUBLICATION 408 UNLESS OTHERWISE INDICATED.
4. SUBBASE SHALL BE COMPACTED TO 70% RELATIVE DENSITY PER ASTM D4253 AND ASTM D4254.
5. SUBBASE SHALL BE COMPACTED TO VISUAL NON-MOVEMENT PRIOR TO PLACEMENT OF FABRIC AND SUBBASE.

02	HEAVY DUTY ASPHALT PAVEMENT (PRIVATE)
SH 2	

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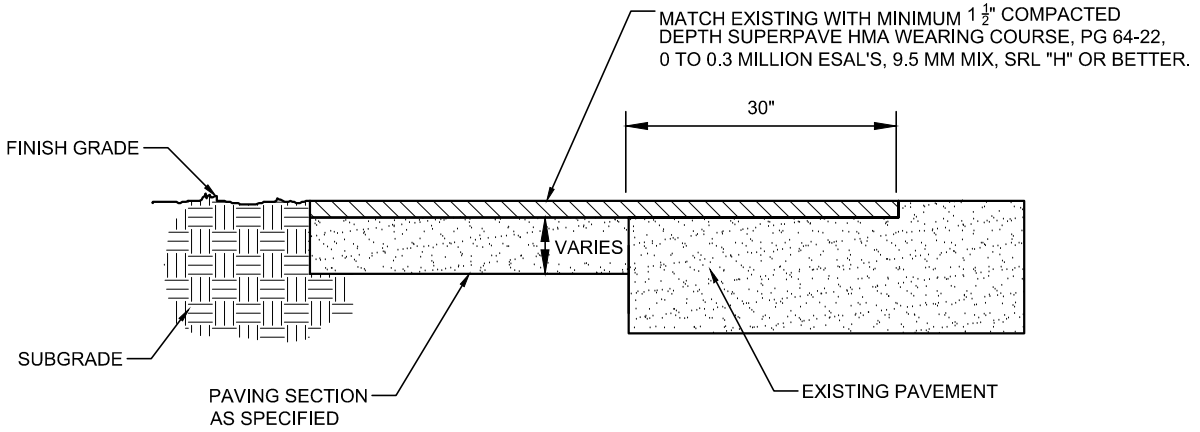
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03	PAVEMENT PATCH
SH 3	

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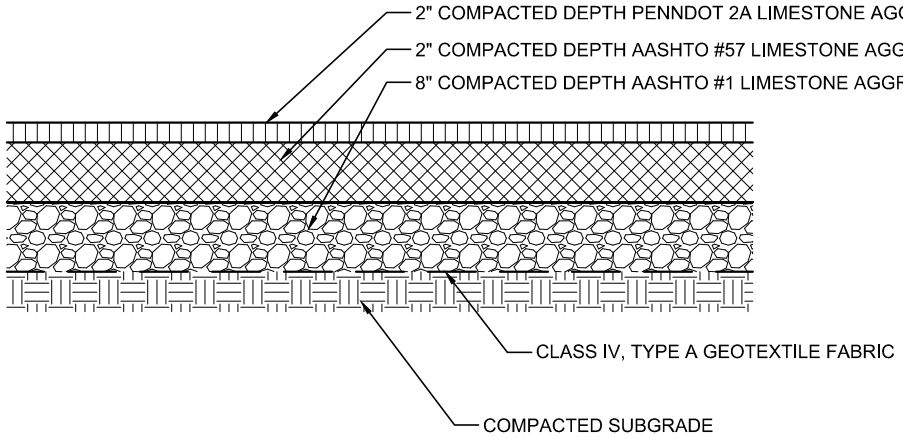
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	Issue Date: MAY 2016

Drawing Description
PAVEMENT PATCH

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NOTES:

1. AGGREGATE PAVING SECTION SHALL BE COMPACTED TO 70% RELATIVE DENSITY PER ASTM D4253 AND D4254.
2. SUBGRADE DRAINS MAY BE REQUIRED WHERE UNDERGROUND WATER IS ENCOUNTERED.
3. CONSTRUCTION MATERIALS AND INSTALLATION SHALL CONFORM TO PENNDOT PUBLICATION 408 UNLESS OTHERWISE INDICATED.
4. SUBGRADE SHALL BE COMPACTED TO VISUAL NON-MOVEMENT PRIOR TO PLACEMENT OF FABRIC AND AGGREGATE.

04	AGGREGATE PAVEMENT
SH 4	

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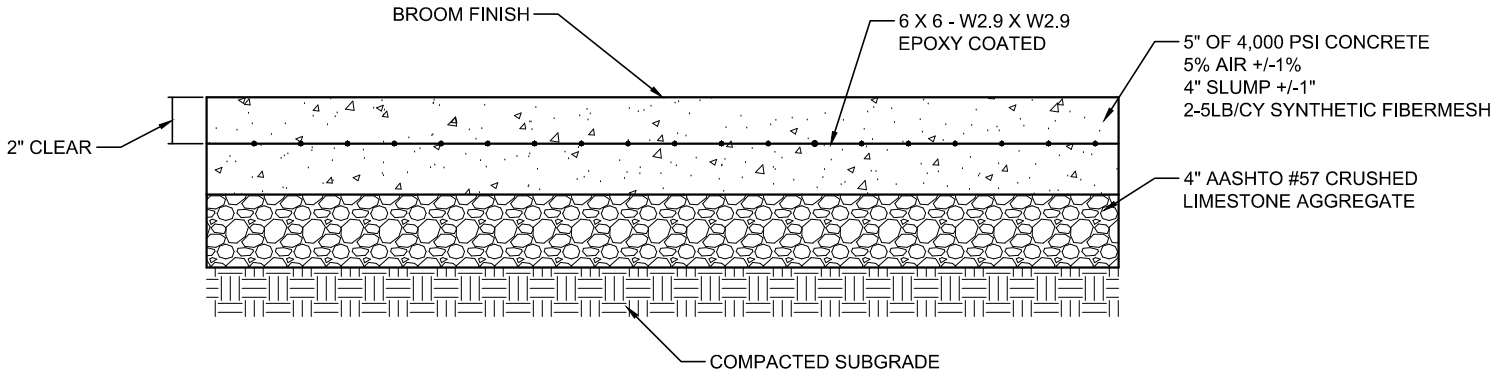
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Drawing Description: AGGREGATE PAVEMENT

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NOTES:

1. CONTRACTOR SHALL PLACE CONTROL JOINTS AT INTERVALS EQUAL TO THE PAVEMENT WIDTH NOT TO EXCEED 12'.
2. EXPANSION JOINTS SHALL BE INSTALLED AT 50' MAXIMUM INTERVALS.
3. CURING SHALL BE BY ABSORPTIVE COVER; MOISTURE-RETAINING COVER; OR APPROVED CURING COMPOUND. CONTRACTOR SHALL SUBMIT PROPOSED CURING METHOD TO OWNER FOR APPROVAL PRIOR TO CONCRETE INSTALLATION.
4. APPLY WATER BASED 40% SILANE PENETRATING SEALER AFTER A MINIMUM OF 28 DAYS PER MANUFACTURERS RECOMMENDATIONS.
5. PROVIDE MINIMUM CROSS-SLOPE OF 1.5% TO MAXIMUM CROSS SLOPE OF 2%.
6. FIBERMESH DOSAGE RATE SHALL BE SPECIFIED IN CONCRETE MIX DESIGN SUBMITTED BY CONTRACTOR.

05	5" THICK CONCRETE PAVEMENT (PRIVATE)
SH 5	

REV. 08/17

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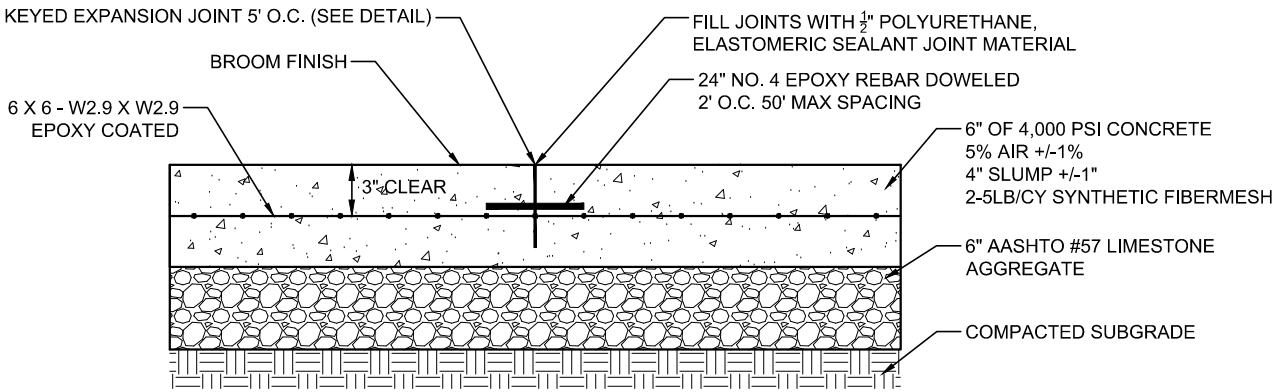
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5" THICK CONCRETE PAVEMENT (PRIVATE)
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NOTES:

1. CONTRACTOR SHALL PLACE CONTROL JOINTS AT INTERVALS EQUAL TO THE PAVEMENT WIDTH NOT TO EXCEED 12'.
2. EXPANSION JOINTS SHALL BE INSTALLED AT 50' MAXIMUM INTERVALS.
3. CURING SHALL BE BY ABSORPTIVE COVER; MOISTURE-RETAINING COVER; OR APPROVED CURING COMPOUND. CONTRACTOR SHALL SUBMIT PROPOSED CURING METHOD TO OWNER FOR APPROVAL PRIOR TO CONCRETE INSTALLATION.
4. APPLY WATER BASED 40% SILANE PENETRATING SEALER AFTER A MINIMUM OF 28 DAYS PER MANUFACTURERS RECOMMENDATIONS.
5. USE EPOXY DOWELS FOR NON-CONSECUTIVE POURS.
6. PROVIDE MINIMUM CROSS SLOPE OF 1.5% TO MAXIMUM CROSS SLOPE OF 2.0%..
7. FIBERMESH DOSAGE RATE SHALL BE SPECIFIED IN CONCRETE MIX DESIGN SUBMITTED BY CONTRACTOR.

06	6" THICK CONCRETE HEAVY-DUTY PAVEMENT (PRIVATE)
SH 6	

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	Issue Date: MAY 2016

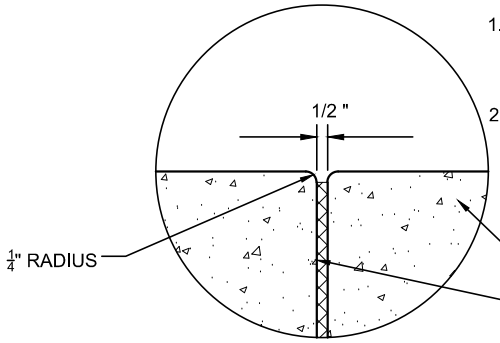
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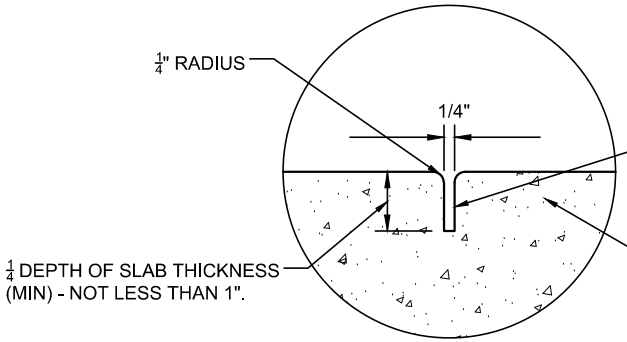
NOTE:

1. EXPANSION JOINTS SHALL BE PLACED AT A MAXIMUM OF 50' O.C. OR AS DIRECTED BY THE ENGINEER
2. PLACE EXPANSION JOINTS TO SEPERATE CONCRETE FROM FIXED OR DIFFERENT CONCRETE STRUCTURE OR NON-CONTIGUOUS POURS.



ALL EXPANSION JOINTS SHALL BE PLACED FULL DEPTH AND FILLED WITH "SIKAFLEX 1A POLYURETHANE, ELASTOMERIC SEALANT/ADHESIVE OR APPROVED EQUAL."

EXPANSION JOINT



NOTE:

CONTROL JOINTS SHALL BE A MAXIMUM OF 5' O.C.

LINE/ CONTROL JOINT

07	EXPANSION - CONTROL JOINTS
SH 7	

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Professional Stamp

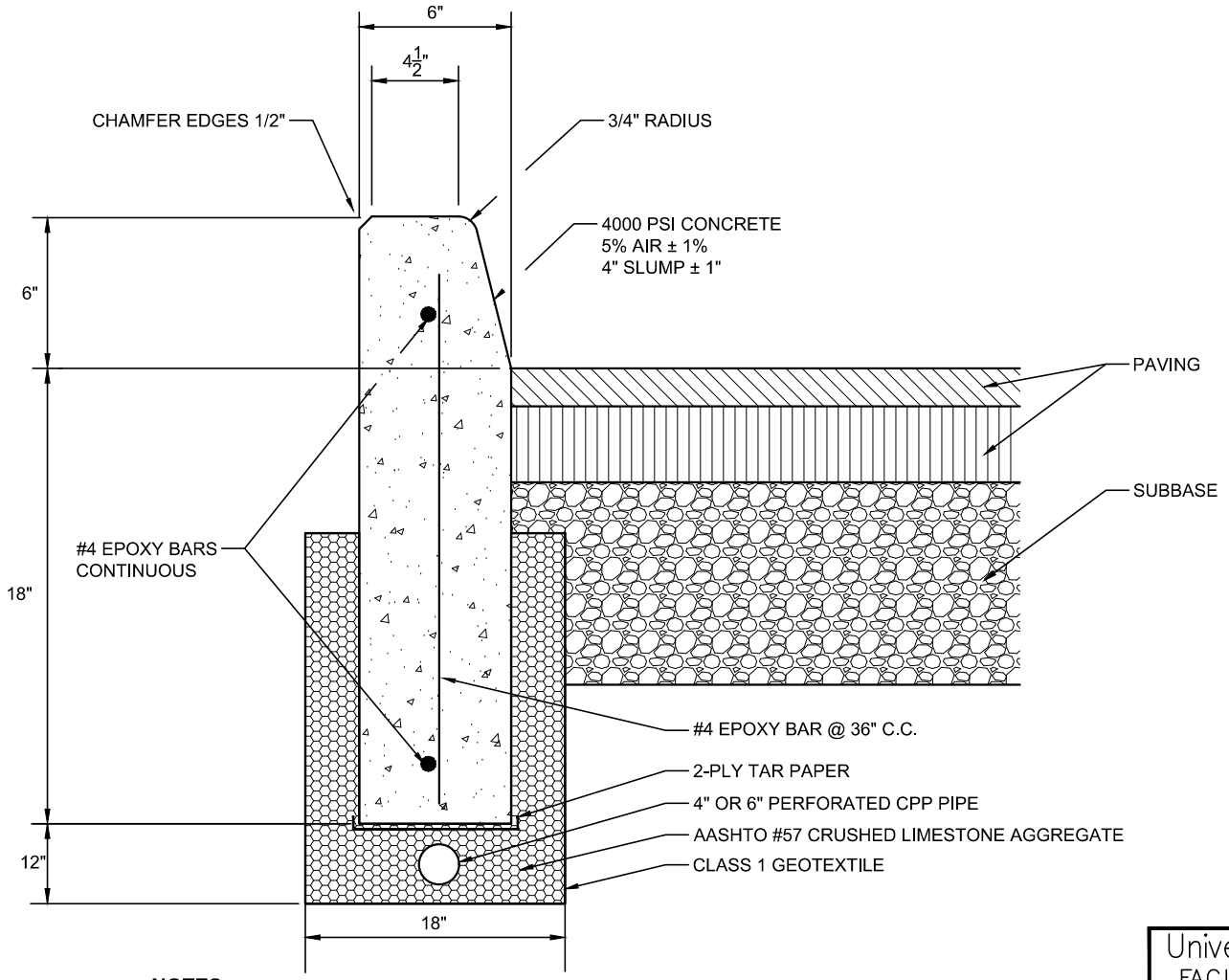
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STANDARD DETAILS	X5887
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Drawing Description: EXPANSION - CONTROL JOINTS

UNIVERSITY OF PITTSBURGH STANDARD DETAILS

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NOTES:

1. PROVIDE EXPANSION JOINTS @ 50' 0.C.OR AS DIRECTED BY THE ENGINEER
2. CONTROL JOINTS @ 10' O.C.
3. PLACE CURB DRAIN AS DIRECTED BY OWNER.

08	6" DEEP SET CONCRETE CURB (PRIVATE)
SH 8	

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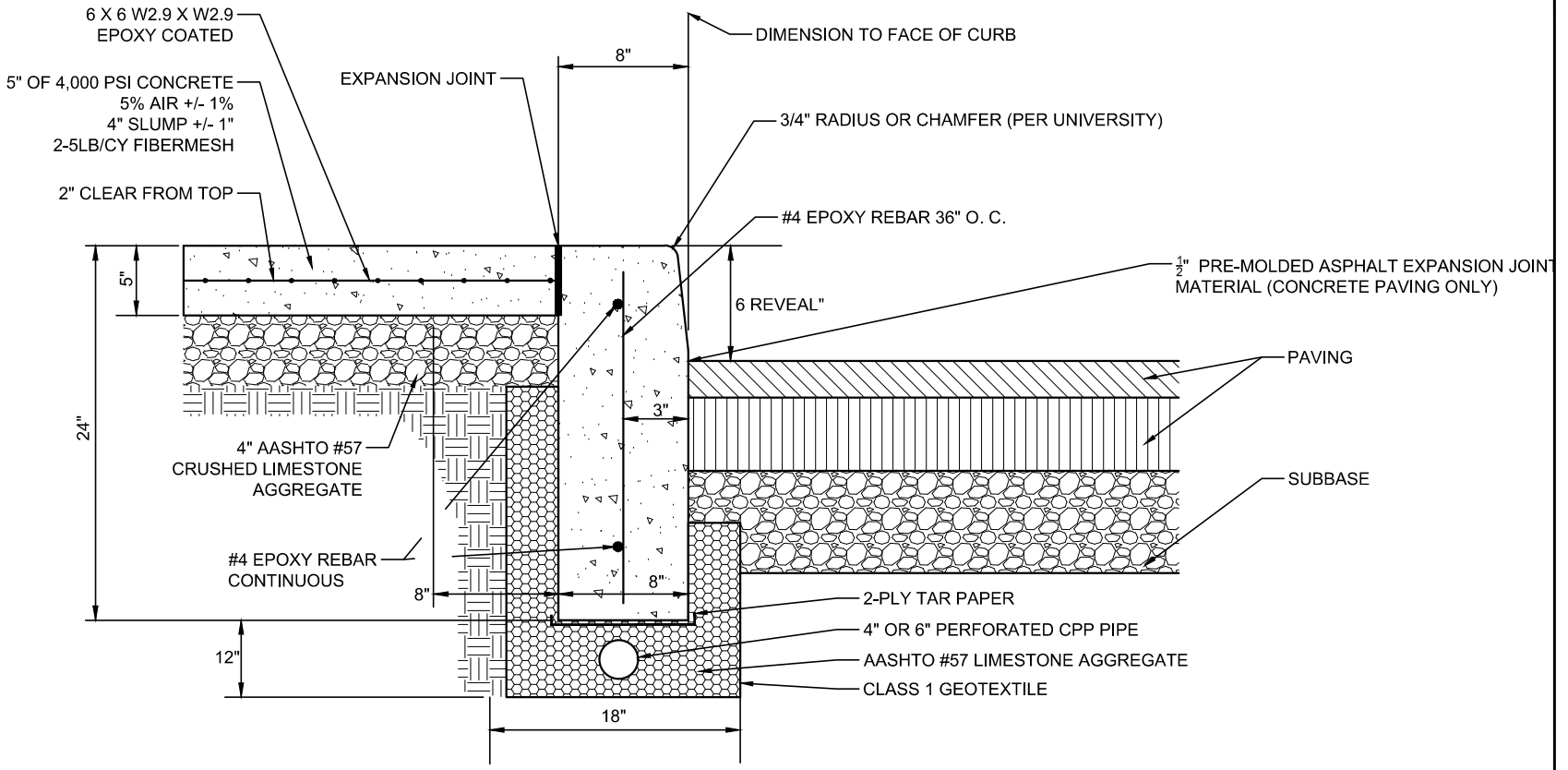
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Project Name	Job No.
STANDARD DETAILS	X5887
	Issue Date: MAY 2016

Drawing Description
6" DEEP SET CONCRETE CURB (PRIVATE)
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NOTES:

1. ALL CURBS AND WALKS SHALL BE MONOLITHIC POURS. SCORE JOINTS IN VERTICAL CURB SURFACE TO ALIGN WITH WALKWAY JOINTS.
2. CONTRACTOR SHALL PLACE CONTROL JOINTS AT INTERVALS EQUAL TO THE PAVEMENT WIDTH NOT TO EXCEED 12'.
3. EXPANSION JOINTS SHALL BE INSTALLED AT 50' MAXIMUM INTERVALS.
4. PLACE CONCRETE CURB DRAIN AS DIRECTED BY OWNER.

09	CONCRETE CURB AND SIDEWALK (PRIVATE)
SH 9	

REV. 08/17

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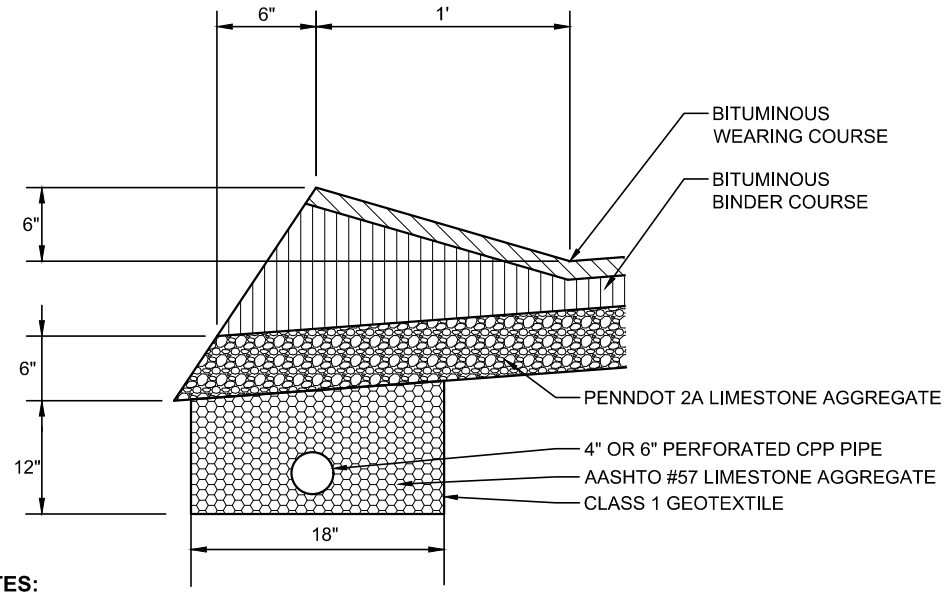
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STANDARD DETAILS	X5887
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Drawing Description: CONCRETE CURB AND SIDEWALK (PRIVATE)

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NOTES:

1. ONCE THE FINAL WEARING COURSE OF BITUMINOUS PAVING IS PLACED, THE CONTRACTOR SHALL SEAL THE GUTTER LINE WITH PG 64-22 ASPHALT CEMENT BY OVERLAPPING 3" ONTO THE WEDGE CURB AND EXTENDING 9" ON TO THE CARTWAY IN ACCORDANCE WITH PENNDOT PUBLICATION 408.
2. SUBGRADE DRAINS MAY BE REQUIRED BY WHERE UNDERGROUND WATER IS ENCOUNTERED.
3. CONSTRUCTION MATERIALS AND INSTALLATION SHALL CONFORM TO PENNDOT PUBLICATION 408 UNLESS OTHERWISE INDICATED.
4. PLACE BITUMINOUS WEDGE CURB DRAIN AS DIRECTED BY OWNER.

10	BITUMINOUS WEDGE CURB (PRIVATE)
SH 10	

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Professional Stamp

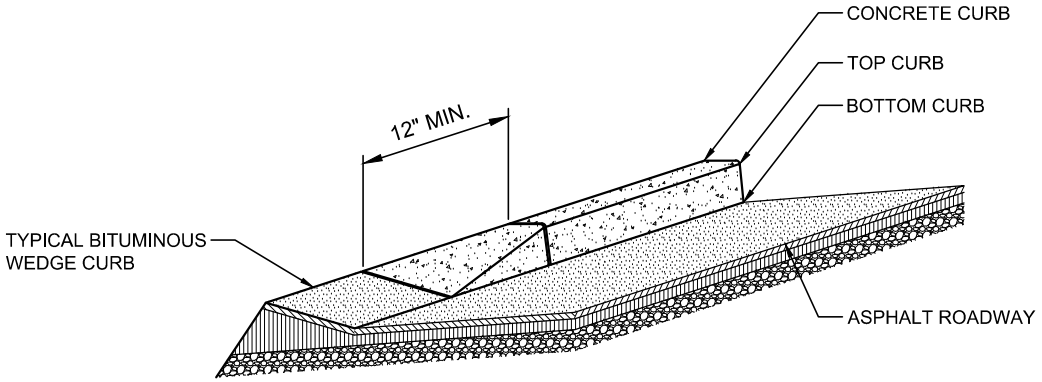
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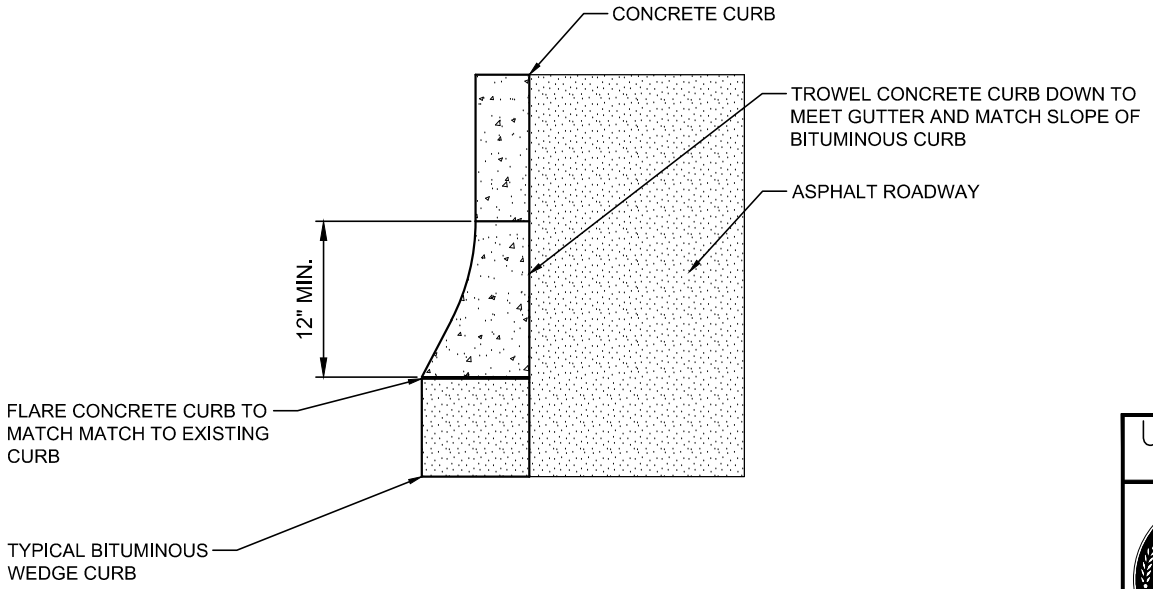
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ISOMETRIC VIEW



PLAN VIEW

11 SH 11	CONCRETE CURB TO BITUMINOUS WEDGE CURB TRANSITION

University of Pittsburgh
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Professional Stamp

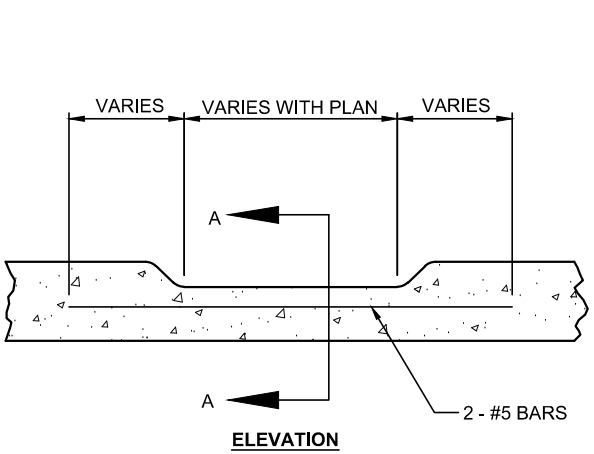
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	Issue Date: MAY 2016

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CONCRETE CURB TO WEDGE CURB TRANSITION

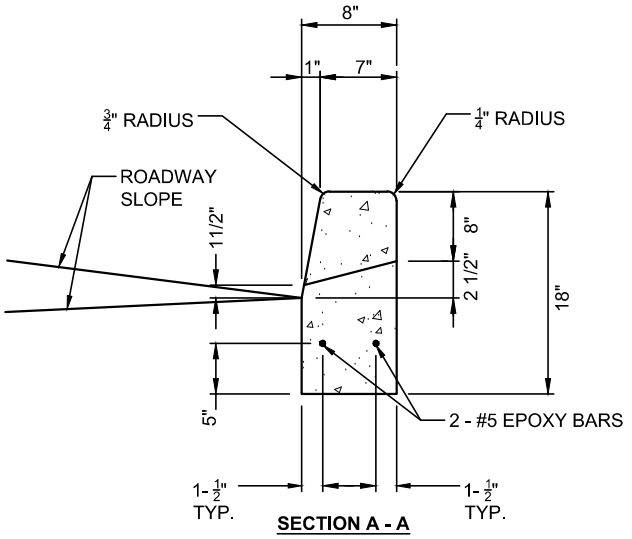
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ELEVATION



SECTION A - A

NOTES:

1. CONSTRUCTION MATERIALS AND INSTALLATION SHALL CONFORM TO PENNDOT PUBLICATION 408 UNLESS OTHERWISE INDICATED.

2. SPACE CONTRACTION JOINTS IN UNIFORM LENGTHS OR SECTIONS.

3. PLACE 1/2 INCH PREMOLDED EXPANSION JOINT FILLER MATERIAL AT STRUCTURES AND AT THE END OF THE WORK DAY. CUT MATERIAL TO CONFORM TO AREA ADJACENT TO CURB OR TO CONFORM TO CROSS SECTIONAL AREA OF CURB.

12	DEPRESSED CURB (ON-SITE)
SH 12	

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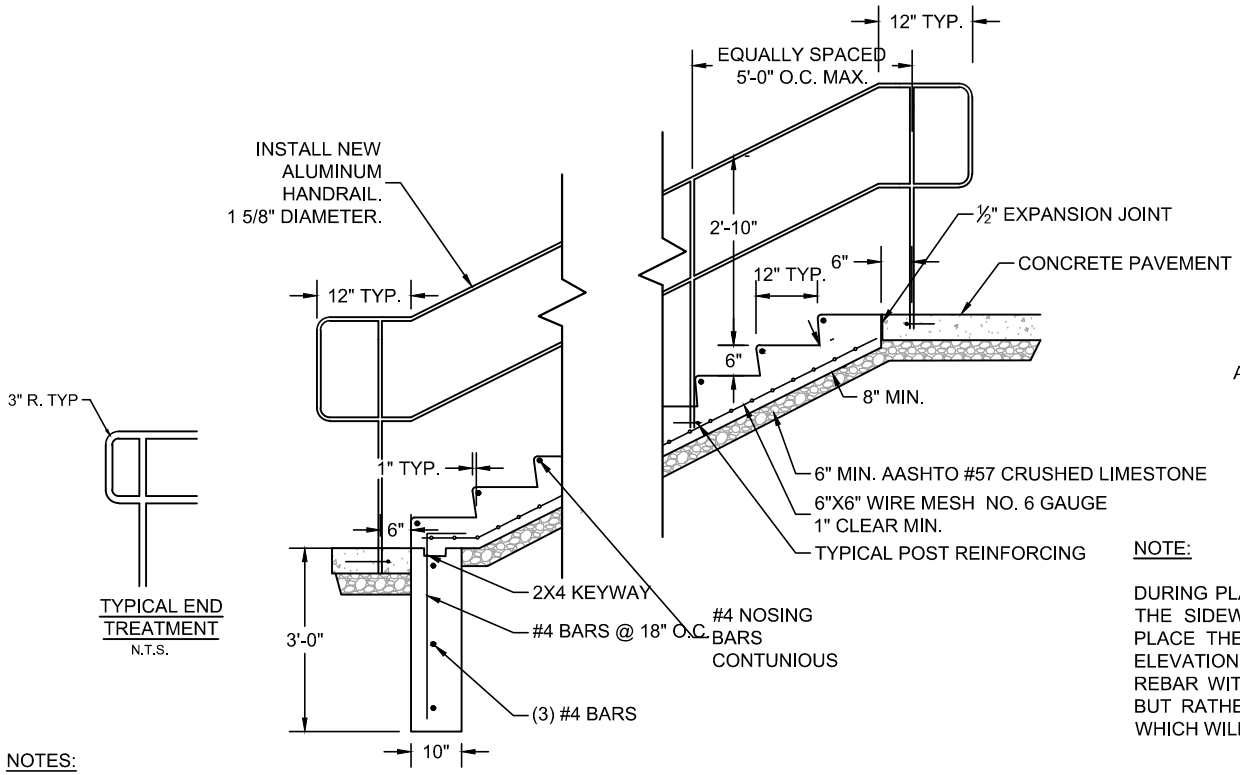
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STANDARD DETAILS	X5887
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DEPRESSED CURB (ON-SITE)

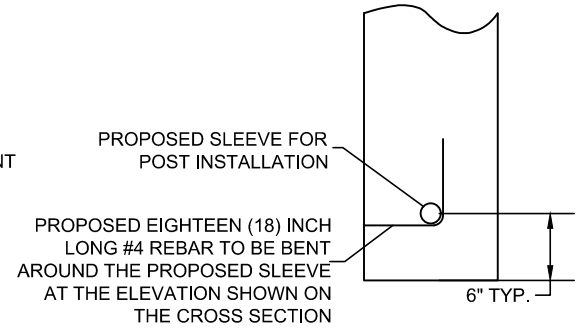
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TYPICAL END
TREATMENT
N.T.S.



PLAN VIEW
POST REINFORCEMENT DETAIL
(IN A STAIR)
N.T.S.

NOTE:

DURING PLACEMENT OF THE POST REINFORCEMENT REBAR WITHIN THE SIDEWALK AREA, THE CONTRACTOR WILL BE REQUIRED TO PLACE THE #4 REBAR ON THE OUTSIDE OF THE SLEEVE AT THE ELEVATION SHOWN ON THE ABOVE DETAIL. THE REINFORCEMENT REBAR WITHIN THE SIDEWALK AREA WILL NOT NEED TO BE BENT, BUT RATHER WILL BE REQUIRED TO REMAIN AS A STRAIGHT BAR WHICH WILL BE TIED TO THE WELDED WIRE MESH.

NOTES:

1. CONTRACTOR TO EMBED POSTS INTO CONCRETE STEPS EIGHT (8) INCHES. POSTS WITHIN CONCRETE SLABS-ON-GRADES SHALL BE EMBEDDED FOUR (4) INCHES.
2. AN 18-INCH LONG REBAR MUST BE PROVIDED ON THE OUTSIDE OF EACH POST SLEEVE TO HELP PREVENT THE CRACKING AND BREAKING AWAY OF THE CONCRETE. THE 18-INCH LONG #4 REBAR MUST BE TIED TO THE REBAR IN THE STEPS/SLABS.
3. MIX DESIGNS MUST BE SUBMITTED FOR REVIEW AND APPROVAL PRIOR TO THE START OF CONSTRUCTION.
4. ALL POSTS ARE REQUIRED TO BE GROUTED INTO PVC SLEEVES THAT WILL BE SET DURING THE POURING OF THE STEPS/WALKWAY. DRILLING OF THE CONCRETE FOR POST INSTALLATION WILL NOT BE PERMITTED UNLESS PREVIOUSLY APPROVED BY THE ENGINEER.
5. ALL REBAR ARE TO BE TIED TOGETHER AND THE BOTTOM ROWS OF REBAR ARE REQUIRED TO BE SET ON CHAIRS TO ENSURE THAT THEY DO NOT MOVE DURING THE POURING OF THE CONCRETE.
6. CURING SHALL BE BY ABSORPTIVE COVER; MOISTURE RETAINING COVER; OR APPROVED CURING COMPOUND. CONTRACTOR SHALL SUBMIT PROPOSED CURING METHOD TO OWNER FOR APPROVAL PRIOR TO CONCRETE INSTALLATION. ALL CONCRETE SIDEWALK AND STEPS SHALL BE FINISHED WITH A BROOM FINISH.
7. APPLY WATER BASED 40% SILANE PENETRATING SEALER AFTER A MINIMUM OF 28 DAYS PER MANUFACTURERS RECOMMENDATIONS.
8. THE STEPS ARE REQUIRED TO POSITIVELY SLOPE (~0.5%) AWAY FROM THE RISER TO ELIMINATE THE POTENTIAL FOR PONDING OF WATER ON THE STEPS.
9. END TREATMENTS WILL BE WELDED IN PLACE AND GROUND SMOOTH AND FINISHED. BOLTED, SCREWED OR COUPLING, ETC CONNECTIONS WILL NOT BE PERMITTED

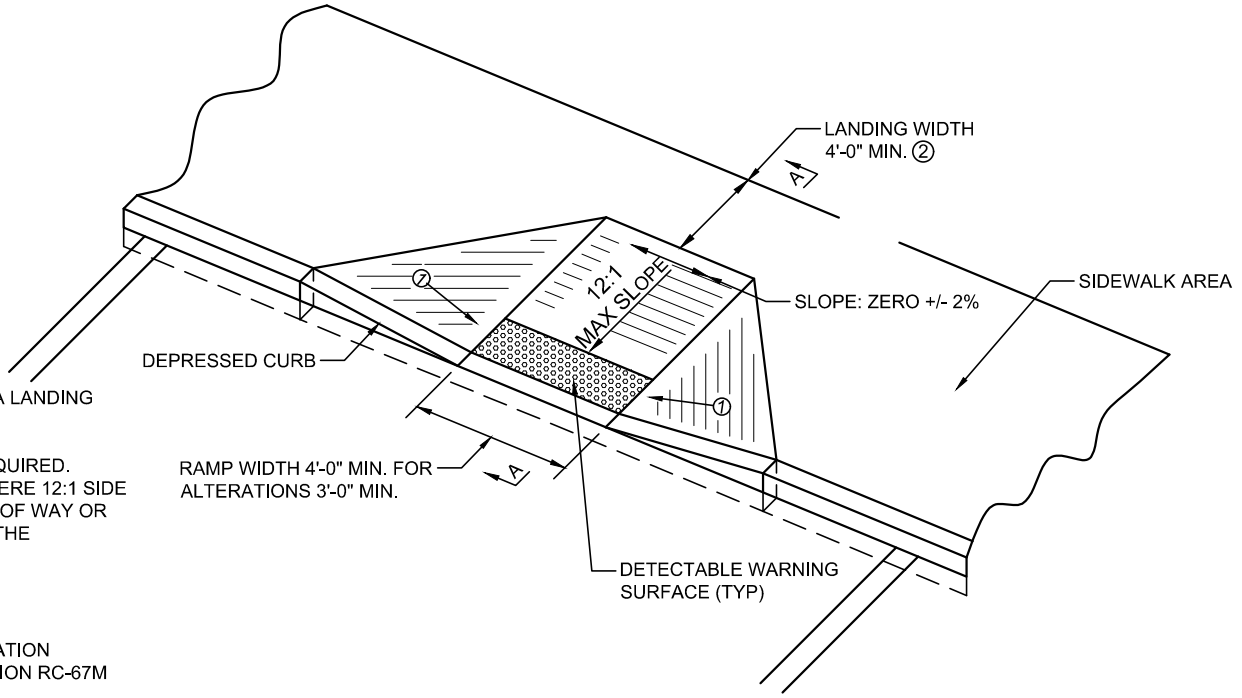
13	CONCRETE STAIR SECTION
SH 13	

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Professional Stamp

Project Name: STANDARD DETAILS
Job No.: X5887
Issue Date: MAY 2016
Drawing Description: CONCRETE STAIR SECTION
UNIVERSITY OF PITTSBURGH STANDARD DETAILS
CAD File Name: G:\Projects\12000\12807- Pitt Greensburg\-0070 Pitt Standard Details\Dwg\02-Sheet\Details.dwg
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① SIDE FLARES 10:1 MAX SLOPE

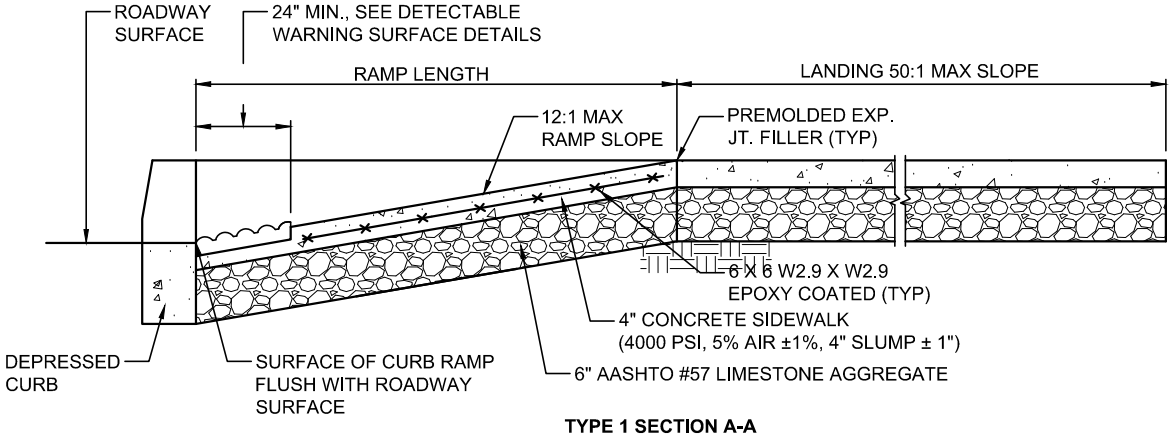
② SIDE FLARES 12:1 MAX FOR RAMPS WITH A LANDING LESS THAN 4'-0".
FOR ALTERATIONS:
IF TECHNICALLY FEASIBLE A LANDING IS REQUIRED. HOWEVER A LANDING IS NOT REQUIRED WHERE 12:1 SIDE FLARES SLOPES ARE PROVIDED AND RIGHT OF WAY OR OTHER STRUCTURAL FEATURES RESTRICT THE INSTALLATION OF A LANDING.

NOTES :

1. REFER TO DEPARTMENT OF TRANSPORTATION STANDARDS FOR ROADWAY CONSTRUCTION RC-67M FOR ADDITIONAL DETAILS AND NOTES.

2. CONTRACTOR TO ENSURE USE OF THE MOST CURRENT DEPARTMENT OF TRANSPORTATION STANDARDS FOR ROADWAY CONSTRUCTION, JUNE 2010 EDITION OR NEWER.

TYPE 1 CURB RAMP



TYPE 1 SECTION A-A

14	TYPE 1 CURB RAMP (RC-67M)
SH 14	

THIS DETAIL WAS BASED ON CURRENT ACCEPTED ADA STANDARD CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT ADA REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

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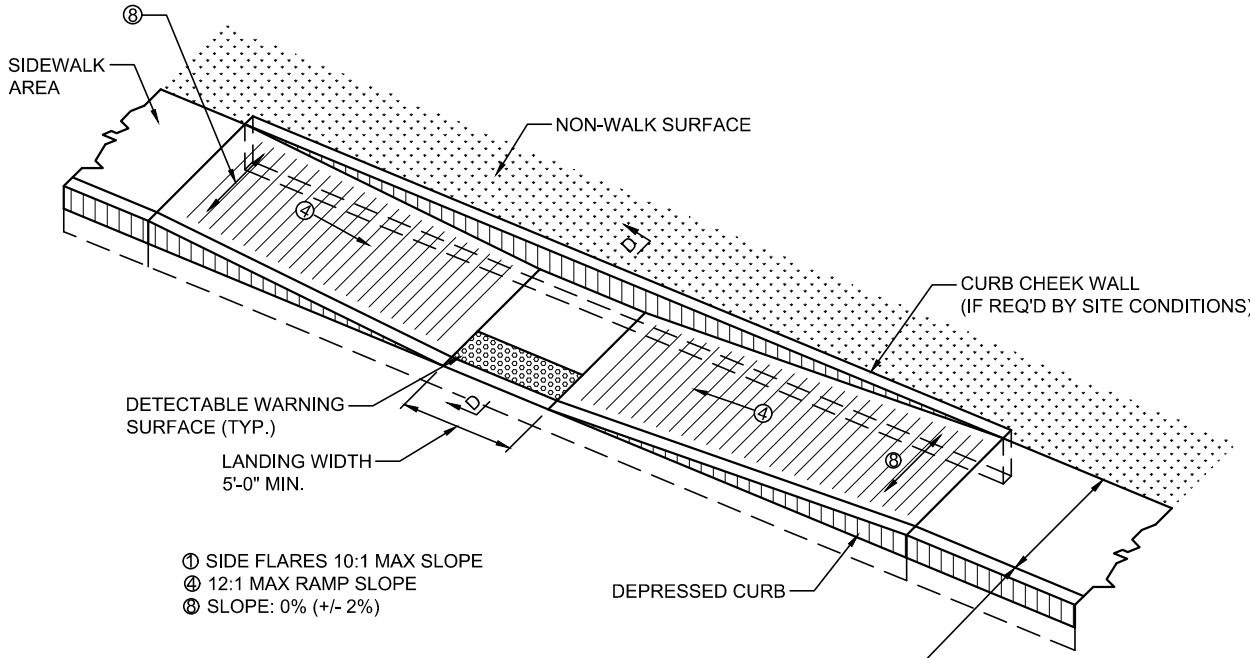
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STANDARD DETAILS	X5887
	Issue Date: MAY 2016

Drawing Description: TYPE 1 CURB RAMP (RC-67M)

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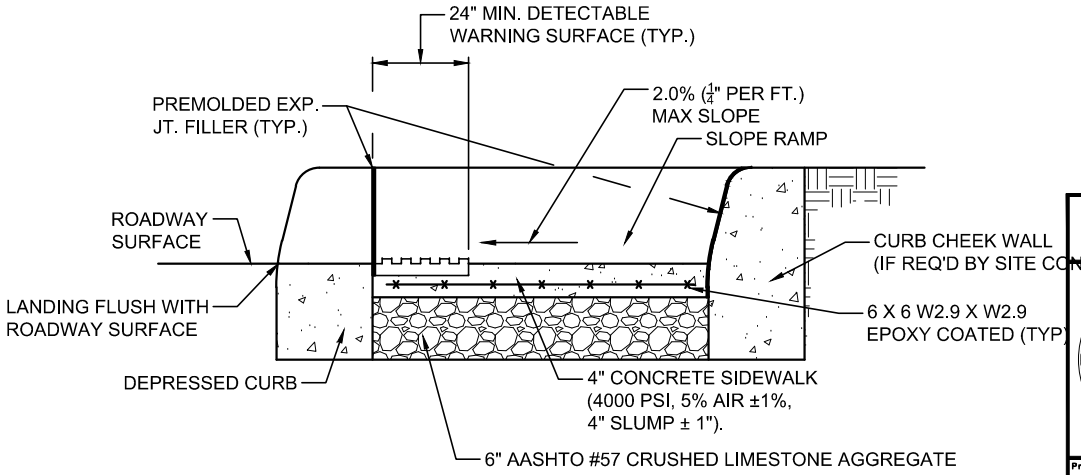
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TYPE 2 CURB RAMP (RC-67M)

NOTES :

1. REFER TO DEPARTMENT OF TRANSPORTATION STANDARDS FOR ROADWAY CONSTRUCTION RC-67M FOR ADDITIONAL DETAILS AND NOTES.
2. CONTRACTOR TO ENSURE USE OF THE MOST CURRENT DEPARTMENT OF TRANSPORTATION STANDARDS FOR ROADWAY CONSTRUCTION, JUNE 2010 EDITION OR NEWER.



TYPE 2 CURB RAMPS SECTION D-D (RC-67M)

15	TYPE 2 CURB RAMP (RC-67M)
SH 15	

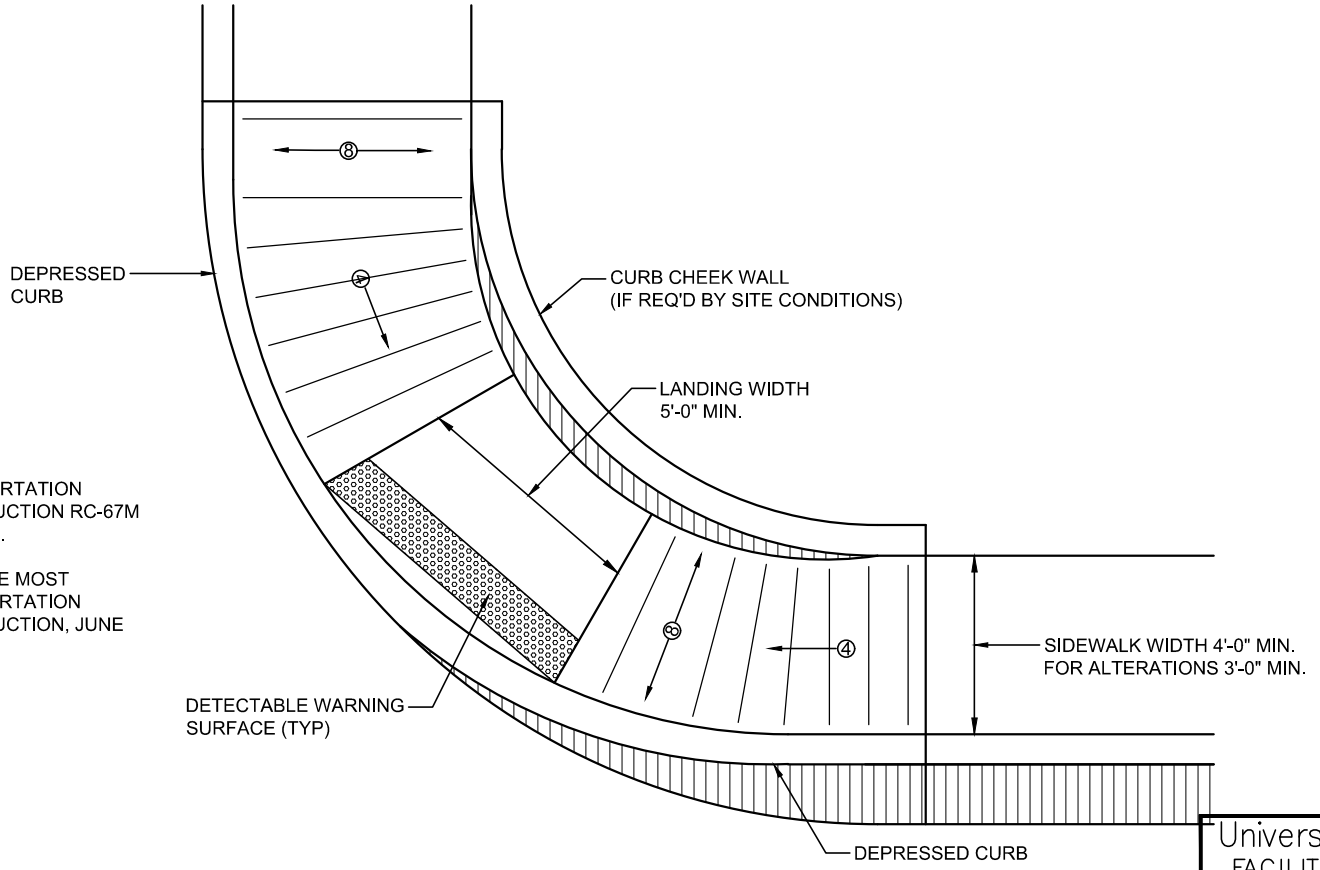
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Drawing Description: TYPE 2 CURB RAMP (RC-67M)	
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NOTES :

1. REFER TO DEPARTMENT OF TRANSPORTATION STANDARDS FOR ROADWAY CONSTRUCTION RC-67M FOR ADDITIONAL DETAILS AND NOTES.
2. CONTRACTOR TO ENSURE USE OF THE MOST CURRENT DEPARTMENT OF TRANSPORTATION STANDARDS FOR ROADWAY CONSTRUCTION, JUNE 2010 EDITION OR NEWER.

① SIDE FLARES 10:1 MAX SLOPE.
④ 12:1 MAX RAMP SLOPE.
⑧ SLOPE: 0% (+/- 2%).

16	TYPE 2 CURB RAMP (DIAGONAL) (RC-67M)
SH 16	

THIS DETAIL WAS BASED ON CURRENT ACCEPTED ADA STANDARD CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT ADA REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

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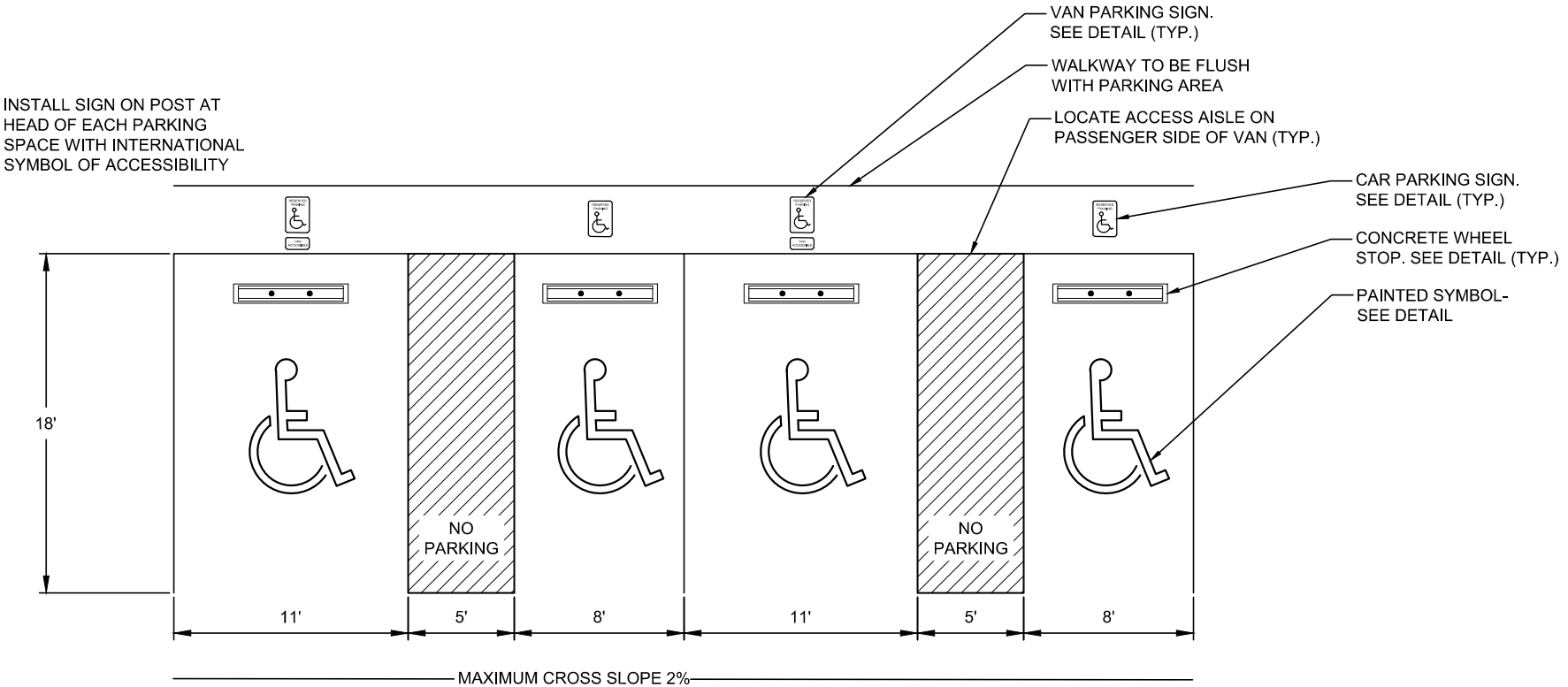
Professional Stamp

Project Name	Job No.
STANDARD DETAILS	X5887
	Issue Date: MAY 2016

Drawing Description
TYPE 2 CURB RAMP (DIAGONAL) (RC-67M)
UNIVERSITY OF PITTSBURGH STANDARD DETAILS

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NOTES:

1. REFER TO SITE PLAN FOR ADDITIONAL INFORMATION.

17 SH 17	TYPICAL HANDICAP PARKING

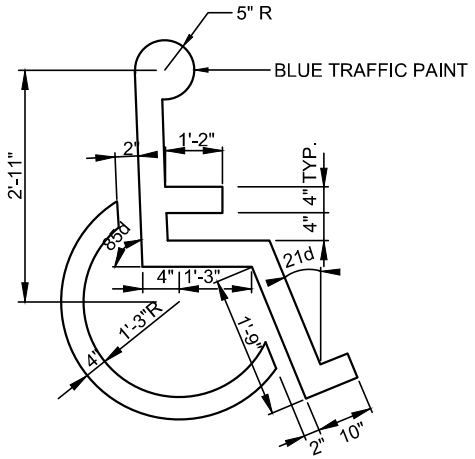
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	Issue Date: MAY 2016
Drawing Description: TYPICAL HANDICAP PARKING UNIVERSITY OF PITTSBURGH STANDARD DETAILS	
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NOTE:
1. REFER TO SITE PLAN FOR ADDITIONAL INFORMATION.

18	HANDICAPPED SYMBOL FOR PARKING
SH 18	

THIS DETAIL WAS BASED ON CURRENT ACCEPTED ADA STANDARD CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT ADA REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

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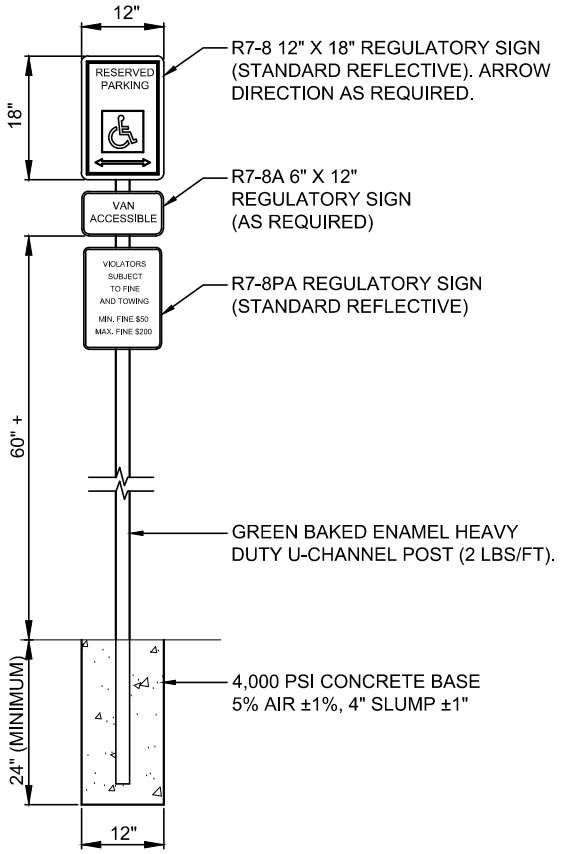
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Project Name	Job No.
STANDARD DETAILS	X5887
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Drawing Description
HANDICAPPED SYMBOL FOR PARKING
UNIVERSITY OF PITTSBURGH STANDARD DETAILS

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19	ACCESSIBILITY HANDICAPPED PARKING SIGN
SH 19	

THIS DETAIL WAS BASED ON CURRENT ACCEPTED ADA STANDARD CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT ADA REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

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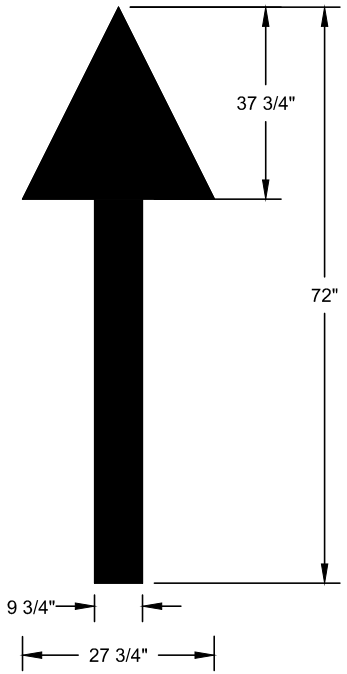
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Project Name	Job No.
STANDARD DETAILS	X5887
	Issue Date: MAY 2016

Drawing Description
ACCESSIBILITY HANDICAPPED PARKING SIGN
UNIVERSITY OF PITTSBURGH STANDARD DETAILS

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NOTES:

1. USE 6" WIDE LANE MARKING PAINT WITH MECHANICAL EQUIPMENT TO PRODUCE UNIFORM STRAIGHT EDGES.
2. USE LATEX TYPE, READY MIXED COMPLYING WITH FEDERAL SPECIFICATION TT-P-1952E TYPES 1 AND 2, COLOR: WHITE.
3. NEW ARROWS TO BE 15 MILS THICK.
4. APPLY PER MANUFACTURERS RECOMMENDATIONS.

20	PAINTED DIRECTIONAL ARROW
SH 20	

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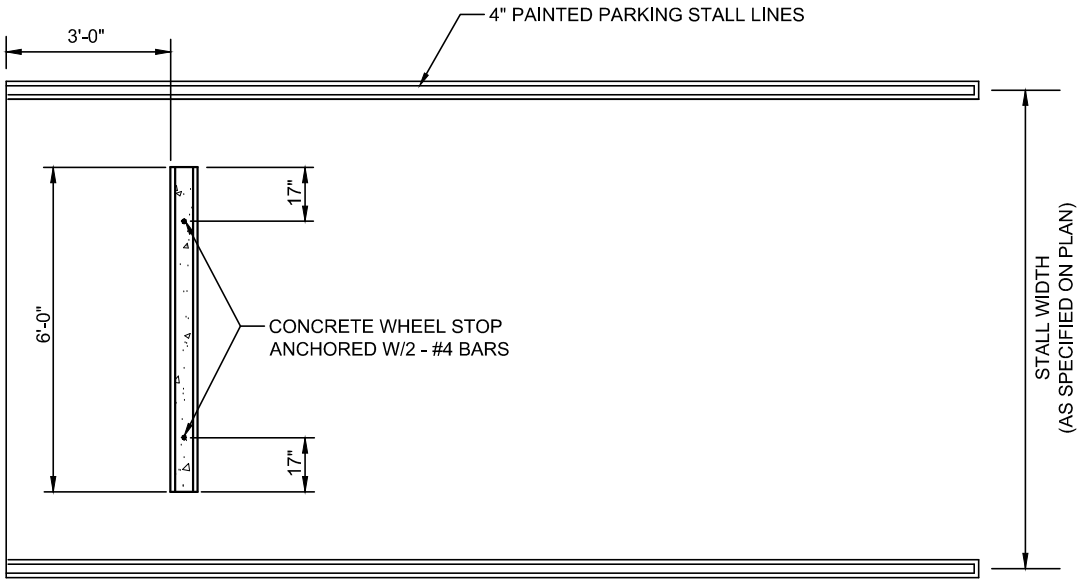
Project Name	Job No.
STANDARD DETAILS	X5887
	Issue Date: MAY 2016

Drawing Description
PAINTED DIRECTIONAL ARROWS

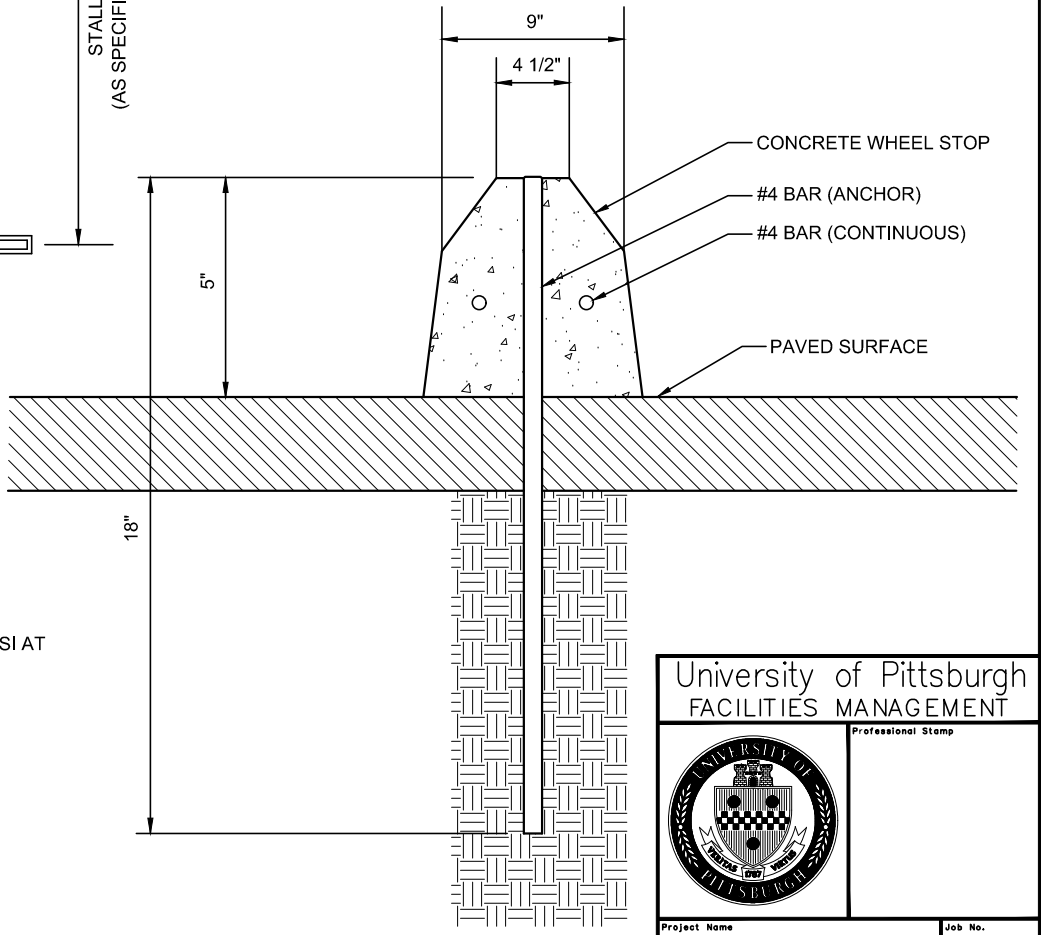
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PLAN VIEW



SECTION

NOTES:

1. REINFORCED PRECAST CONCRETE SHALL HAVE A COMPRESSION STRENGTH OF 5000 PSI AT 28 DAYS.
2. REINFORCING TO BE (2) 4# BARS FULL LENGTH OF EACH PIECE.

21 SH 21	CONCRETE WHEEL STOP

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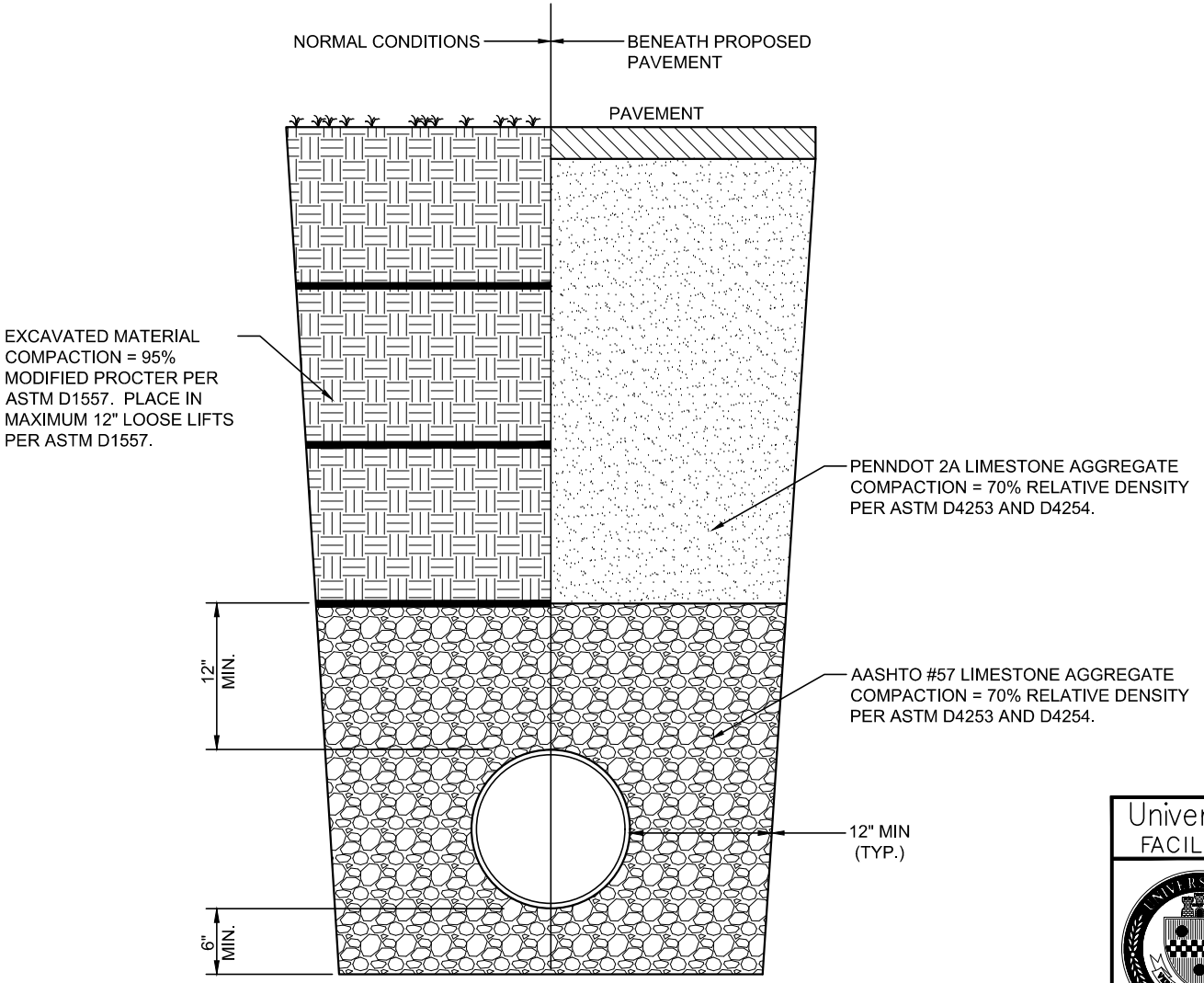
Project Name: STANDARD DETAILS	Job No.: X5887
	Issue Date: MAY 2016

Drawing Description: CONCRETE WHEEL STOP

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22	UNDERGROUND PIPE OR CONDUIT BACKFILL
SH 22	

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Project Name	Job No.
STANDARD DETAILS	X5887
	Issue Date: MAY 2016

Drawing Description
UNDERGROUND PIPE OR CONDUIT BACKFILL
UNIVERSITY OF PITTSBURGH STANDARD DETAILS

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STANDARD SITE CONSTRUCTION EROSION AND SEDIMENTATION CONTROL DETAILS

STANDARD EROSION AND SEDIMENT CONTROL PLAN NOTES

REVISIONS			
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01		-	-
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1. ALL EARTH DISTURBANCES, INCLUDING CLEARING AND GRUBBING AS WELL AS CUTS AND FILLS SHALL BE DONE IN ACCORDANCE WITH THE APPROVED E&S PLAN. A COPY OF THE APPROVED DRAWINGS (STAMPED, SIGNED AND DATED BY THE REVIEWING AGENCY) MUST BE AVAILABLE AT THE PROJECT SITE AT ALL TIMES. THE REVIEWING AGENCY SHALL BE NOTIFIED OF ANY CHANGES TO THE APPROVED PLAN PRIOR TO IMPLEMENTATION OF THOSE CHANGES. THE REVIEWING AGENCY MAY REQUIRE A WRITTEN SUBMITTAL OF THOSE CHANGES FOR REVIEW AND APPROVAL AT ITS DISCRETION.
2. AT LEAST 7 DAYS PRIOR TO STARTING ANY EARTH DISTURBANCE ACTIVITIES, INCLUDING CLEARING AND GRUBBING, THE OWNER AND/OR OPERATOR SHALL INVITE ALL CONTRACTORS, THE LANDOWNER, APPROPRIATE MUNICIPAL OFFICIALS, THE E&S PLAN PREPARER, THE PCSM PLAN PREPARER, THE LICENSED PROFESSIONAL RESPONSIBLE FOR OVERSIGHT OF CRITICAL STAGES OF IMPLEMENTATION OF THE PCSM PLAN, AND A REPRESENTATIVE FROM THE LOCAL CONSERVATION DISTRICT TO AN ON-SITE PRECONSTRUCTION MEETING.
3. AT LEAST 3 DAYS PRIOR TO STARTING ANY EARTH DISTURBANCE ACTIVITIES, OR EXPANDING INTO AN AREA PREVIOUSLY UNMARKED, THE PENNSYLVANIA ONE CALL SYSTEM INC. SHALL BE NOTIFIED AT 1-800-242-1776 FOR THE LOCATION OF EXISTING UNDERGROUND UTILITIES.
4. ALL EARTH DISTURBANCE ACTIVITIES SHALL PROCEED IN ACCORDANCE WITH THE SEQUENCE PROVIDED ON THE PLAN DRAWINGS. DEVIATION FROM THAT SEQUENCE MUST BE APPROVED IN WRITING FROM THE LOCAL CONSERVATION DISTRICT OR BY THE DEPARTMENT PRIOR TO IMPLEMENTATION.
5. AREAS TO BE FILLED ARE TO BE CLEARED, GRUBBED, AND STRIPPED OF TOPSOIL TO REMOVE TREES, VEGETATION, ROOTS AND OTHER OBJECTIONABLE MATERIAL.
6. CLEARING, GRUBBING, AND TOPSOIL STRIPPING SHALL BE LIMITED TO THOSE AREAS DESCRIBED IN EACH STAGE OF THE CONSTRUCTION SEQUENCE. GENERAL SITE CLEARING, GRUBBING AND TOPSOIL STRIPPING MAY NOT COMMENCE IN ANY STAGE OR PHASE OF THE PROJECT UNTIL THE E&S BMPS SPECIFIED BY THE BMP SEQUENCE FOR THAT STAGE OR PHASE HAVE BEEN INSTALLED AND ARE FUNCTIONING AS DESCRIBED IN THIS E&S PLAN.
7. AT NO TIME SHALL CONSTRUCTION VEHICLES BE ALLOWED TO ENTER AREAS OUTSIDE THE LIMIT OF DISTURBANCE BOUNDARIES SHOWN ON THE PLAN MAPS. THESE AREAS MUST BE CLEARLY MARKED AND FENCED OFF BEFORE CLEARING AND GRUBBING OPERATIONS BEGIN.
8. TOPSOIL REQUIRED FOR THE ESTABLISHMENT OF VEGETATION SHALL BE STOCKPILED AT THE LOCATION(S) SHOWN ON THE PLAN MAPS(S) IN THE AMOUNT NECESSARY TO COMPLETE THE FINISH GRADING OF ALL EXPOSED AREAS THAT ARE TO BE STABILIZED BY VEGETATION. EACH STOCKPILE SHALL BE PROTECTED IN THE MANNER SHOWN ON THE PLAN DRAWINGS. STOCKPILE HEIGHTS SHALL NOT EXCEED 35 FEET. STOCKPILE SLOPES SHALL BE 2H:1V OR FLATTER.
9. IMMEDIATELY UPON DISCOVERING UNFORESEEN CIRCUMSTANCES POSING THE POTENTIAL FOR ACCELERATED EROSION AND/OR SEDIMENT POLLUTION, THE OPERATOR SHALL IMPLEMENT APPROPRIATE BEST MANAGEMENT PRACTICES TO MINIMIZE THE POTENTIAL FOR EROSION AND SEDIMENT POLLUTION AND NOTIFY THE LOCAL CONSERVATION DISTRICT AND/OR THE REGIONAL OFFICE OF THE DEPARTMENT.
10. ALL BUILDING MATERIALS AND WASTES SHALL BE REMOVED FROM THE SITE AND RECYCLED OR DISPOSED OF IN ACCORDANCE WITH THE DEPARTMENT'S SOLID WASTE MANAGEMENT REGULATIONS AT 25 PA. CODE 260.1 ET SEQ., 271.1, AND 287.1 ET. SEQ. NO BUILDING MATERIALS OR WASTES OR UNUSED BUILDING MATERIALS SHALL BE BURNED, BURIED, DUMPED, OR DISCHARGED AT THE SITE.
11. ALL OFF-SITE WASTE AND BORROW AREAS MUST HAVE AN E&S PLAN APPROVED BY THE LOCAL CONSERVATION DISTRICT OR THE DEPARTMENT FULLY IMPLEMENTED PRIOR TO BEING ACTIVATED.
12. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT ANY MATERIAL BROUGHT ON SITE IS CLEAN FILL. FORM FP-001 MUST BE RETAINED BY THE PROPERTY OWNER FOR ANY FILL MATERIAL AFFECTED BY A SPILL OR RELEASE OF A REGULATED SUBSTANCE BUT QUALIFYING AS CLEAN FILL DUE TO ANALYTICAL TESTING.
13. ALL PUMPING OF WATER FROM ANY WORK AREA SHALL BE DONE ACCORDING TO THE PROCEDURE DESCRIBED IN THIS PLAN, OVER UNDISTURBED VEGETATED AREAS.
14. VEHICLES AND EQUIPMENT MAY NEITHER ENTER DIRECTLY NOR EXIT DIRECTLY FROM THE PROJECT SITE ONTO PUBLIC ROADS.
15. UNTIL THE SITE IS STABILIZED, ALL EROSION AND SEDIMENT BMPS SHALL BE MAINTAINED PROPERLY. MAINTENANCE SHALL INCLUDE INSPECTIONS OF ALL EROSION AND SEDIMENT BMPS AFTER EACH RUNOFF EVENT AND ON A WEEKLY BASIS. ALL PREVENTATIVE AND REMEDIAL MAINTENANCE WORK, INCLUDING CLEAN OUT, REPAIR, REPLACEMENT, REGRADING, RESEEDING, REMULCHING AND RENETTING MUST BE PERFORMED IMMEDIATELY. IF THE E&S BMPS FAIL TO PERFORM AS EXPECTED, REPLACEMENT BMPS, OR MODIFICATIONS OF THOSE INSTALLED WILL BE REQUIRED.
16. A LOG SHOWING DATES THAT E&S BMPS WERE INSPECTED AS WELL AS ANY DEFICIENCIES FOUND AND THE DATE THEY WERE CORRECTED SHALL BE PROVIDED UPON REQUEST OF THE REGULATORY AGENCY.
17. SEDIMENT TRACKED ONTO ANY PUBLIC ROADWAY OR SIDEWALK SHALL BE RETURNED TO THE CONSTRUCTION SITE BY THE END OF EACH WORK DAY AND DISPOSED IN THE MANNER DESCRIBED IN THIS PLAN. IN NO CASE SHALL THE SEDIMENT BE WASHED, SHOVELED, OR SWEPT INTO ANY ROADSIDE DITCH, STORM SEWER, OR SURFACE WATER.
18. ALL SEDIMENT REMOVED FROM BMPS SHALL BE DISPOSED OF IN THE MANNER DESCRIBED ON THE PLAN DRAWINGS.
19. AREAS WHICH ARE TO BE TOPSOILED SHALL BE SCARIFIED TO A MINIMUM DEPTH OF 3 TO 5 INCHES – 6 TO 12 INCHES ON COMPACTED SOILS – PRIOR TO PLACEMENT OF TOPSOIL. AREAS TO BE VEGETATED SHALL HAVE A MINIMUM 4 INCHES OF TOPSOIL IN PLACE PRIOR TO SEEDING AND MULCHING. FILL OUTSLOPES SHALL HAVE A MINIMUM OF 2 INCHES OF TOPSOIL.
20. ALL FILLS SHALL BE COMPACTED AS REQUIRED TO REDUCE EROSION, SLIPPAGE, SETTLEMENT, SUBSIDENCE OR OTHER RELATED PROBLEMS. FILL INTENDED TO SUPPORT BUILDINGS, STRUCTURES AND CONDUITS, ETC. SHALL BE COMPACTED IN ACCORDANCE WITH LOCAL REQUIREMENTS OR CODES. REFER TO GEOTECHNICAL REPORT AND CROSS SECTIONS.
21. ALL EARTHEN FILLS SHALL BE PLACED IN COMPACTED LAYERS NOT TO EXCEED 9 INCHES IN THICKNESS.
22. FILL MATERIALS SHALL BE FREE OF FROZEN PARTICLES, BRUSH, ROOTS, SOD, OR OTHER FOREIGN OR OBJECTIONABLE MATERIALS THAT WOULD INTERFERE WITH OR PREVENT CONSTRUCTION OF SATISFACTORY FILLS.
23. FROZEN MATERIALS OR SOFT, MUCKY, OR HIGHLY COMPRESSIBLE MATERIALS SHALL NOT BE INCORPORATED INTO FILLS.
24. FILL SHALL NOT BE PLACED ON SATURATED OR FROZEN SURFACES.
25. SEEPS OR SPRINGS ENCOUNTERED DURING CONSTRUCTION SHALL BE HANDLED IN ACCORDANCE WITH THE STANDARD AND SPECIFICATION FOR SUBSURFACE DRAIN OR OTHER APPROVED METHOD.
26. ALL GRADED AREAS SHALL BE PERMANENTLY STABILIZED IMMEDIATELY UPON REACHING FINISHED GRADE. CUT SLOPES IN COMPETENT BEDROCK AND ROCK FILLS NEED NOT BE VEGETATED. SEEDED AREAS WITHIN 50 FEET OF A SURFACE WATER, OR AS OTHERWISE SHOWN ON THE PLAN DRAWINGS, SHALL BE BLANKETED ACCORDING TO THE STANDARDS OF THIS PLAN.
27. IMMEDIATELY AFTER EARTH DISTURBANCE ACTIVITIES CEASE IN ANY AREA OR SUBAREA OF THE PROJECT, THE OPERATOR SHALL STABILIZE ALL DISTURBED AREAS. DURING NON-GERMINATING MONTHS, MULCH OR PROTECTIVE BLANKETING SHALL BE APPLIED AS DESCRIBED IN THE PLAN. AREAS NOT AT FINISHED GRADE, WHICH WILL BE REACTIVATED WITHIN 1 YEAR, MAY BE STABILIZED IN ACCORDANCE WITH THE TEMPORARY STABILIZATION SPECIFICATIONS. THOSE AREAS WHICH WILL NOT BE REACTIVATED WITHIN 1 YEAR SHALL BE STABILIZED IN ACCORDANCE WITH THE PERMANENT STABILIZATION SPECIFICATIONS.
28. PERMANENT STABILIZATION IS DEFINED AS A MINIMUM UNIFORM, PERENNIAL 70% VEGETATIVE COVER OR OTHER PERMANENT NON-VEGETATIVE COVER WITH A DENSITY SUFFICIENT TO RESIST ACCELERATED EROSION. CUT AND FILL SLOPES SHALL BE CAPABLE OF RESISTING FAILURE DUE TO SLUMPING, SLIDING, OR OTHER MOVEMENTS.
29. E&S BMPS SHALL REMAIN FUNCTIONAL AS SUCH UNTIL ALL AREAS TRIBUTARY TO THEM ARE PERMANENTLY STABILIZED OR UNTIL THEY ARE REPLACED BY ANOTHER BMP APPROVED BY THE LOCAL CONSERVATION DISTRICT OR THE DEPARTMENT.
30. UPON COMPLETION OF ALL EARTH DISTURBANCE ACTIVITIES AND PERMANENT STABILIZATION OF ALL DISTURBED AREAS, THE OWNER AND/OR OPERATOR SHALL CONTACT THE INSPECTING AUTHORITY FOR AN INSPECTION PRIOR TO REMOVAL/CONVERSION OF THE E&S BMPS.
31. AFTER FINAL SITE STABILIZATION HAS BEEN ACHIEVED, TEMPORARY EROSION AND SEDIMENT BMPS MUST BE REMOVED OR CONVERTED TO PERMANENT POST CONSTRUCTION STORMWATER MANAGEMENT BMPS. AREAS DISTURBED DURING REMOVAL OR CONVERSION OF THE BMPS SHALL BE STABILIZED IMMEDIATELY. IN ORDER TO ENSURE RAPID REVEGETATION OF DISTURBED AREAS, SUCH REMOVAL/CONVERSIONS ARE TO BE DONE ONLY DURING THE GERMINATING SEASON.
32. UPON COMPLETION OF ALL EARTH DISTURBANCE ACTIVITIES AND PERMANENT STABILIZATION OF ALL DISTURBED AREAS, THE OWNER AND/OR OPERATOR SHALL CONTACT THE INSPECTING AUTHORITY T TO SCHEDULE A FINAL INSPECTION.
33. FAILURE TO CORRECTLY INSTALL E&S BMPS, FAILURE TO PREVENT SEDIMENT-LADEN RUNOFF FROM LEAVING THE CONSTRUCTION SITE, OR FAILURE TO TAKE IMMEDIATE CORRECTIVE ACTION TO RESOLVE FAILURE OF E&S BMPS MAY RESULT IN ADMINISTRATIVE, CIVIL, AND/OR CRIMINAL PENALTIES BEING INSTITUTED BY THE DEPARTMENT AS DEFINED IN SECTION 602 OF THE PENNSYLVANIA CLEAN STREAMS LAW. THE CLEAN STREAMS LAW PROVIDES FOR UP TO $10,000 PER DAY IN CIVIL PENALTIES, UP TO $10,000 IN SUMMARY CRIMINAL PENALTIES, AND UP TO $25,000 IN MISDEMEANOR CRIMINAL PENALTIES FOR EACH VIOLATION.
34. CONCRETE WASH WATER SHALL BE HANDLED IN THE MANNER DESCRIBED ON THE PLAN DRAWINGS. IN NO CASE SHALL IT BE ALLOWED TO ENTER ANY SURFACE WATERS OR GROUNDWATER SYSTEMS.
35. UNDERGROUND UTILITIES CUTTING THROUGH ANY ACTIVE CHANNEL SHALL BE IMMEDIATELY BACKFILLED AND THE CHANNEL RESTORED TO ITS ORIGINAL CROSS-SECTION AND PROTECTIVE LINING. ANY BASE FLOW WITHIN THE CHANNEL SHALL BE CONVEYED PAST THE WORK AREA IN THE MANNER DESCRIBED IN THIS PLAN UNTIL SUCH RESTORATION IS COMPLETE.
36. SEDIMENT BASINS AND/OR TRAPS SHALL BE KEPT FREE OF ALL CONSTRUCTION WASTE, WASH WATER, AND OTHER DEBRIS HAVING POTENTIAL TO CLOG THE BASIN/TRAP OUTLET STRUCTURES AND/OR POLLUTE THE SURFACE WATERS.
37. SEDIMENT BASINS SHALL BE PROTECTED FROM UNAUTHORIZED ACTS BY THIRD PARTIES.
38. ANY DAMAGE THAT OCCURS IN WHOLE OR IN PART AS A RESULT OF BASIN OR TRAP DISCHARGE SHALL BE IMMEDIATELY REPAIRED BY THE PERMITTEE IN A PERMANENT MANNER SATISFACTORY TO THE MUNICIPALITY, LOCAL CONSERVATION DISTRICT, AND THE OWNER OF THE DAMAGED PROPERTY.
39. UPON REQUEST, THE APPLICANT OR HIS CONTRACTOR SHALL PROVIDE AN AS-BUILT (RECORD DRAWING) FOR ANY SEDIMENT BASIN OR TRAP TO THE INSPECTING AUTHORITY OR THE DEPARTMENT.
40. EROSION CONTROL BLANKETING SHALL BE INSTALLED ON ALL SLOPES 3H:1V OR STEEPER WITHIN 50 FEET OF A SURFACE WATER AND ON ALL OTHER DISTURBED AREAS SPECIFIED ON THE PLAN MAPS AND/OR DETAIL SHEETS.
41. FILL MATERIAL FOR EMBANKMENTS SHALL BE FREE OF ROOTS, OR OTHER WOODY VEGETATION, ORGANIC MATERIAL, LARGE STONES, AND OTHER OBJECTIONABLE MATERIALS. THE EMBANKMENT SHALL BE COMPACTED IN MAXIMUM 10" LAYERED LIFTS AT 90% DENSITY.

23	STANDARD EROSION AND SEDIMENT CONTROL PLAN NOTES
SH 23	

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Project Name
STANDARD DETAILS

Job No.
X5887

Issue Date
MAY 2016

Drawing Description
STANDARD EROSION AND SEDIMENT CONTROL NOTES

UNIVERSITY OF PITTSBURGH STANDARD DETAILS

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10690

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MAINTENANCE SCHEDULE

CONTROL MEASURE	INSPECT	PROBLEMS TO LOOK FOR	POSSIBLE REMEDIES
VEGETATION	WEEKLY AND AFTER EVERY RUNOFF EVENT	SEDIMENT AT TOE OF SLOPE RILLS AND GULLIES FORMING BARE SOIL PATCHES	CHECK FOR TOP-OF-SLOPE DIVERSION AND INSTALL IF NEEDED. FILL RILLS AND REGRADE GULLIED SLOPES. RESEED, FERTILIZE, AND MULCH BARE AREAS.
DIVERSION OR INTERCEPTOR CHANNELS & BENCHES	WEEKLY AND AFTER EVERY RUNOFF EVENT	GULLY ON SLOPE BELOW CHANNEL WHEEL TRACK; LOW POINT (WATER PONDED IN CHANNEL) SEDIMENT OR DEBRIS IN CHANNEL EROSION OF UNLINED CHANNEL SURFACE EROSION OF VEGETATED CHANNEL LINING LOSS OF PROTECTIVE LINING RUNOFF ESCAPING THROUGH EMBANKMENT SIDES	REPAIR BREACHES. BUILD UP LOW POINTS WITH COMPACTED SOIL OR SANDBAGS OR REBUILD CHANNEL WITH POSITIVE DRAINAGE. REMOVE OBSTRUCTION. SEED AND MULCH CHANNEL AND ANCHOR WITH NETTING; OR LINE CHANNEL WITH CRUSHED ROCK; OR INSTALL CHECK DAMS; OR REALIGN CHANNEL ON GENTLER GRADIENT; OR DIVERT SOME OR ALL OF CHANNEL DRAINAGE TO A MORE STABLE FACILITY. RESEED, MULCH, AND ANCHOR WITH NETTING; OR INSTALL CHECK DAMS. RESHAPE CHANNEL TO DESIGN SPECIFICATIONS AS PER DETAILS AND REPLACE PROTECTIVE LINER WITH MORE DURABLE MATERIAL (I.E. LARGER RIP-RAP) REBUILD/RAISE EMBANKMENT
INTERCEPTOR CHANNELS IN ACCESS ROAD	EVERY DAY AT THE END OF THE DAY	CHANNEL CONFIGURATION DOES NOT MEET DESIGN CONFIGURATION	REGRADE CHANNEL TO DESIGN CONFIGURATION REGRADE FOR POSITIVE SLOPE
ROCK CONSTRUCTION ENTRANCES	WEEKLY AND AFTER EVERY RUNOFF EVENT	SINK HOLES OR RUTS SEDIMENT ON PUBLIC ROADWAY	ADD ROCK TO BRING TO SPECIFIED DIMENSIONS. SWEEP MATERIAL BACK TO PROJECT SITE. DO NOT WASH ROADWAY WITH WATER.

THE PERMITTEE SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF ALL TEMPORARY CONTROL MEASURES DURING CONSTRUCTION. ALL DEVICES SHOULD BE INSPECTED WEEKLY AND AFTER EVERY RUNOFF EVENT. IF DURING THESE INSPECTIONS, ANY DEVICE IS FOUND TO BE CLOGGED, DAMAGED, HALF-FULL OF SILT OR NOT FULLY OPERATIONAL, THE DEVICE(S) SHALL BE CLEANED OF ALL DEBRIS. ALL REPAIRS MUST BE COMPLETED WITHIN 72 HOURS OF DISCOVERY.

UPON COMPLETION OF THE PROJECT, RECYCLING OR DISPOSAL OF ALL TEMPORARY EROSION CONTROL MATERIALS SHALL BE THE RESPONSIBILITY OF THE EARTHMOVING CONTRACTOR. CONSTRUCTION WASTE INCLUDES, BUT IS NOT LIMITED TO, EXCESS SOIL MATERIALS, SILT REMOVED FROM EROSION CONTROL FACILITIES, EXCESS BUILDING MATERIALS, CONCRETE WASH WATER, SANITARY WASTES, AND OBSOLETE EROSION CONTROL MATERIALS (SILT FENCE, SILT SACKS, ETC.).

SILT REMOVED FROM SEDIMENT CONTROL FACILITIES SHALL BE SPREAD ON THE TOPSOIL STOCKPILE, OR IN LAWN OR LANDSCAPE AREAS. OBSOLETE EROSION CONTROL MATERIALS AND EXCESS BUILDING MATERIALS MUST BE DISPOSED OF AT A DEP APPROVED SITE.

24	MAINTENANCE SCHEDULE
SH 24	

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Project Name	Job No.
STANDARD DETAILS	X5887
	Issue Date: MAY 2016

Drawing Description: MAINTENANCE SCHEDULE

UNIVERSITY OF PITTSBURGH STANDARD DETAILS

CAD File Name	Drawn By
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Drawing Number: 10690	Set Order: 24 of 44

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MAINTENANCE SCHEDULE

CONTROL MEASURE	INSPECT	PROBLEMS TO LOOK FOR	POSSIBLE REMEDIES
FILTER FABRIC FENCE	WEEKLY AND AFTER EVERY RUNOFF EVENT	UNDERCUTTING OF FENCE FENCE COLLAPSING TORN FABRIC RUNOFF ESCAPING AROUND BARRIER SEDIMENT LEVEL NEAR TOP OF FENCE	REPLACE FAILED SECTION WITH ROCK FILTER OUTLET CHECK FENCE POST SIZE AND SPACING, GAUGE OF WIRE MESH, AND FABRIC STRENGTH. CHECK DRAINAGE AREA, SLOPE LENGTH, AND GRADIENT BEHIND BARRIER. CORRECT ANY SUBSTANDARD CONDITION. REPLACE WITH CONTINUOUS PIECE OF FABRIC FROM POST TO POST. SECURELY ANCHOR WITH PROPER STAPLES. EXTEND FENCE. REMOVE SEDIMENT WHEN LEVEL REACHES HALF OF FENCE HEIGHT.
INLET PROTECTION	WEEKLY AND AFTER EVERY RUNOFF EVENT	SEDIMENT ACCUMULATION SEDIMENT ACCUMULATED IN INLET FILTER BAG TO 1/2 FULL RUNOFF ESCAPING AROUND BARRIER FILTER BAG TORN OR DAMAGED	REMOVE SEDIMENT AND DISPOSE ON SITE. CLEAN AND/OR REPLACE BAG REBUILD BARRIER REPLACE BAG
SEDIMENT BASINS AND TRAPS	WEEKLY AND AFTER EVERY RUNOFF EVENT	SEDIMENT ACCUMULATION ABOVE DESIGNATED CLEANOUT LEVEL	REMOVE SEDIMENT AND DISPOSE ON SITE.
RIP-RAP APRONS	WEEKLY AND AFTER EVERY RUNOFF EVENT	APRON WASHED AWAY	RESHAPE AS NECESSARY AND REPLACE RIPRAP WITH LARGER SIZE RIPRAP.
JUTE MAT	WEEKLY AND AFTER EVERY RUNOFF EVENT	LOSS OF PROTECTIVE LINING TORN/PUNCHED FABRIC	RESHAPE AS NECESSARY AND REPLACE FABRIC OVERLAP WITH CONTINUOUS PIECE OF MATTING. SECURELY ANCHOR WITH PROPER STAPLES.
ROCK FILTER	WEEKLY AND AFTER EVERY RUNOFF EVENT	CLOGGED FILTER STONE SEDIMENT ACCUMULATION	REPLACE REMOVE SEDIMENT WHEN LEVEL REACHES HALF OF FILTER HEIGHT.

THE PERMITTEE SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF ALL TEMPORARY CONTROL MEASURES DURING CONSTRUCTION. ALL DEVICES SHOULD BE INSPECTED WEEKLY AND AFTER EVERY RUNOFF EVENT. IF DURING THESE INSPECTIONS, ANY DEVICE IS FOUND TO BE CLOGGED, DAMAGED, HALF-FULL OF SILT OR NOT FULLY OPERATIONAL, THE DEVICE(S) SHALL BE CLEANED OF ALL DEBRIS. ALL REPAIRS MUST BE COMPLETED WITHIN 72 HOURS OF DISCOVERY.

UPON COMPLETION OF THE PROJECT, RECYCLING OR DISPOSAL OF ALL TEMPORARY EROSION CONTROL MATERIALS SHALL BE THE RESPONSIBILITY OF THE EARTHMOVING CONTRACTOR. CONSTRUCTION WASTE INCLUDES, BUT IS NOT LIMITED TO, EXCESS SOIL MATERIALS, SILT REMOVED FROM EROSION CONTROL FACILITIES, EXCESS BUILDING MATERIALS, CONCRETE WASH WATER, SANITARY WASTES, AND OBSOLETE EROSION CONTROL MATERIALS (SILT FENCE, SILT SACKS, ETC.).

SILT REMOVED FROM SEDIMENT CONTROL FACILITIES SHALL BE SPREAD ON THE TOPSOIL STOCKPILE, OR IN LAWN OR LANDSCAPE AREAS. OBSOLETE EROSION CONTROL MATERIALS AND EXCESS BUILDING MATERIALS MUST BE DISPOSED OF AT A DEP APPROVED SITE.

25	MAINTENANCE SCHEDULE (CONT.)
SH 25	

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Project Name	Job No.
STANDARD DETAILS	X5887
	Issue Date: MAY 2016

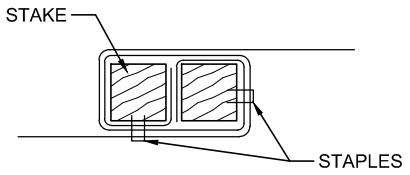
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MAINTENANCE SCHEDULE (CONTINUED)
UNIVERSITY OF PITTSBURGH STANDARD DETAILS

CAD File Name	Drawn By
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Drawing Number: 10690	**Set Order**: 25 of 44

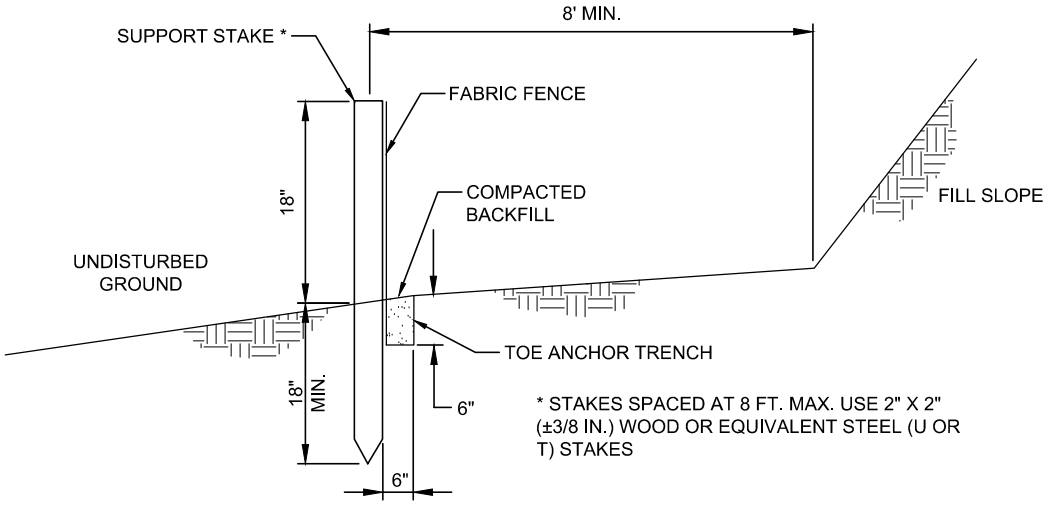
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No.	By	Date	Description
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FABRIC PROPERTY	MINIMUM ACCEPTABLE VALUE	TEST METHOD
GRAB TENSILE STRENGTH (LB)	120	ASTM D1682
ELONGATION AT FAILURE (%)	20% MAX	ASTM D1682
MULLEN BURST STRENGTH (PSI)	200	ASTM D3786
TRAPEZOIDAL TEAR STRENGTH (LB)	50	
PUNCTURE STRENGTH (LB)	40	ASTM D751 (MODIFIED)
SLURRY FLOW RATE (GAL/MIN/SF)	0.3	ASTM 5141
EQUIVALENT OPENING SIZE	30	US STD. SIEVE CW-02215
ULTRAVIOLET RADIATION STABILITY (%)	80	ASTM G-26

TABLE 4.3 OF THE PA DEP EROSION AND SEDIMENT POLLUTION CONTROL PROGRAM MANUAL, MARCH 2012



JOINING FENCE SECTIONS



SECTION VIEW

NOTES:

FABRIC SHALL HAVE THE MINIMUM PROPERTIES AS SHOWN IN TABLE 4.3 OF THE PA DEP EROSION AND SEDIMENT POLLUTION CONTROL PROGRAM MANUAL, MARCH 2012.

FABRIC WIDTH SHALL BE 30 IN. MINIMUM. STAKES SHALL BE HARDWOOD OR EQUIVALENT STEEL (U OR T) STAKES.

SILT FENCE SHALL BE PLACED AT LEVEL EXISTING GRADE. BOTH ENDS OF THE FENCE SHALL BE EXTENDED AT LEAST 8 FEET UP SLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT.

SEDIMENT SHALL BE REMOVED WHEN ACCUMULATIONS REACH HALF THE ABOVE GROUND HEIGHT OF THE FENCE.

ANY SECTION OF SILT FENCE WHICH HAS BEEN UNDERMINED OR TOPPED SHALL BE IMMEDIATELY REPLACED WITH A ROCK FILTER OUTLET (STANDARD CONSTRUCTION DETAIL # 4-6 OF THE PA DEP EROSION AND SEDIMENT POLLUTION CONTROL PROGRAM MANUAL, MARCH 2012).

FENCE SHALL BE REMOVED AND PROPERLY DISPOSED OF WHEN TRIBUTARY AREA IS PERMANENTLY STABILIZED.

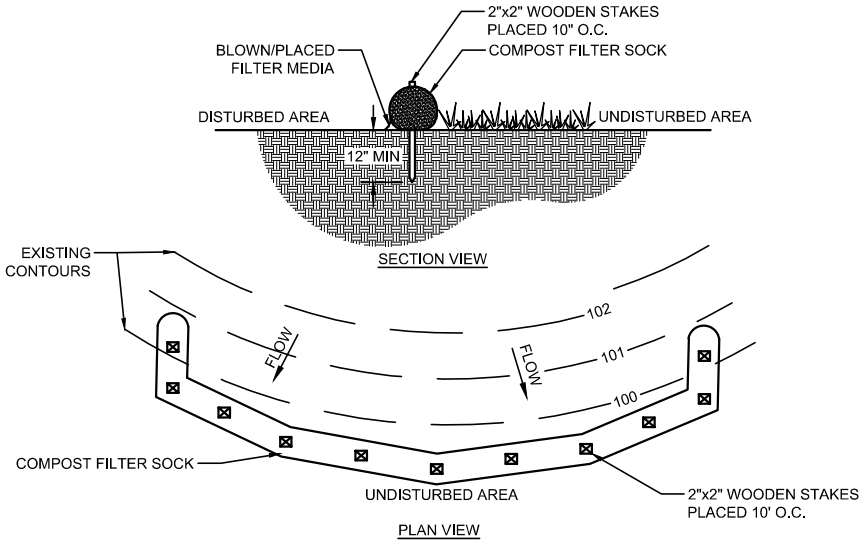
26	STANDARD SILT FENCE (18" HIGH)
SH 26	

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Project Name: STANDARD DETAILS
Job No.: X5887
Issue Date: MAY 2016
Drawing Description: STANDARD SILT FENCE (18 IN HIGH)
UNIVERSITY OF PITTSBURGH STANDARD DETAILS
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NOTES:

1.COMPOST FILTER SOCK SHALL BE PLACED AT EXISTING LEVEL GRADE. BOTH ENDS OF THE SOCK SHALL BE EXTENDED AT LEAST 8' UP SLOPE AT 45° TO THE MAIN SOCK ALIGNMENT. MAXIMUM SLOPE LENGTH ABOVE ANY SOCK SHALL NOT EXCEED THAT SHOWN ON FIGURE 4.2. SEE TABLE BELOW.

2.TRAFFIC SHALL NOT BE PERMITTED TO CROSS FILTER SOCKS.

3.ACCUMULATED SEDIMENT SHALL BE REMOVED WHEN IT REACHES 1/2 THE ABOVE GROUND HEIGHT OF THE SOCK AND DISPOSED IN THE MANNER DESCRIBED ELSEWHERE IN THE PLAN.

4.SOCKS SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT. DAMAGED SOCKS SHALL BE REPAIRED ACCORDING TO MANUFACTURER'S SPECIFICATIONS OR REPLACED WITHIN 24 HOURS OF INSPECTION.

5.BIODEGRADABLE FILTER SOCK SHALL BE REPLACED AFTER 6 MONTHS; PHOTODEGRADABLE SOCKS AFTER 1 YEAR. POLYPROPYLENE SOCKS SHALL BE REPLACED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.

6.UPON STABILIZATION OF THE AREA TRIBUTARY TO THE SOCK, STAKES SHALL BE REMOVED. THE SOCK MAY BE LEFT IN PLACE AND VEGETATED OR REMOVED. IN THE LATTER CASE, THE MESH SHALL BE CUT OPEN AND THE MULCH SPREAD AS A SOIL SUPPLEMENT.

7.SILT SOCK FABRIC MATERIAL SHALL BE MULTI-FILAMENT POLYPROPYLENE (MFPP), MINIMUM FUNCTIONAL LONGEVITY 1 YEAR.

9.SLOPE LENGTH TABLE FROM FIGURE 4.2. PADEP BMP MANUAL:

SILT SOCK DIAMETER	3:1 SLOPE	2:1 SLOPE
12"	40'	25'
18"	70'	35'
24"	90'	50'
32"	110'	65'

TABLE 4.1

COMPOST SOCK FABRIC MINIMUM SPECIFICATIONS

MATERIAL TYPE	3 mil HDPE	5 mil HDPE	5 mil HDPE	MULTI-FILAMENT POLYPROPYLENE (MFPP)	HEAVY DUTY MULTI-FILAMENT POLYPROPYLENE (HDMFPP)
MATERIAL CHARACTERISTICS	PHOTO-DEGRADABLE	PHOTO-DEGRADABLE	BIO-DEGRADABLE	PHOTO-DEGRADABLE	PHOTO-DEGRADABLE
SOCK DIAMETERS	12" 18"	12" 18" 24" 32"	12" 18" 24" 32"	12" 18" 24" 32"	12" 18" 24" 32"
MESH OPENING	3/8"	3/8"	3/8"	3/8"	3/8"
TENSILE STRENGTH		26 PSI	26 PSI	44 PSI	202 PSI
ULTRAVIOLET STABILITY % ORIG. STRENGTH (ASTM G-155)	23% AT 1000 HR.	23% AT 1000 HR.		100 % AT 1000 HR.	100% AT 1000 HR.
MINIMAL FUNCTIONAL LONGEVITY	6 MONTHS	9 MONTHS	6 MONTHS	1 YEAR	2 YEARS
TWO-PLY SYSTEM					
INNER CONTAINMENT NETTING	HDPE BIAXIAL NET				
	CONTINUOUSLY WOUND				
	FUSION-WELDED JUNCTURES				
	3/4" X 3/4" MAX. APERTURE SIZE				
OUTER FILTRATION MESH	COMPOSITE POLYPROPYLENE FABRIC (WOVEN LAYER AND NON-WOVEN FLEECE MECHANICALLY FUSED VIA NEEDLE PUNCH)				
	3/16" MAX. APERTURE SIZE				
SOCK FABRICS COMPOSED OF BURLAP MAY BE USED ON PROJECTS LASTING 6 MONTHS OR LESS.					

TABLE 4.2

COMPOST STANDARDS

ORGANIC MATTER CONTENT	25% - 100% (DRY WEIGHT BASIS)
ORGANIC PORTION	FIBROUS AND ELONGATED
Ph	5.5 - 8.5
MOISTURE CONTENT	30% - 60%
PARTICLE SIZE	30%-50% PASS THRU 3/8" SIEVE
SOLUBLE SALT CONCENTRATION	5.0 dS/m (mmhos/cm) MAXIMUM

27	COMPOST FILTER SOCK
SH 27	

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Project Name: STANDARD DETAILS

Job No.: X5887

Issue Date: MAY 2016

Drawing Description: COMPOST FILTER SOCK

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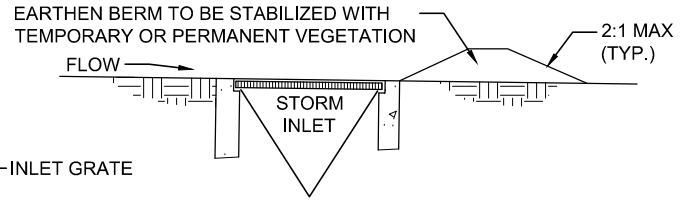
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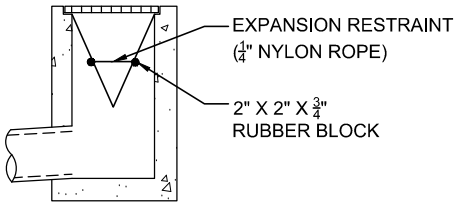
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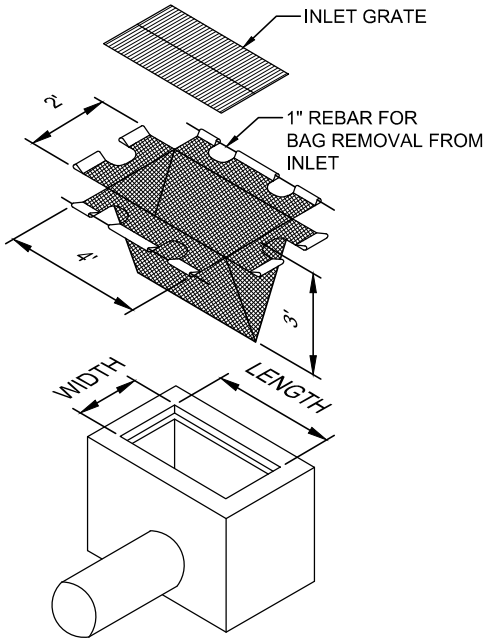
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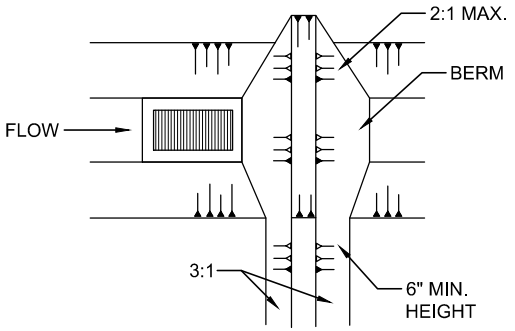
SECTION VIEW



INSTALLATION DETAIL



ISOMETRIC VIEW



PLAN VIEW

NOTES:

MAXIMUM DRAINAGE AREA = 1/2 ACRE.

INLET PROTECTION SHALL NOT BE REQUIRED FOR INLET TRIBUTARY TO SEDIMENT BASIN OR TRAP. BERMS SHALL BE REQUIRED FOR ALL INSTALLATIONS.

ROLLED EARTHEN BERM IN ROADWAY SHALL BE MAINTAINED UNTIL ROADWAY IS STONED. ROAD SUBBASE BERM ON ROADWAY SHALL BE MAINTAINED UNTIL ROADWAY IS PAVED. EARTHEN BERM IN CHANNEL SHALL BE MAINTAINED UNTIL PERMANENT STABILIZATION IS COMPLETED OR REMAIN PERMANENTLY.

AT A MINIMUM, THE FABRIC SHALL HAVE A MINIMUM GRAB TENSILE STRENGTH OF 120 LBS., A MINIMUM BURST STRENGTH OF 200 PSI, AND A MINIMUM TRAPEZOIDAL TEAR STRENGTH OF 50 LBS. FILTER BAGS SHALL BE CAPABLE OF TRAPPING ALL PARTICLES NOT PASSING A NO. 40 SIEVE.

INLET FILTER BAGS SHALL BE INSPECTED ON A WEEKLY BASIS AND AFTER EACH RUNOFF EVENT. BAGS SHALL BE EMPTIED AND RINSED OR REPLACED WHEN HALF FULL OR WHEN FLOW CAPACITY HAS BEEN REDUCED SO AS TO CAUSE FLOODING OR BYPASSING OF THE INLET. DAMAGED OR CLOGGED BAGS SHALL BE REPLACED. A SUPPLY SHALL BE MAINTAINED ON SITE FOR REPLACEMENT OF BAGS. ALL NEEDED REPAIRS SHALL BE INITIATED IMMEDIATELY AFTER THE INSPECTION. DISPOSE ACCUMULATED SEDIMENT AS WELL AS ALL USED BAGS ACCORDING TO THE PLAN NOTES.

DO NOT USE ON MAJOR PAVED ROADWAYS WHERE PONDING MAY CAUSE TRAFFIC HAZARDS.

28	FILTER BAG INLET PROTECTION
SH 28	

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Project Name	Job No.
STANDARD DETAILS	X5887
	Issue Date: MAY 2016

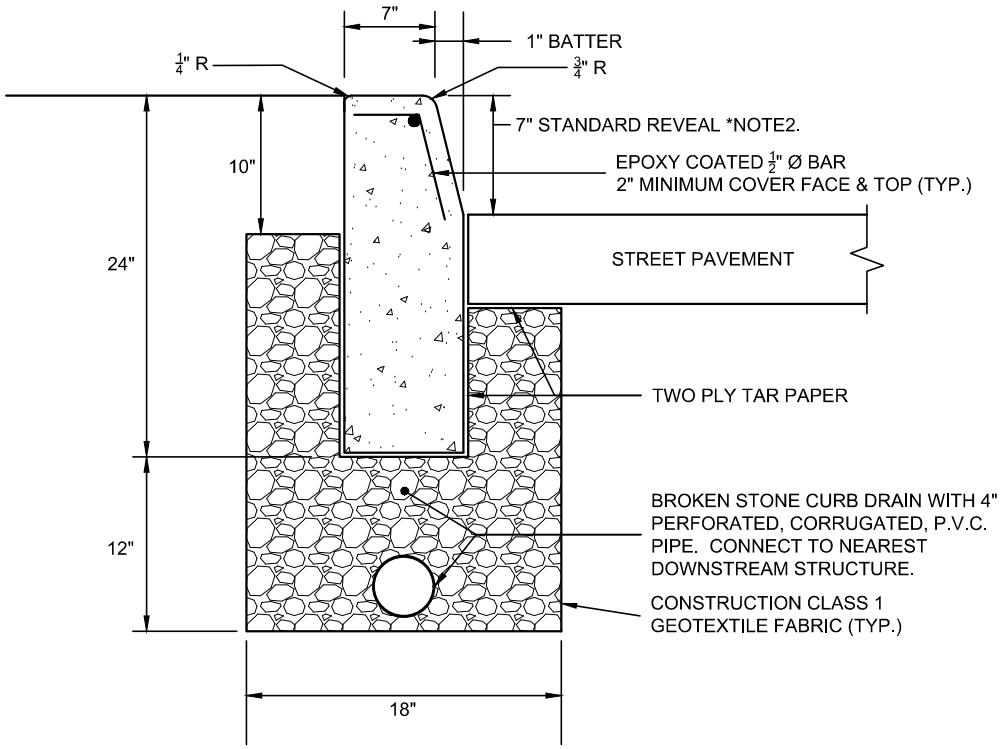
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FILTER BAG INLET PROTECTION

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CITY OF PITTSBURGH
CONSTRUCTION DETAILS

REVISIONS			
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NOTES:

1. CURB CONSTRUCTION JOINTS SHALL COINCIDE WITH TRANSVERSE JOINTS IN THE EXISTING OR NEW STREET PAVEMENT. 10'-0" MAXIMUM LENGTH OF CURB SECTIONS.
2. HEIGHT TO MATCH EXISTING IF NOTED AS SUCH.

CITY OF PITTSBURGH RIGHT-OF-WAY

29	CITY OF PITTSBURGH STANDARD CONCRETE CURB
SH 29	

THIS DETAIL WAS BASED ON CURRENT ACCEPTED CITY OF PITTSBURGH DPW CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT DPW REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

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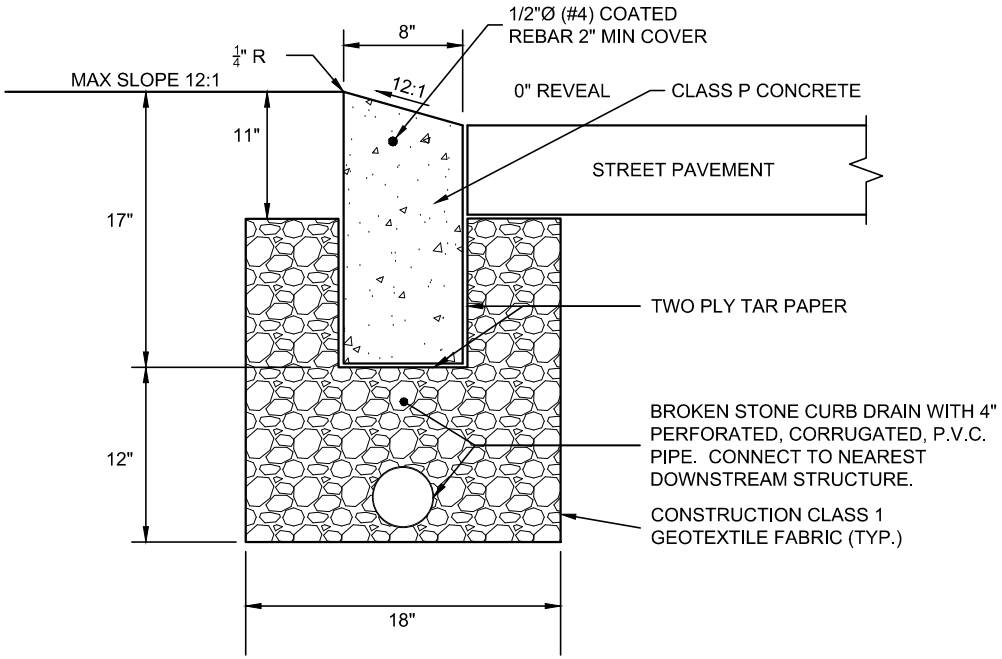
Project Name: STANDARD DETAILS	Job No.: X5887
	Issue Date: MAY 2016

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CITY OF PITTSBURGH
STANDARD CONCRETE CURB

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NOTES:

1. CURB CONSTRUCTION JOINTS SHALL COINCIDE WITH TRANSVERSE JOINTS IN THE EXISTING OR NEW STREET PAVEMENT. 10'-0" MAXIMUM LENGTH OF CURB SECTIONS.

CITY OF PITTSBURGH RIGHT-OF-WAY

30	CITY OF PITTSBURGH STANDARD CURB RAMP
SH 30	

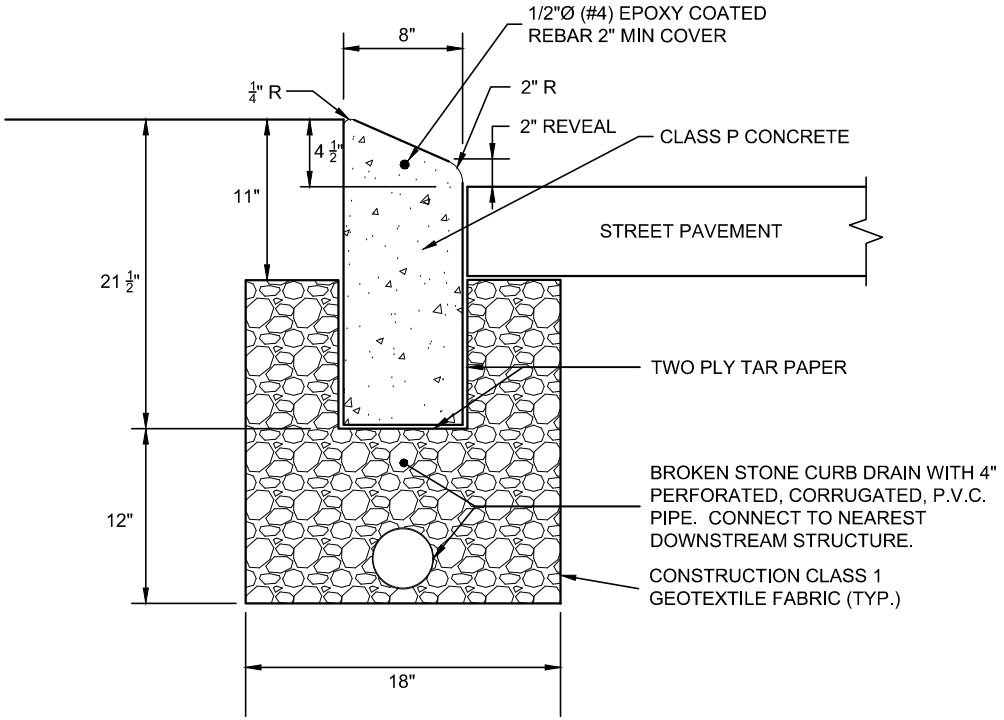
THIS DETAIL WAS BASED ON CURRENT ACCEPTED CITY OF PITTSBURGH DPW CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT DPW REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

University of Pittsburgh
FACILITIES MANAGEMENT

Professional Stamp

Project Name: STANDARD DETAILS
Job No.: X5887
Issue Date: MAY 2016
Drawing Description: CITY OF PITTSBURGH STANDARD CURB RAMP
UNIVERSITY OF PITTSBURGH STANDARD DETAILS
CAD File Name: G:\Projects\12000\12807- Pitt Greensburg\-0070 Pitt Standard Details\Dwg\02-Sheet\Details.dwg
Drawn By: --
Drawing Number: 10690
Set Order: 30 of 44

REVISIONS			
No.	By	Date	Description
01		-	-
02		-	-



NOTES:

1. CURB CONSTRUCTION JOINTS SHALL COINCIDE WITH TRANSVERSE JOINTS IN THE EXISTING OR NEW STREET PAVEMENT. 10'-0" MAXIMUM LENGTH OF CURB SECTIONS.

CITY OF PITTSBURGH RIGHT-OF-WAY

31	CITY OF PITTSBURGH STANDARD DEPRESSED CURB
SH 31	

THIS DETAIL WAS BASED ON CURRENT ACCEPTED CITY OF PITTSBURGH DPW CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT DPW REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

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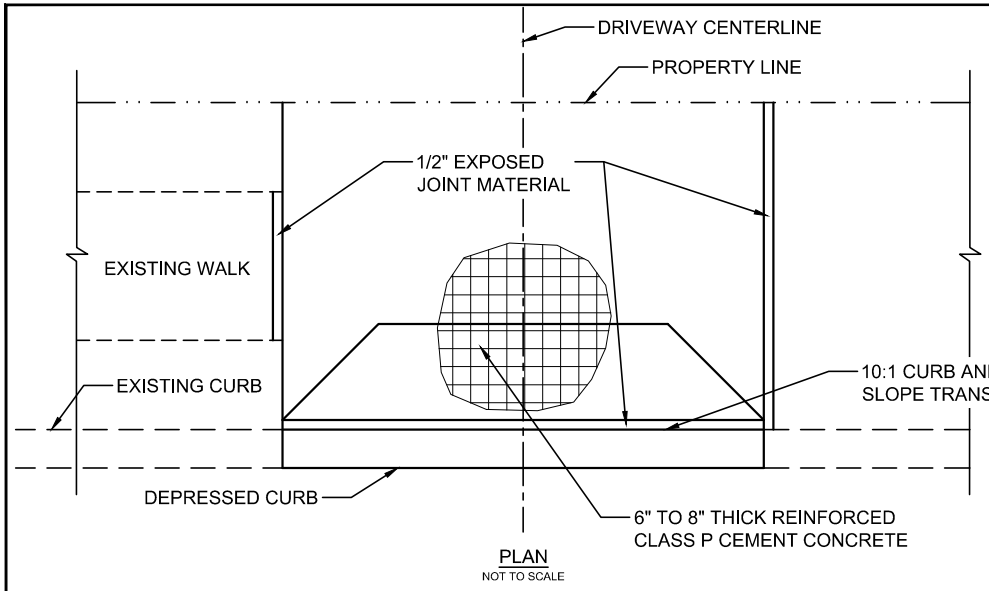
Professional Stamp

Project Name: STANDARD DETAILS	Job No.: X5887
	Issue Date: MAY 2016

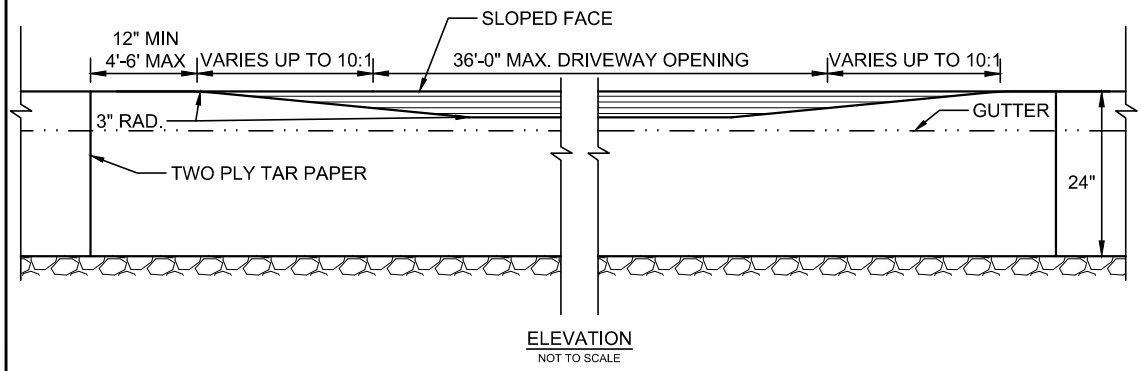
Drawing Description:
CITY OF PITTSBURGH
STANDARD DEPRESSED CURB

UNIVERSITY OF PITTSBURGH STANDARD DETAILS

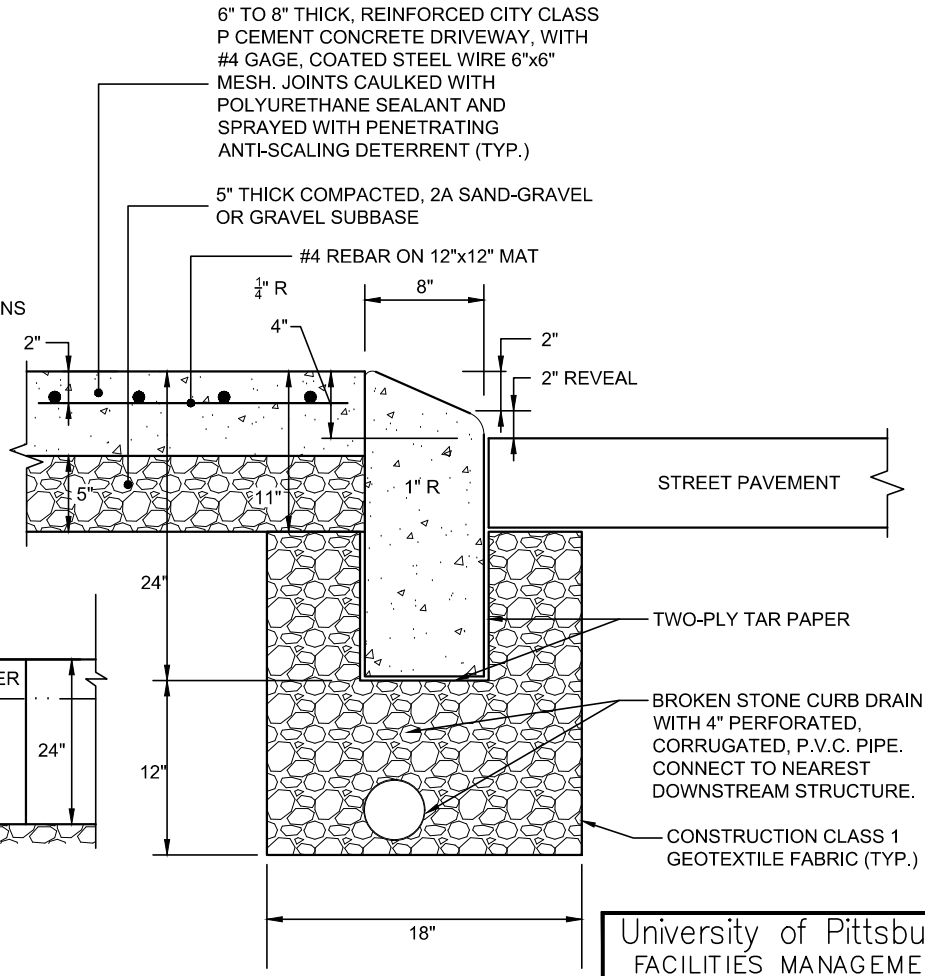
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Drawing Number: 10690	Set Order: 31 of 44



PLAN
NOT TO SCALE



ELEVATION
NOT TO SCALE



CITY OF PITTSBURGH RIGHT-OF-WAY

32	CITY OF PITTSBURGH STANDARD CONCRETE DEPRESSED CURB FOR PRIVATE DRIVEWAY ENTRANCE
SH 32	

THIS DETAIL WAS BASED ON CURRENT ACCEPTED CITY OF PITTSBURGH DPW CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT DPW REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

REVISIONS

No.	By	Date	Description
01		-	-
02		-	-

University of Pittsburgh
FACILITIES MANAGEMENT

Professional Stamp

Project Name: STANDARD DETAILS
Job No.: X5887
Issue Date: MAY 2016
Drawing Description: STANDARD DEPRESSED CURB FOR PRIVEWAY DRIVEWAY ENTRANCE (PGH)
UNIVERSITY OF PITTSBURGH STANDARD DETAILS
CAD File Name: G:\Projects\12000\12807- Pitt Greensburg\-0070 Pitt Standard Details\Dwg\02-Sheet\Details.dwg
Drawn By: --
Drawing Number: 10690
Set Order: 32 of 44

REVISIONS			
No.	By	Date	Description
01		-	-
02		-	-

NOTES:

1. ALL CONCRETE CURB AND DECK CURB WILL BE PLACED SEPARATELY FROM THE SIDEWALK, DRIVEWAY, CURB RAMP, AND STREET PAVEMENTS.

2. ALL EXPOSED CONCRETE WILL BE CITY OF PITTSBURGH, CLASS P OR PP, CEMENT CONCRETE AND WILL BE CURED BY THE SAME METHOD AS CONCRETE PAVEMENT, OR BASE COURSE, AND CURBS WILL BE CONSTRUCTED IN SECTIONS NOT TO EXCEED 10'-0" AND TRANSVERSE PAVEMENT JOINTS WILL BE EXTENDED IN KIND THROUGH CURBS.

3. ITEMS LISTED AS COATED CAN BE EITHER STAINLESS STEEL, FULLY HOT DIPPED GALVANIZED OR EPOXY COATED.

4. STONE DRAINS WILL BE COMPOSED OF AASHTO #57 OR 2A GRAVEL. NO SLAG OF ANY KIND WILL BE PERMITTED.

5. USE ACCEPTABLE METAL FORMS FOR STRAIGHT CURB AND WOODEN FORMS FOR RADIUS CURB LESS THAN 100'-0" RADIUS OR SHORT TANGENT SECTIONS.

6. CONCRETE CURBS MAY BE PLACED WITH A SLIP FORMING, SELF-PROPELLED EXTRUSION MACHINE. UNIFORMLY FEED THE STIFF CONCRETE THROUGH THE MACHINE SO THAT THE CURB'S SHAPE IS MAINTAINED.

7. CONTACT CITY OF PITTSBURGH DEPARTMENT OF PUBLIC WORKS FOR ALL RELATIVE AND CURRENT DETAILS.

CITY OF PITTSBURGH RIGHT-OF-WAY

33	CITY OF PITTSBURGH STANDARD CURB NOTES
SH 33	

THIS DETAIL WAS BASED ON CURRENT ACCEPTED CITY OF PITTSBURGH DPW CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT DPW REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

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FACILITIES MANAGEMENT

Professional Stamp

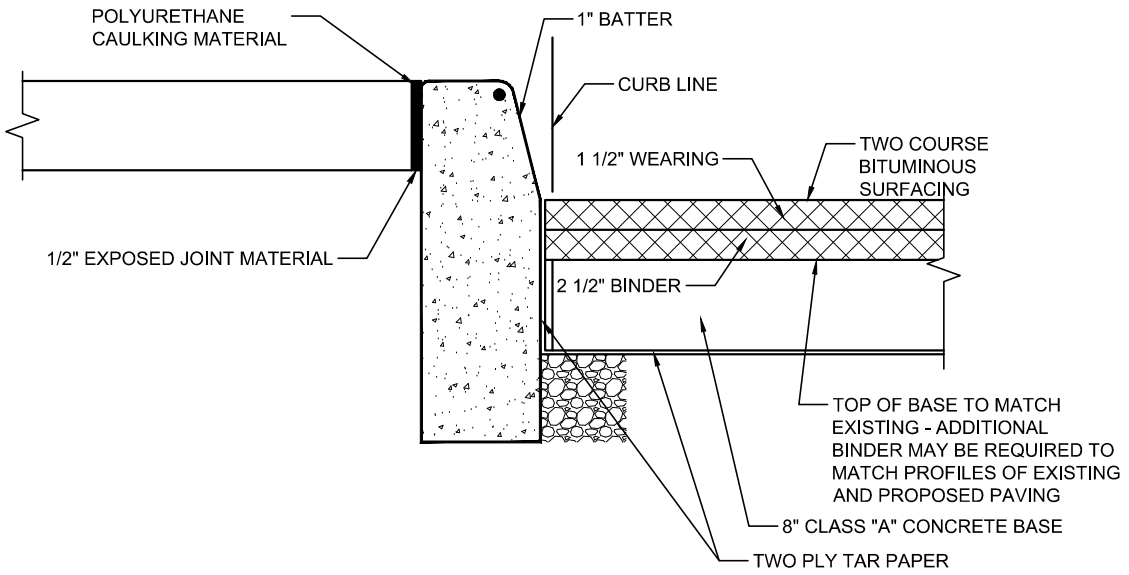
Project Name: STANDARD DETAILS	Job No.: X5887
	Issue Date: MAY 2016

Drawing Description:
CITY OF PITTSBURGH
STANDARD CURB NOTES

UNIVERSITY OF PITTSBURGH STANDARD DETAILS

CAD File Name: G:\Projects\12000\12807- Pitt Greensburg\-0070 Pitt Standard Details\Dwg\02-Sheet\Details.dwg	Drawn By: --
Drawing Number: 10690	Set Order: 33 of 44

REVISIONS			
No.	By	Date	Description
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NOTES:

1. CURB CONSTRUCTION JOINTS SHALL COINCIDE WITH TRANSVERSE JOINTS IN THE EXISTING OR NEW STREET PAVEMENT. 10'-0" MAXIMUM LENGTH OF CURB SECTIONS.
2. MATERIAL TO MEET PENNDOT AND CITY OF PITTSBURGH DPW MINIMUM SPECIFICATIONS.

CITY OF PITTSBURGH RIGHT-OF-WAY

34	CITY OF PITTSBURGH BITUMINOUS PAVEMENT SECTION
SH 34	

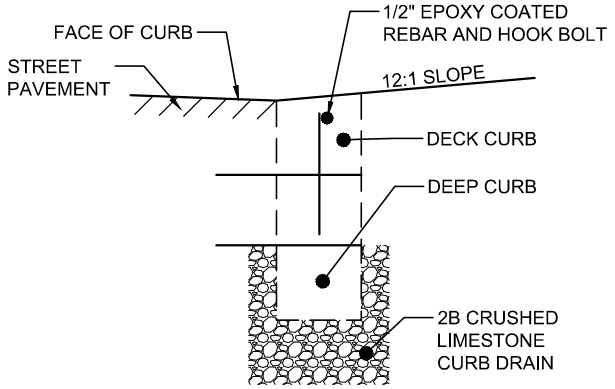
THIS DETAIL WAS BASED ON CURRENT ACCEPTED CITY OF PITTSBURGH DPW CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT DPW REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

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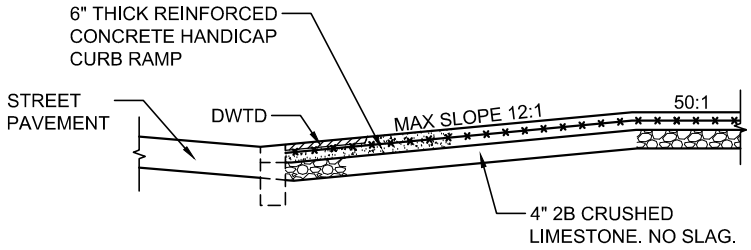
Professional Stamp

Project Name: STANDARD DETAILS
Job No.: X5887
Issue Date: MAY 2016
Drawing Description: CITY OF PITTSBURGH BIT. PAVEMENT STECTION
UNIVERSITY OF PITTSBURGH STANDARD DETAILS
CAD File Name: G:\Projects\12000\12807- Pitt Greensburg\-0070 Pitt Standard Details\Dwg\02-Sheet\Details.dwg
Drawn By: --
Drawing Number: 10690
Set Order: 34 of 44

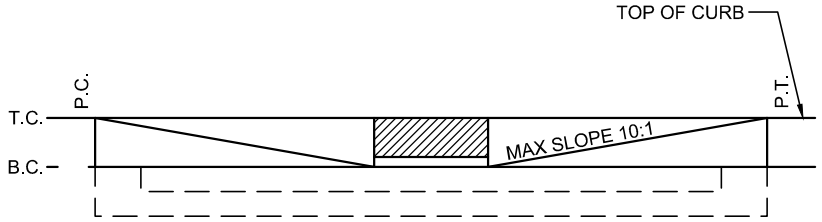
REVISIONS			
No.	By	Date	Description
01		-	-
02		-	-



CURB DETAIL
NOT TO SCALE



SECTION B-B
NOT TO SCALE



SECTION A-A
NOT TO SCALE

CITY OF PITTSBURGH RIGHT-OF-WAY

35	CITY OF PITTSBURGH TRUNCATED DOME HANDICAP CURB TYPE 3 RAMP SECTIONS
SH 35	

THIS DETAIL WAS BASED ON CURRENT ACCEPTED CITY OF PITTSBURGH DPW CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT DPW REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

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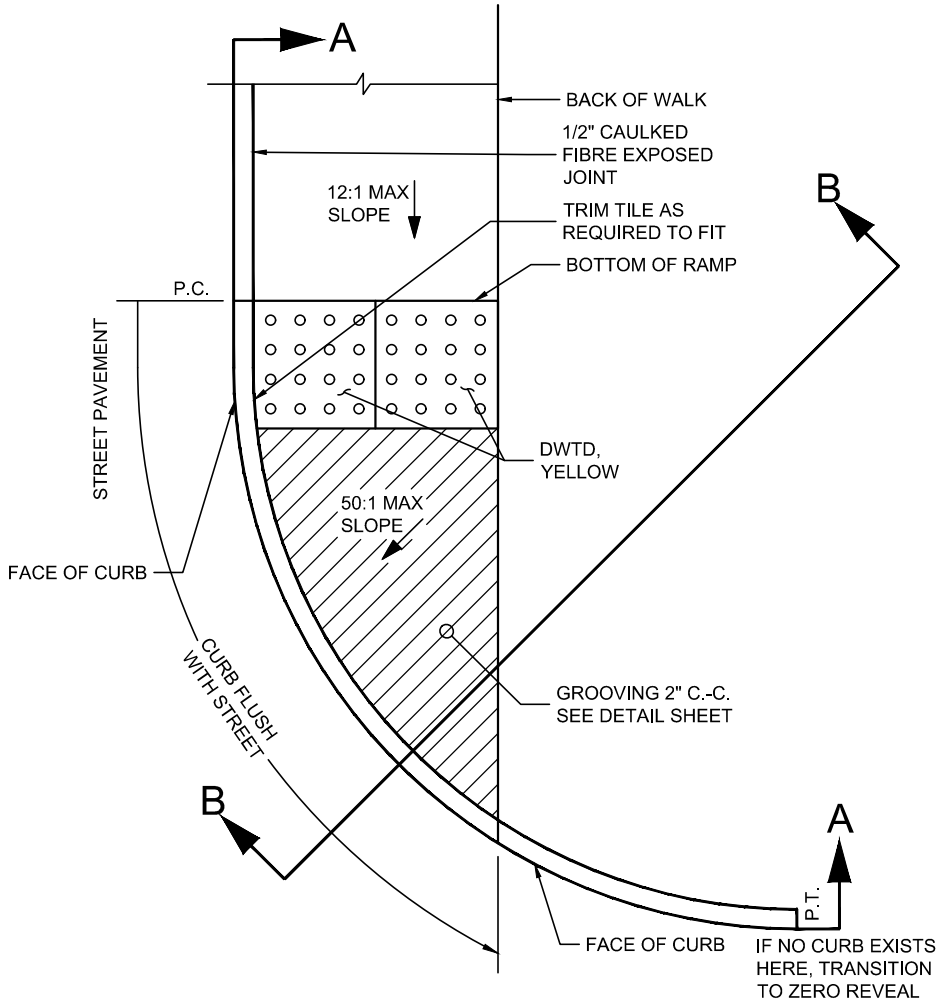
Professional Stamp

Project Name: STANDARD DETAILS	Job No.: X5887
	Issue Date: MAY 2016

Drawing Description:
TRUNCATED DOME HANDICAP CURB TYPE 3 RAMP SECTIONS (CITY OF PGH)
UNIVERSITY OF PITTSBURGH STANDARD DETAILS

CAD File Name: G:\Projects\12000\12807- Pitt Greensburg\-0070 Pitt Standard Details\Dwg\02-Sheet\Details.dwg	Drawn By: --
Drawing Number: 10690	Set Order: 35 of 44

REVISIONS			
No.	By	Date	Description
01		-	-
02		-	-



NOTE:

1. USE 12:1 SLOPE ON SIDE TRANSITIONS IF 4' LANDING CANNOT BE INSTALLED.
2. REFER TO CITY OF PITTSBURGH TRUNCATED DOME HANDICAP CURB RAMP SECTION.

CITY OF PITTSBURGH RIGHT-OF-WAY

36 SH 36	CITY OF PITTSBURGH TRUNCATED DOME HANDICAP CURB RAMP TYPE 1

THIS DETAIL WAS BASED ON CURRENT ACCEPTED CITY OF PITTSBURGH DPW CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT DPW REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

University of Pittsburgh
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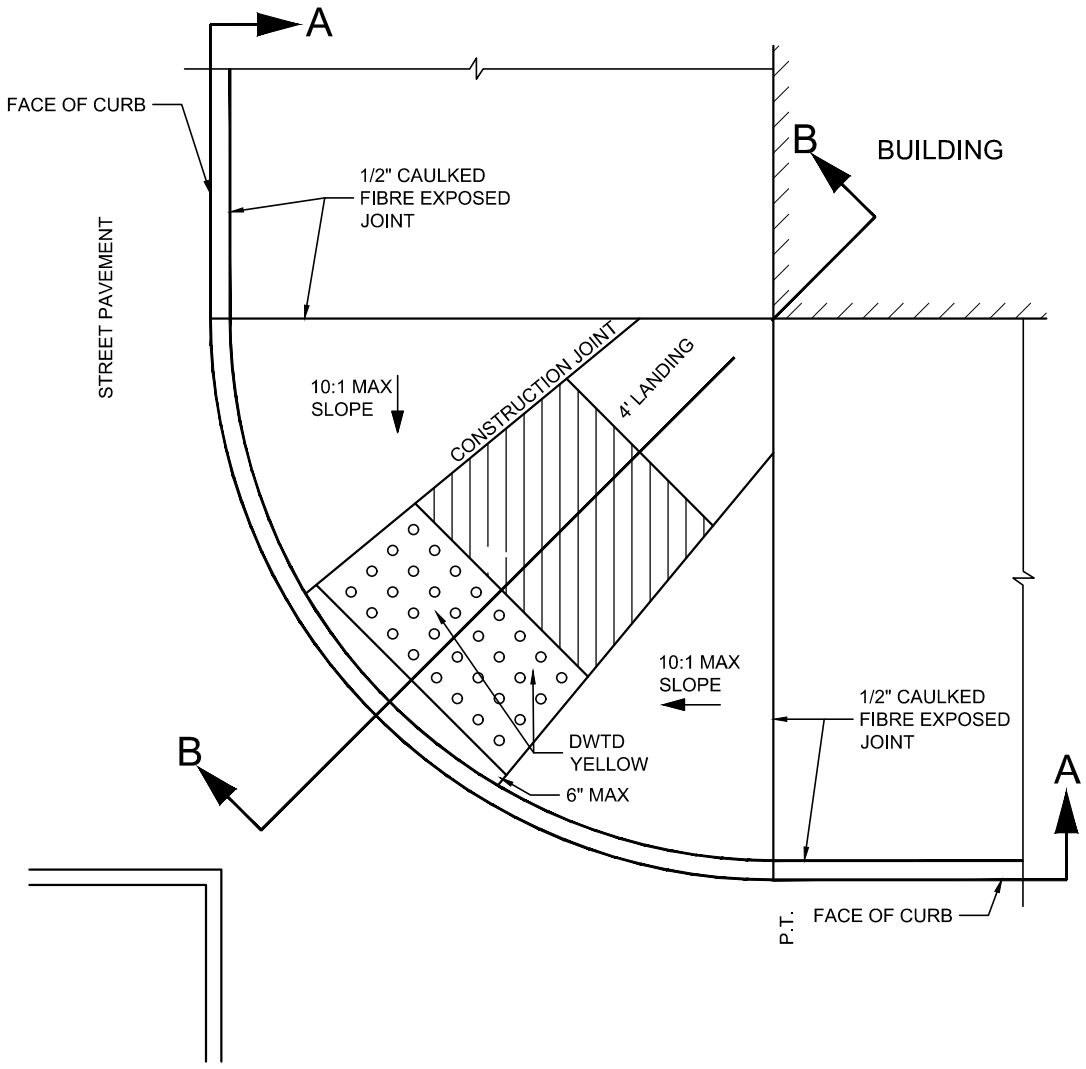
Professional Stamp

Project Name: STANDARD DETAILS	Job No.: X5887
	Issue Date: MAY 2016

Drawing Description: TRUNCATED DOME HANDICAP CURB CURB RAMP TYPE 1 (CITY OF PGH)
UNIVERSITY OF PITTSBURGH STANDARD DETAILS

CAD File Name: G:\Projects\12000\12807- Pitt Greensburg\-0070 Pitt Standard Details\Dwg\02-Sheet\Details.dwg	Drawn By: --
Drawing Number: 10690	Set Order: 36 of 44

REVISIONS			
No.	By	Date	Description
01		-	-
02		-	-



NOTE:

1. USE 12:1 SLOPE ON SIDE TRANSITIONS IF 4' LANDING CANNOT BE INSTALLED.

CITY OF PITTSBURGH RIGHT-OF-WAY

37	CITY OF PITTSBURGH TRUNCATED DOME HANDICAP CURB RAMP TYPE 2
SH 37	

THIS DETAIL WAS BASED ON CURRENT ACCEPTED CITY OF PITTSBURGH DPW CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT DPW REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

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FACILITIES MANAGEMENT

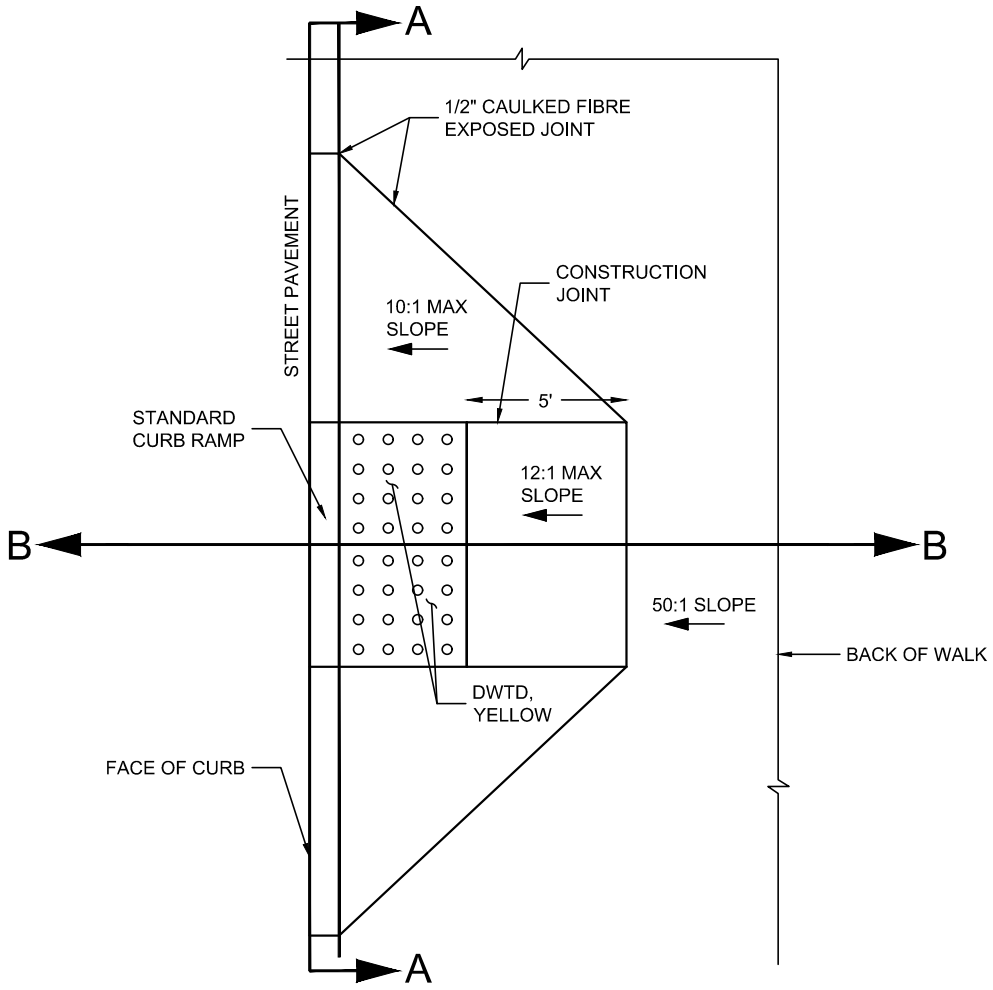
Professional Stamp

Project Name: STANDARD DETAILS	Job No.: X5887
	Issue Date: MAY 2016

Drawing Description:
TRUNCATED DOME
HANDICAP CURB CURB RAMP
TYPE 2 (CITY OF PGH)
UNIVERSITY OF PITTSBURGH STANDARD DETAILS

CAD File Name: G:\Projects\12000\12807- Pitt Greensburg\-0070 Pitt Standard Details\Dwg\02-Sheet\Details.dwg	Drawn By: --
Drawing Number: 10690	Set Order: 37 of 44

REVISIONS			
No.	By	Date	Description
01		-	-
02		-	-



NOTE:

1. USE 12:1 SLOPE ON SIDE TRANSITIONS IF 4' LANDING CANNOT BE INSTALLED.
2. REFER TO CITY OF PITTSBURGH TRUNCATED DOME HANDICAP CURB RAMP SECTION.

CITY OF PITTSBURGH RIGHT-OF-WAY

38	CITY OF PITTSBURGH TRUNCATED DOME HANDICAP CURB RAMP TYPE 3
SH 38	

THIS DETAIL WAS BASED ON CURRENT ACCEPTED CITY OF PITTSBURGH DPW CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT DPW REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

University of Pittsburgh
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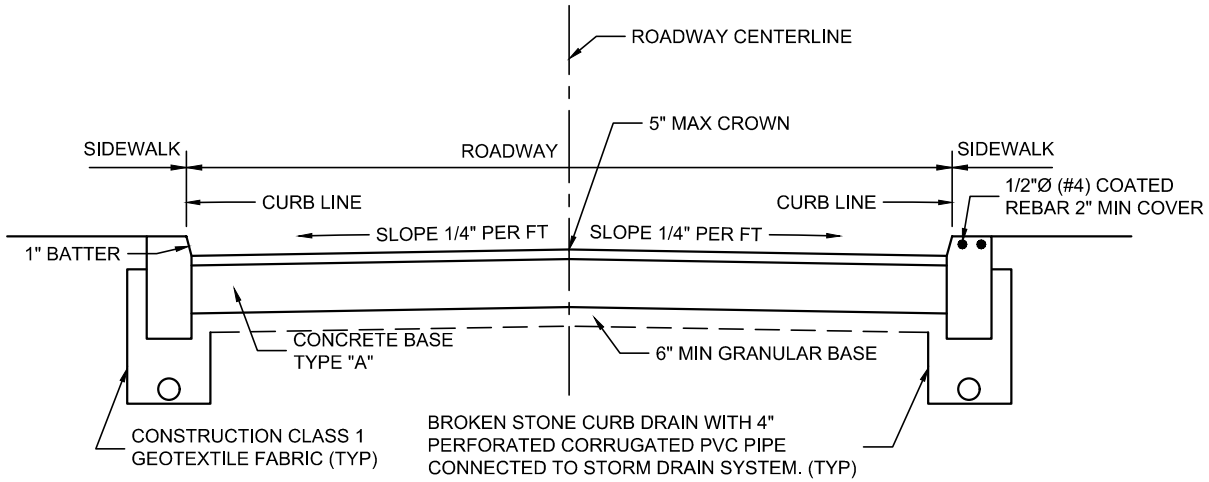
Professional Stamp

Project Name: STANDARD DETAILS	Job No.: X5887
	Issue Date: MAY 2016

Drawing Description:
TRUNCATED DOME HANDICAP CURB CURB RAMP TYPE 3 (CITY OF PGH)
UNIVERSITY OF PITTSBURGH STANDARD DETAILS

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Drawing Number: 10690	Set Order: 38 of 44

REVISIONS			
No.	By	Date	Description
01		-	-
02		-	-



NOTES:

1. CURB CONSTRUCTION JOINTS SHALL COINCIDE WITH TRANSVERSE JOINTS IN THE EXISTING OR NEW STREET PAVEMENT. 10'-0" MAXIMUM LENGTH OF CURB SECTIONS.

CITY OF PITTSBURGH RIGHT-OF-WAY

39	CITY OF PITTSBURGH GENERAL ROADWAY SECTION
SH 39	

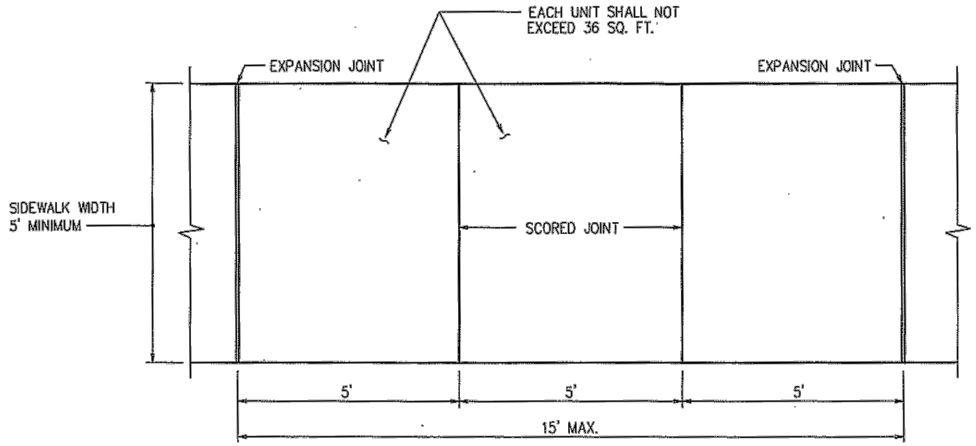
THIS DETAIL WAS BASED ON CURRENT ACCEPTED CITY OF PITTSBURGH DPW CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT DPW REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

University of Pittsburgh
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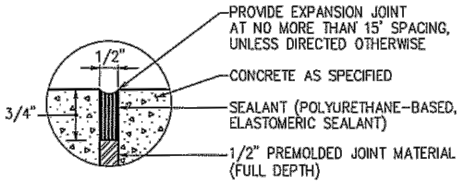
Professional Stamp

Project Name: STANDARD DETAILS
Job No.: X5887
Issue Date: MAY 2016
Drawing Description: CITY OF PITTSBURGH GENERAL ROADWAY SECTION
UNIVERSITY OF PITTSBURGH STANDARD DETAILS
CAD File Name: G:\Projects\12000\12807- Pitt Greensburg\-0070 Pitt Standard Details\Dwg\02-Sheet\Details.dwg
Drawn By: --
Drawing Number: 10690
Set Order: 39 of 44

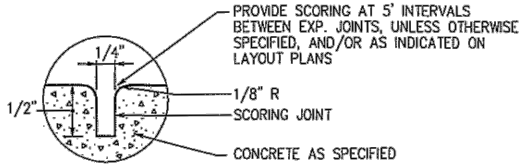
REVISIONS			
No.	By	Date	Description
01		-	-
02		-	-



PLAN VIEW



EXPANSION JOINT DETAIL



SCORING JOINT DETAIL

CITY OF PITTSBURGH RIGHT-OF-WAY

40 SH 40	CITY OF PITTSBURGH EXPANSION AND SCORING JOINT DETAILS

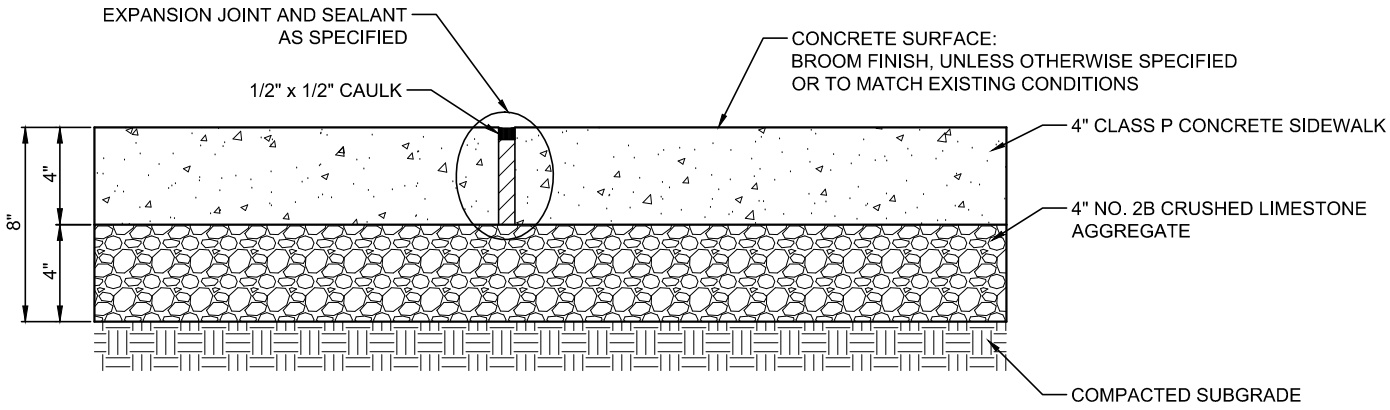
THIS DETAIL WAS BASED ON CURRENT ACCEPTED CITY OF PITTSBURGH DPW CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT DPW REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

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FACILITIES MANAGEMENT

Professional Stamp

Project Name: STANDARD DETAILS
Job No.: X5887
Issue Date: MAY 2016
Drawing Description: CITY OF PITTSBURGH EXP. AND SCORING JOINT
UNIVERSITY OF PITTSBURGH STANDARD DETAILS
CAD File Name: G:\Projects\12000\12807- Pitt Greensburg\-0070 Pitt Standard Details\Dwg\02-Sheet\Details.dwg
Drawn By: --
Drawing Number: 10690
Set Order: 40 of 44

REVISIONS			
No.	By	Date	Description
01		-	-
02		-	-



NOTES:

1. CONTRACTOR SHALL PLACE CONTROL JOINTS AT INTERVALS EQUAL TO THE PAVEMENT WIDTH NOT TO EXCEED 12'.
2. EXPANSION JOINTS SHALL BE INSTALLED AT 50' MAXIMUM INTERVALS.
3. CURING SHALL BE BY ABSORPTIVE COVER; MOISTURE-RETAINING COVER; OR APPROVED CURING COMPOUND. CONTRACTOR SHALL SUBMIT PROPOSED CURING METHOD TO OWNER FOR APPROVAL PRIOR TO CONCRETE INSTALLATION.
4. APPLY WATER BASED 40% SILANE PENETRATING SEALER AFTER A MINIMUM OF 28 DAYS PER MANUFACTURERS RECOMMENDATIONS.
5. PROVIDE MINIMUM CROSS-SLOPE OF 1.5% TO MAXIMUM CROSS SLOPE OF 2%.

CITY OF PITTSBURGH RIGHT-OF-WAY

41	NON-REINFORCED CONCRETE SIDEWALK (4" THICK)
SH 41	

THIS DETAIL WAS BASED ON CURRENT ACCEPTED CITY OF PITTSBURGH DPW CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT DPW REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

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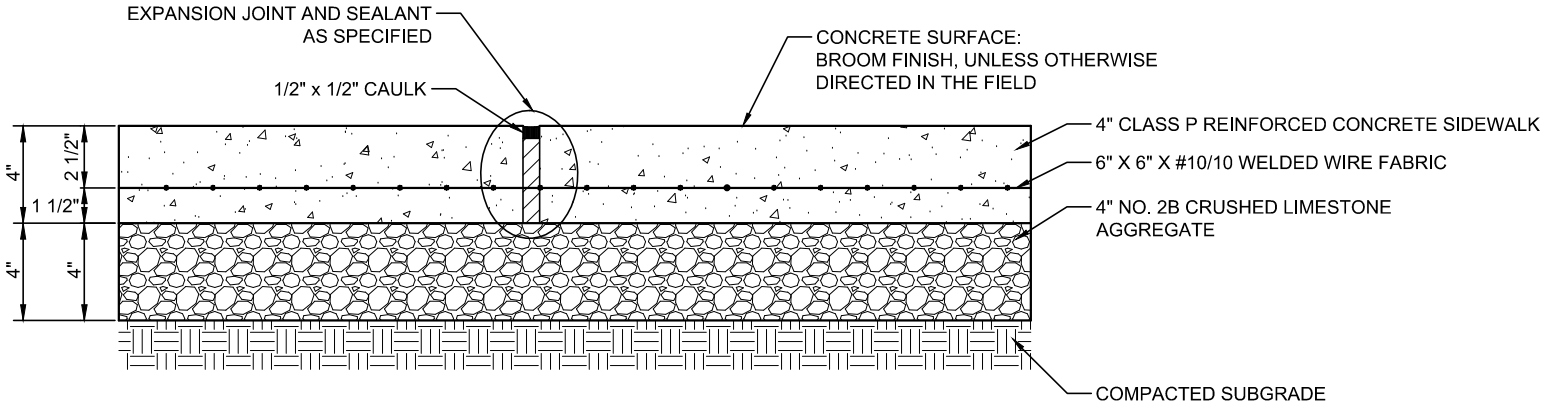
Professional Stamp

Project Name: STANDARD DETAILS	Job No.: X5887
	Issue Date: MAY 2016

Drawing Description:
4 IN. THICK NON-REINFORCED CONCRETE SIDEWALK (CITY OF PGH)
UNIVERSITY OF PITTSBURGH STANDARD DETAILS

CAD File Name: G:\Projects\12000\12807- Pitt Greensburg\-0070 Pitt Standard Details\Dwg\02-Sheet\Details.dwg	Drawn By: --
Drawing Number: 10690	Set Order: 41 of 44

REVISIONS			
No.	By	Date	Description
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02		-	-



NOTES:

1. CONTRACTOR SHALL PLACE CONTROL JOINTS AT INTERVALS EQUAL TO THE PAVEMENT WIDTH NOT TO EXCEED 12'.
2. EXPANSION JOINTS SHALL BE INSTALLED AT 50' MAXIMUM INTERVALS.
3. CURING SHALL BE BY ABSORPTIVE COVER; MOISTURE-RETAINING COVER; OR APPROVED CURING COMPOUND. CONTRACTOR SHALL SUBMIT PROPOSED CURING METHOD TO OWNER FOR APPROVAL PRIOR TO CONCRETE INSTALLATION.
4. APPLY WATER BASED 40% SILANE PENETRATING SEALER AFTER A MINIMUM OF 28 DAYS PER MANUFACTURERS RECOMMENDATIONS.
5. PROVIDE MINIMUM CROSS-SLOPE OF 1.5% TO MAXIMUM CROSS SLOPE OF 2%.

CITY OF PITTSBURGH RIGHT-OF-WAY

42	REINFORCED CONCRETE SIDEWALK (4" THICK)
SH 42	

THIS DETAIL WAS BASED ON CURRENT ACCEPTED CITY OF PITTSBURGH DPW CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT DPW REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

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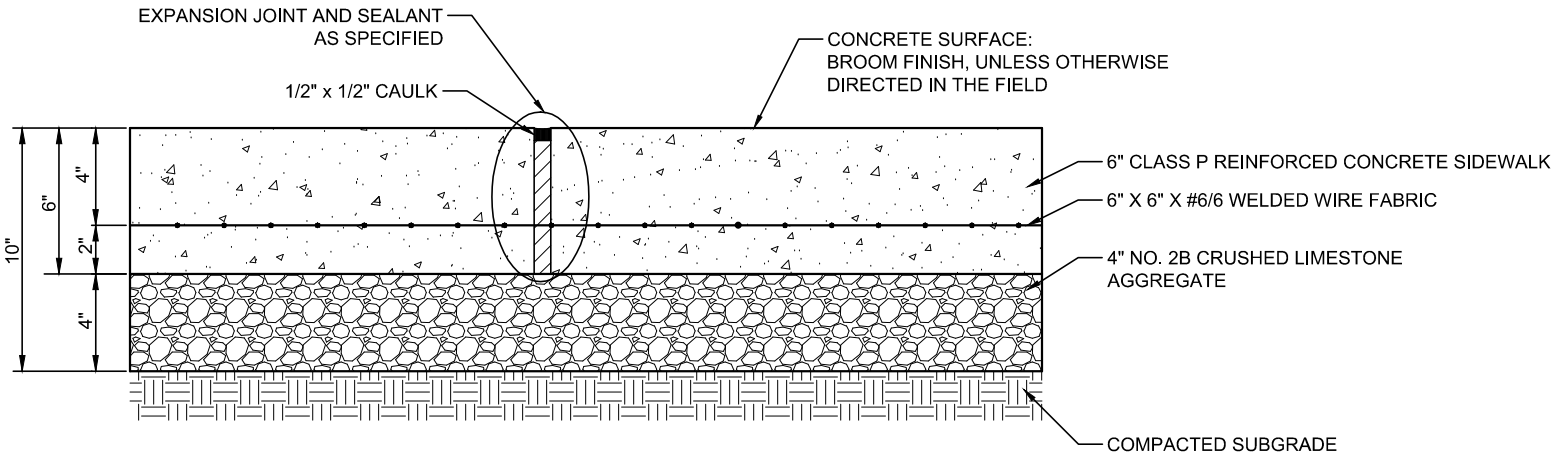
Professional Stamp

Project Name: STANDARD DETAILS	Job No.: X5887
	Issue Date: MAY 2016

Drawing Description:
4 IN. THICK REINFORCED CONCRETE SIDEWALK (CITY OF PGH)
UNIVERSITY OF PITTSBURGH STANDARD DETAILS

CAD File Name: G:\Projects\12000\12807- Pitt Greensburg\-0070 Pitt Standard Details\Dwg\02-Sheet\Details.dwg	Drawn By: --
Drawing Number: 10690	Set Order: 42 of 44

REVISIONS			
No.	By	Date	Description
01		-	-
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NOTES:

1. CONTRACTOR SHALL PLACE CONTROL JOINTS AT INTERVALS EQUAL TO THE PAVEMENT WIDTH NOT TO EXCEED 12'.
2. EXPANSION JOINTS SHALL BE INSTALLED AT 50' MAXIMUM INTERVALS.
3. CURING SHALL BE BY ABSORPTIVE COVER; MOISTURE-RETAINING COVER; OR APPROVED CURING COMPOUND. CONTRACTOR SHALL SUBMIT PROPOSED CURING METHOD TO OWNER FOR APPROVAL PRIOR TO CONCRETE INSTALLATION.
4. APPLY WATER BASED 40% SILANE PENETRATING SEALER AFTER A MINIMUM OF 28 DAYS PER MANUFACTURERS RECOMMENDATIONS.
5. USE DOWELS FOR NON-CONSECUTIVE POURS.
6. PROVIDE MINIMUM CROSS SLOPE OF 1.5% TO MAXIMUM CROSS SLOPE OF 2.0%.

CITY OF PITTSBURGH RIGHT-OF-WAY

43	REINFORCED CONCRETE SIDEWALK (6" THICK)
SH 43	

THIS DETAIL WAS BASED ON CURRENT ACCEPTED CITY OF PITTSBURGH DPW CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT DPW REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

University of Pittsburgh
FACILITIES MANAGEMENT

Professional Stamp

Project Name: STANDARD DETAILS	Job No.: X5887
	Issue Date: MAY 2016

Drawing Description: 6 IN. THICK REINFORCED CONCRETE SIDEWALK (CITY OF PGH)
UNIVERSITY OF PITTSBURGH STANDARD DETAILS

CAD File Name: G:\Projects\12000\12807- Pitt Greensburg\-0070 Pitt Standard Details\Dwg\02-Sheet\Details.dwg	Drawn By: --
Drawing Number: 10690	Set Order: 43 of 44

REVISIONS			
No.	By	Date	Description
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02		-	-

NOTES:

1. ALL SIDEWALKS SHALL BE A MINIMUM OF 5'-0" IN WIDTH.

2. EXPANSION JOINTS SHALL BE INSTALLED AT A MAXIMUM OF 15'-0". SCORED JOINTS SHALL BE INSTALLED AT 5'-0" APART WITH EACH UNIT NOT EXCEEDING 36 SQ. FT.

3. ALL CONCRETE SHALL BE 4000 PSI @ 28 DAYS. CEMENT SHALL BE HIGH EARLY STRENGTH (TYPE III).

CITY OF PITTSBURGH RIGHT-OF-WAY

44	CITY OF PITTSBURGH STANDARD SIDEWALK NOTES
SH 44	

THIS DETAIL WAS BASED ON CURRENT ACCEPTED CITY OF PITTSBURGH DPW CONSTRUCTION DETAILS AT THE TIME OF ISSUANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPLIANCE WITH CURRENT DPW REGULATIONS PRIOR TO ANY WORK BEING COMPLETED.

University of Pittsburgh
FACILITIES MANAGEMENT

Professional Stamp

Project Name: STANDARD DETAILS	Job No.: X5887
	Issue Date: MAY 2016

Drawing Description:
CITY OF PITTSBURGH STANDARD SIDEWALK NOTES

UNIVERSITY OF PITTSBURGH STANDARD DETAILS

CAD File Name: G:\Projects\12000\12807- Pitt Greensburg\-0070 Pitt Standard Details\Dwg\02-Sheet\Details.dwg	Drawn By: --
Drawing Number: 10690	Set Order: 44 of 44

STANDARD TECHNICAL SPECIFICATIONS

SECTION 02080 - PIPED UTILITIES - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping joining materials.
2. Transition fittings.
3. Piped utility demolition.

1.3 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

B. HDPE: High Density Polyethylene

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

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PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Rain conductors shall match the diameter of the existing pipe and be PVC Schedule 40 pipe with fittings.

B. All other piped utilities shall match the existing piping material.

2.2 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

B. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

C. Solvent Cements for Joining Plastic Piping:

1. PVC Piping: ASTM D2564. Include primer according to ASTM F656.

2.3 TRANSITION FITTINGS

A. Transition Fittings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Spears Manufacturing Co.

2. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

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C. Flexible Transition Shielded Couplings for Underground Non-pressure Drainage Piping:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cascade Waterworks Mfg. Co.
b. Fernco, Inc. – Strong Back RC Series.
c. Mission Rubber Company.
d. Plastic Oddities.
e. Approved Equal.

2. Description: Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear rings, ends of the same size as piping to be joined, and corrosion-resistant metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 PIPED UTILITY DEMOLITION

A. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.

B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

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3.2 PIPING INSTALLATION

A. Install piping according to the following requirements and Division 2 Sections specifying piping systems.

B. Plans indicate general location and arrangement of piping systems. Adjust as required.

C. Install piping at indicated slopes.

D. Install piping free of sags and bends.

E. Install fittings for changes in direction and branch connections.

F. Select system components with pressure rating equal to or greater than system operating pressure.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 2 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Non-pressure Piping: Join according to ASTM D2855.

E. Plastic Non-pressure Piping Gasketed Joints: Join according to ASTM D3212.

F. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

G. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

END OF SECTION 02080

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SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Preparing sub-grades for slabs on grade, walks, pavements, lawns and grasses and landscaping.

B. Related Sections include the following:

1. Division 2 Section “Trench Excavation and Backfill for Sewers and Utilities” for trench excavation and backfilling of sewer and utility trenches.

1.3 DEFINITIONS

A. Backfill: Soil Material or aggregate material used to fill a trench excavation.

1. Initial backfill (Pipe Zone): Aggregate material placed under, beside, and over pipes in a trench to depths indicated on the Standard Details and per pipe manufacturer’s recommendations.

B. Base Course: Course placed between the subgrade course and sidewalks, concrete pavement and hot mix asphalt paving.

C. Borrow: Satisfactory soil material, free of organic or other deleterious material imported from off the project site for use as fill or backfill.

D. Drainage Course: Course of washed granular material meeting PennDOT 2A or AASHTO #57 limestone requirements supporting the slab on grade that also minimizes upward capillary flow of pore water.

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E. Bulk Excavation (if applicable): Completion of all excavation ("cuts") and structural fills to the lines and grades as shown on the Drawings.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Owner. Authorized additional excavation and replacement material will be paid for according to Contract provisions.
2. Satisfactory Material: Soil whose composition is satisfactory for use in embankment construction. In general, any mineral (inorganic) soil, blasted or broken rock, and similar materials of natural or man-made origin including mixtures thereof.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the Owner. Unauthorized excavation, as well as remedial work directed by the Owner, shall be at the Contractor's sole expense.
4. Unsatisfactory Material: Any soil containing vegetation or organic matter, such as muck, peat, organic silt, topsoil or sod, which is not satisfactory for use in embankment construction or for support of permanent structures. Certain manmade deposits such as land-fill material may also be determined to be unsatisfactory material.

F. Trench Excavation: Removal and replacement of material in order to install new piping and structures. For purposes of this Specification, all trench excavation shall be defined as "unclassified". See additional paragraphs in this Section for further definition.

G. Fill: Soil materials used to raise existing grades.

H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base, drainage fill, or topsoil materials.

I. Topsoil: Natural or cultivated surface-soil layer containing not less than two (2%) percent nor more than ten (10%) percent of organic matter, as specified in AASHTO designation T194. The material contains sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than two (2) inches in diameter. Topsoil shall be free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

J. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

K. Final backfill: Aggregate material or fill placed over initial backfill to fill a trench to grades indicated on drawings.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Each type of geotextile.

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1.5 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities unless permitted in writing by the Facility Owner and the Owner and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Facility Owner and the Owner not less than two (2) days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without the Facility Owner's written permission.
3. Obtain PA One Call Number prior to beginning work.

B. Demolish and completely remove from site existing underground utilities indicated to be removed unless indicated otherwise. Coordinate with Facility Owners to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow materials when sufficient satisfactory soil materials are not available from bulk excavations.

B. Base or Subbase Material: AASHTO No. 57 limestone or PennDOT 2A limestone as required.

C. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least ninety (90%) percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

D. Drainage Course: AASHTO No. 57 limestone.

E. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

F. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

G. Sand: ASTM C 33, fine aggregate, natural, or manufactured sand.

H. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, GC, SW, SP, SM, SC, ML and CL or a combination of these groups; free of rock or gravel larger than three (3) inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

I. Unsatisfactory Soils: ASTM D 2487 Soil Classification Groups OL, CL, MH, OH and PT expansive or carbonaceous shales and soils that cannot maintain an optimum moisture content of three (3) percent at the time of compaction.

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2.2 GEOTEXTILES

1. Subsurface Drainage Geotextile: Shall comply with the requirements of a Class 1 geotextile in Section 735 in the current edition of PennDOT Publication 408.
2. Separation Geotextile: Shall comply with the requirements of a Class 4 Type A geotextile in Section 735 in the current edition of PennDOT Publication 408.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by bulk earthwork operations.

B. Preparation of subgrade for bulk earthwork and trenching operations shall include removal of trees, vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface.

3.2 DEWATERING

A. Prevent surface water and ground water from entering bulk excavations and trench excavations. Do not allow water to pond and collect on prepared subgrades. Do not allow water to flood project site and/or surrounding properties.

B. Protect subgrades and trenches from softening, undermining, washout, and damage by rain or water accumulation.

C. Provide and maintain all temporary drainage and dewatering systems, such as pumps, sumps and discharge lines as required during bulk excavation and trench excavation at no additional cost to the Owner.

D. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations and trenches. Do not use excavated trenches as temporary drainage ditches.

E. During grading operations, pits, cuts, excavation areas and/or embankments and subgrades shall be shaped, sloped and maintained to facilitate drainage of surface water. Existing drainage routes shall not be choked or obstructed until new ones are established. Temporary culverts, pumps or other equipment shall be used to facilitate drainage of fills during construction.

F. Care shall be exercised during excavations to avoid discharge of surface flows across watershed lines.

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3.3 BULK EXCAVATION REQUIREMENTS (IF APPLICABLE)

A. The Contractor shall be responsible for bulk excavation (if applicable) of all material encountered regardless of type. All bulk excavation shall be considered as unclassified. The Contractor shall be responsible for any and all required excavation, including trench excavation, through any and all types of encountered material including soil, rock, and pavement materials (whether evident on the surface or not).

B. The Contractor shall excavate all materials as required to the dimensions and grades indicated on the Drawings.

C. The Contractor shall complete excavation and fill embankment procedures to the subgrade surface elevations which conform to the finished grades.

D. The Contractor shall be responsible at all times for carrying out all excavation operations in a safe and prudent manner so that all persons and property will be protected from hazard.

E. The Contractor shall prepare and submit a construction schedule for bulk excavation and trenching operations prior to beginning work.

F. The Contractor shall be responsible for the offsite disposal of all surplus excavated or trenched material. Prior to commencement of work, the Contractor shall advise the Owner of the quantity of surplus material, if any, he estimates will be disposed of off-site. The Contractor shall provide the Owner with a copy of the approved grading permit and Erosion and Sedimentation Control Plan for the off-site spoil site.

G. In the event the Contractor disposes of too much excavated material, he shall replace the material as necessary and required at his sole cost and expense. Material to be replaced shall meet the requirements for satisfactory material as specified herein and shall be subject to the approval of the Owner.

H. The existing surface, subsurface and base may consist of any or all of the following materials: asphalt, plain concrete, brick pavers, cobblestone pavers, reinforced concrete, coarse aggregate, cinders, sand, slag, unclassified fill previously placed, rock and in-situ natural soils. Removal of the existing surface, subsurface and base shall include the removal of any materials encompassing manholes, utility boxes, utility lines, and trench lines.

I. All excavations and trenching shall be considered as unclassified. No additional compensation, other than time, will be considered for excavation through any encountered subsurface materials.

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J. The Contractor shall provide all necessary measures to control dust through the use of water, calcium chloride, or other material approved by the Owner, at such locations and during such periods as directed or as be required by the Owner.

1. Calcium Chloride shall be spread in pellet or flake form by approved devices so that uniform distribution is attained over the entire area being treated.
2. Watering equipment shall consist of pipelines, tanks, tank trucks or other approved devices capable of applying a uniform spread of water over the surface. A suitable device for regulating the flow and positive shut-off of the water shall be provided for positive control by the operator.
3. The Owner will advise the Contractor of any unsatisfactory procedures used for dust control. If the unsatisfactory procedures are not corrected promptly, the Owner may suspend the performance of any or all construction until the condition has been corrected.
4. Payment for dust control shall be incidental.

3.4 EXCAVATION FOR CONCRETE WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades to a tolerance of one-half (½) of an inch.

3.5 DISPOSAL OF MATERIAL OUTSIDE OF THE WORK SITE

A. The Contractor shall dispose all waste and excess materials off-site and shall be responsible for all costs incurred therefore.

B. The Contractor must first obtain a written permit from the off-site property owner on whose property the disposal is to be made. He shall file with the Owner said permit or a certified copy thereof, together with a written release from the property owner, absolving the Owner from any and all responsibility in connection with the disposal of material on said off-site property.

C. During the disposal of waste and excess materials the Contractor shall comply with all Federal, State and Local governmental rules, regulations, laws and ordinances concerning such disposal of waste and excess materials.

3.6 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavations under pavement, sidewalks, landscaping areas, utilities, sewer lines and other construction areas with satisfactory soil to subgrade in accordance with the soil fill requirements at no additional cost to the Owner.

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3.7 BACKFILL

A. Place and mechanically compact backfill in excavations and trenches promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage.
2. Removal of concrete form work.
3. Removal of trash and debris.
4. Removal of temporary shoring and bracing.
5. Installation of permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of water, mud, frost, snow, or ice.

C. Place on-site satisfactory soil final trench backfill material in maximum twelve (12")-inch loose lifts mechanically compacted to ninety five (95%)-percent modified Proctor density per ASTM D1557.

3.8 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
3. Slope grades to direct water away from buildings and to prevent ponding.

3.9 GEOTEXTILE INSTALLATION

A. The Contractor shall be required to install Class 4 Type A geotextile fabric on the subgrade prior to installing the stone subbase.

1. The Contractor shall install the Class 4 Type A geotextile fabric in accordance with the requirements set forth in Section 212 in the most current edition of the PennDOT Publication 408. The maximum overlap between rolls is twelve (12) inches with no additional compensation for the cost of the overlapping or pins required for installation.
2. The geotextile shall be pinned to the sub-base using eight (8) penny aluminum nails spaced twelve (12) inches center to center.
3. Trucks shall not be permitted to travel over the fabric when aggregate is being installed. The aggregate shall be placed on the fabric by dumping the trucks and then blading the aggregate onto the fabric with a front loader. The aggregate must be dropped onto the fabric and not shoved over it.
4. Protect the geotextile fabric from traffic and other damage and install the subbase material on it the same day.

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3.10 SUBBASE FOR CEMENT CONCRETE PAVEMENT AND WALKS

A. Concrete Sidewalks and Driveways subbase shall be in accordance with applicable Specification Sections and Details.

B. Shape subbase to required crown elevations and cross-slope grades.

C. Place subbase six (6) inches or less to compacted thickness in a single layer.

D. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than seventy percent (70%) density as per ASTM D4253 and D4254.

3.11 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

2. Stockpile topsoil for re-use in Owner-designated areas.

3.12 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by the Owner. Reshape and re-compact.

C. Where settling occurs before project correction period elapses, remove finished surfacing, backfill with additional competent material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

2. All corrective work shall be conducted at the Contractor’s sole expense.

END OF SECTION 02300

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SECTION 02310 – TRENCH EXCAVATION AND BACKFILL FOR SEWERS AND UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes trench excavation and backfill for sewers and utility trenches, with the following components:

1. Excavation Requirements
2. PennDOT 2A Limestone
3. AASHTO No. 57 Limestone
4. Select On-site Final Backfill

B. Related Sections include the following:

A. Division 1 Section “Earthwork” for additional requirements.
B. Division 2 Section “Hot Mix Asphalt Paving” for installation of bituminous asphalt pavement.

1.3 DEFINITIONS

A. PennDOT: Pennsylvania Department of Transportation

B. Backfill: Soil material or aggregate material used to fill an excavation.

1. Aggregate Backfill: PennDOT 2A Limestone or AASHTO No. 57 Limestone
2. Final Backfill: On-site material approved by the Owner

C. Bedding Course: Six (6”)-inches of AASHTO No. 57 Limestone placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil, free of organic or other deleterious material imported from off-site for use as backfill.

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E. Trench Excavation: Removal of all material encountered above subgrade elevations and to lines and dimensions indicated regardless of type encountered.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Owner. Authorized additional excavation and replacement material will be paid for according to applicable Contract provisions.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the Owner. Unauthorized excavation, as well as remedial work directed by the Owner to correct unauthorized excavation, shall be at the Contractor's sole cost and expense.

F. Fill: Soil materials used to raise existing grades.

G. Pipe Zone: The area from the pipe invert to one (1) foot above the crown of the pipe for the full width and length of the trench.

H. Utilities: On-site underground pipes, conduits, ducts and cables within the project limits.

1.4 SUBMITTALS

A. Product Data: For the following:

1. PennDOT 2A Limestone
2. AASHTO No. 57 Limestone

PART 2 - PRODUCTS

2.1 AGGREGATE MATERIALS

A. PennDOT 2A Limestone and/or AASHTO #57 Limestone meeting specifications set for in Section 703 in the most current edition of PennDOT Publication 408 for PennDOT 2A and/or AASHTO No. 57 Limestone.

B. Sand: ASTM C33, fine aggregate, natural, or manufactured sand.

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2.2 SOIL MATERIALS

A. Soil Material: Fine, clean earth soil material free from large stones, clods, topsoil, sod, frozen earth, wood or any other objectionable material as determined by the Owner.

B. Unsuitable Soil Material at Bottom of Trench: Soil material at the bottom of the trench unable to support the pipe and backfill, as determined by the Owner.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Where the location and depth of existing utilities are of concern in maintaining grade, the Contractor may be directed to make exploratory excavations to verify that the design grades can be achieved or for making adjustments as approved by the Owner.

B. The Contractor shall be responsible for the protection of all utilities in the trench zone. All damage to gas, water, telephone, power, cable or sewer lines shall be repaired immediately according to applicable Contract provisions and Facility Owner standards. In no event shall any utility service remain interrupted overnight.

3.2 TRENCH EXCAVATION

A. The Contractor shall protect the installation of the pipe at all times during construction.

B. Trench excavation shall conform to the line and grade of the sewer or utilities as shown on the Drawings and according to minimum manufacturer's recommended trench widths.

C. All excavations shall be kept free from water, snow and ice during construction.

D. Mats shall be placed for excavation equipment where damage could be caused to existing pavements.

E. The minimum trench width shall be the outside diameter of the pipe plus twelve (12) inches on both sides of the pipe to ensure proper compaction of the bedding and backfill or as recommended by the pipe manufacturer. The maximum trench width shall conform to current ASTM and OSHA requirements predetermined by the depth of the excavation and pipe size or as required by site conditions. No additional compensation will be considered for required trench widths caused by existing site conditions or necessary to meet ASTM, OSHA or pipe manufacturer requirements.

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F. The bottom of the trenches shall be prepared to conform to the grade of the pipe and the bottom of the foundation of structures. Special precautions shall be exercised to insure that pipes, when installed, will not rest on rock, masonry or any other material that would present a non-uniform foundation. Where two or more pipes are to be laid in the same trench, the Contractor shall excavate the trench so that all pipes are laid in conformance with the specified pipe bedding, or better.

G. Excavation below Required Grade: Excavation below the grade of pipes or subsurface structures shown on the drawings necessitated by changes in grades in accordance with the directions of the Owner will be paid for under "Additional Trench Excavation", as hereinafter defined. Excavation carried below the required level without authorization by the Owner shall be backfilled at the Contractor's expense with aggregate material as approved by the Owner. Compaction of such backfill material shall be as specified elsewhere herein.

H. Excavation in Paved Areas: When excavations are to be made in paved surfaces, the paved surfaces shall be neatly cut one (1) foot beyond each side of the trench and ahead of the excavation by means of pneumatic tool, saw cutting or other approved tools to provide a clean, uniform edge, with minimum disturbance of remaining pavements. The pavements so removed shall not be used for trench backfill, but shall be disposed of off-site in an approved manner.

I. Surplus Excavated Material: The Contractor shall remove all excess excavated material from the site or haul it to an on-site Owner-approved stockpile for removal before project completion.

3.3 MATERIAL EXCAVATION AND BACKFILL

A. Authorized Changes and/or Alterations: The Owner may, as a result of unforeseen conditions arising during the progress of the work, order the grade or location of any pipe or other structure changed from that established on the Drawings.

B. Credit to Owner: Should such changes or alterations result in a reduction in the quantity of earth excavation, a credit to the Owner for the reduction in the amount of earth trench excavation occasioned by such change shall be made.

C. Payment for trench excavation, aggregate bedding/backfill and select on-site backfill shall be included in the pipe and manhole bid prices.

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3.4 AGGREGATE PIPE BEDDING

A. Aggregate Bedding: Bedding in the "pipe zone" shall consist of a minimum of six (6)-inches of approved AASHTO #57 limestone installed below the pipe for the entire trench width. In addition, a minimum of twelve (12")-inches of approved AASHTO No. 57 limestone shall be installed above the crown of the pipe as well as aggregate placed in the trench alongside the pipe from the invert to the crown. The bedding shall be placed in six (6")-inch loose lifts and compacted using mechanical compaction equipment to seventy (70%)-percent relative density per ASTM D 4253 and ASTM D 4254.

3.5 TRENCH BACKFILL FOR SEWERS AND SEWER STRUCTURES

A. Under non-paved areas and outside eight (8)-feet of structures and/or curbs, the backfill shall be approved select on-site material placed to within four (4")-inches from the final proposed elevation to allow for topsoil placement and compaction. Select on-site material shall be placed in eight (8")-inch loose lifts mechanically compacted to ninety five (95%) modified Proctor density per ASTM D 1557.

B. Under pavement and within eight (8)-feet of structures and/or curbs:

1. Backfill shall be approved PennDOT 2A limestone placed in six (6")-inch lifts to the subgrade elevation of the proposed impervious surface from twelve (12")-inches above the crown of the pipe compacted using mechanical compaction equipment to seventy (70%)-percent relative density per ASTM D 4253 and ASTM D 4254.

C. Backfilled areas which settle shall be repaired at the Contractor's sole expense.

3.6 UNSUITABLE MATERIALS

A. If unsuitable material as determined by the Owner is found at the trench bottom, the Contractor shall be required to excavate below grade and backfill the trench with AASHTO No. 57 limestone meeting the specifications set forth in the most current edition of PennDOT Publication 408, Section 703.2(c), and Table C. Payment for excavation and placement of such material shall be by applicable contract provisions. No payment for unsuitable replacement will be allowed unless specifically directed by the Owner.

3.7 TRENCH BACKFILL FOR UTILITIES

A. The Contractor shall backfill trenches for utilities in accordance with the requirements of the Facility Owner having jurisdiction for the utility being installed.

END OF SECTION 02310

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SECTION 02620 - SUBDRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes subdrainage systems for the following:

1. Under slab areas.
2. Curb drains.
3. Landscaped areas.

1.3 DEFINITIONS

A. PE: Polyethylene plastic.

B. PVC: Polyvinyl chloride plastic.

C. Sub-drainage: Drainage system that collects and removes subsurface or seepage water.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Drainage conduits.
2. Geotextile filter fabrics.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SOIL MATERIALS

A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Division 2 Section "Earthwork."

2.3 PERFORATED WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:

1. NPS 3 to 6: ASTM F405 and AASHTO M252, Type CP, snap and/or split couplers with Type A or Type B perforation pattern.

B. Perforated PVC Sewer Pipe and Fittings:

1. NPS 3 to 6: ASTM D2729 solvent weld drain pipe belled end with standard perforation pattern.

2.4 GEOTEXTILE FILTER FABRICS

A. Description: Use fabric consisting of long chain polymeric filaments or yarns such as polyethylene, polyamide, polyvinyledene-chloride, polypropylene, or polyester formed into a stable network so that the filaments or yarns retain their position to each other. Use Class 1 geotextile (either woven or non-woven) meeting all physical requirements shown on Table A, Section 735 of PennDOT Publication 408 (most recent revision).

1. Source of Supply: Use supplier listed on PennDOT Bulletin 15 (Qualified Products List for Construction.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and above ground obstructions before beginning installation. Protect all utilities and structures to avoid disruption and damage.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.3 PIPING APPLICATIONS

A. Underslab Subdrainage Piping:

1. Perforated PE pipe and fittings, couplings, and coupled joints.

B. Curb Drain

1. Curb drains shall be constructed using AASHTO #57 limestone aggregate to the detailed dimensions. Prior to placing the aggregate, the trench shall be thoroughly compacted and shaped to uniform grade for proper drainage. Four (4) inch, six (6) inch or eight (8) inch PE perforated drain tubing shall be placed where specified or detailed.

2. Any and all other items of construction, including geotextile and tar paper, shall be placed according to the applicable Detail.

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3.4 UNDERSLAB DRAINAGE INSTALLATION

A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least six (6") inches between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than four (4") inches

D. Install horizontal drainage panels as follows:

1. Coordinate placement with other drainage materials.
2. Lay perforated drainage pipe at inside edge of footings.
3. Place drainage panel meeting CSI Section 33 46 00 over drainage pipe with core side up. Peel back fabric and wrap fabric around pipe. Locate top of core at bottom elevation of floor slab.
4. Butt additional panels against other installed panels. If panels have plastic flanges, overlap installed panel with flange.
5. Install all panels according to manufacturer's recommendations.
6. Use in conjunction with Owner-approved waterproofing system if required.

3.5 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Underslab Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of one (1%) percent.
2. Lay perforated pipe with perforations down.
3. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
4. All drainage piping must outlet into an existing storm structure or connect to existing drainage piping.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install PE and PVC piping according to ASTM D 2321 and manufacturer's published guidelines.

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3.6 PIPE JOINT CONSTRUCTION

A. Join perforated, PE pipe and fittings with couplings for soil-tight joints according to manufacturer's recommendations and all applicable AASHTO and ASTM standards.

B. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.7 IDENTIFICATION

A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installation of green warning tapes directly over piping.

1. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.8 FIELD QUALITY CONTROL

A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.9 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 02620

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SECTION 02741 – HOT MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hot mix asphalt paving
2. Cold milling of existing bituminous pavement
3. Aggregate base
4. Keyways

1.3 DEFINITIONS

A. Hot Mix Bituminous Paving Terminology: Refer to ASTM D8 for definitions of terms.

B. Hot Mix Asphalt Paving: Bituminous paving or material

C. PennDOT: Pennsylvania Department of Transportation.

D. City: City of Pittsburgh. The Contractor shall become familiar with and strictly follow the City of Pittsburgh, Department of Public Works, Right of Way Procedures Manual (January 2015 with updates if applicable) for all procedures and requirements for work within City rights of way at no additional cost to the Owner.

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1.4 SUBMITTALS

A. Job Mix Designs and Certifications:

1. PennDOT certification and job mix formulas from the supplier for the bituminous materials for the proposed Work seven (7) days prior to the pre-construction conference.
2. PennDOT Form TR 465 must be supplied for each day the bituminous material is delivered to the job.
3. PennDOT Form CS-4171 (Certificate of Compliance) and Form TR-448A (Job Mix Formula Report) being computer print outs for the weight of aggregate and asphalt cement content along with accumulated total tonnage listed and the temperature of the mix leaving the plant must be submitted daily.
4. Material Supplier's Bill of Lading indicating the temperature of the material is leaving the plant, the type of material, the net weight of material in the truck and a cumulative total tonnage of material being installed must be submitted on a daily basis.
5. Tack Coat: PennDOT certification and source of material must be submitted seven (7) days prior to the pre-construction meeting. Material Supplier's Bill of Lading must be submitted on a daily basis.

B. Qualification Data: PennDOT pre-qualification certifications from all Contractors and Suppliers meeting the appropriate classifications for the project and a minimum of three (3) references for previous projects completed or as listed on Pennsylvania State Contract 5610-36 for work with the City of Pittsburgh right of ways.

C. Material Test Reports: For each bituminous paving material by a company qualified and certified by PennDOT to complete the tests required by this specification.

D. Material Certificates: For each paving fabric, signed by manufacturers.

E. City Requirements: All bituminous (asphalt) for the City of Pittsburgh streets shall be in full accordance with the City of Pittsburgh, Department of Public Works, Right of Way Procedures Manual (January 2015 with updates if applicable).

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver geotextile materials to the project site in original packaging with the manufacturer's labels containing the brand name and type of material. Store geotextile materials and other paving fabrics in accordance with Section 735 in the most current edition of PennDOT Publication 408.

B. The temperature of the hot-mix asphalt paving mix being delivered shall not be more than fifteen (15) degrees below the minimum temperature shown on the material supplier's Bill of Lading and not above the maximum specified temperature.

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1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply bituminous materials, geotextiles or paving fabrics unless the following requirements are met:

1. The subbase or existing bituminous material is dry as determined by the Owner.
2. The existing pavement has been cleaned in accordance with Section 401 of the most current edition of PennDOT Publication 408.
3. Tack Coat: Minimum air and surface temperature of 40 degrees F and rising in accordance with Section 460 in the most current edition of PennDOT Publication 408.
4. Bituminous Base Course: Minimum surface and air temperature of 35 degrees F and rising at time of placement in accordance with Section 305 in the most current edition of PennDOT Publication 408.

5. Superpave Bituminous Binder and Wearing Surface: Minimum surface and air temperature of 40 degrees F and rising at time of placement in accordance with Section 409 in the most current edition of PennDOT Publication 408. Binder and wearing courses shall not be installed between October 31 and April 1 without written permission of the Owner.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. Coarse Aggregate: Shall conform to the requirements in Sections 401 and 703 in the most current edition of PennDOT Publication 408.

B. Fine Aggregate: Shall conform to the requirements in Sections 401 and 703 in the most current edition of PennDOT Publication 408.

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2.2 ASPHALT PAVING MATERIALS

A. Asphalt Cement: Shall conform to the requirements in Section 702 in the most current edition of PennDOT Publication 408 for AASHTO MP1, PG 64-22.

B. Tack Coat: Shall conform to the requirements in Section 460 in the most current edition of PennDOT Publication 408 for emulsified asphalt, Class AE-T.

C. Superpave Base, Binder and Wearing Surface: Superpave Asphalt Mixture Design, , PG 64-22, 0 to 0.3 million ESAL's, 9.5, 19 and 25 mm mix complying with the requirements in Section 409 in the most current edition of PennDOT Publication 408. The bituminous wearing surface shall incorporate coarse aggregate having a Skid Resistance Level (SRL) designation of "H" or better, supplied from sources approved for this classification as defined and listed in PennDOT Bulletin No. 14.

D. Joint Sealant: Shall conform to the requirements for AET emulsified asphalt in Section 401 in the most current edition of PennDOT Publication 408.

E. City Asphalt Paving Materials: Shall conform to City of Pittsburgh, Department of Public Works, Right of Way Procedures Manual (January 2015 with updates if applicable).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subbase and existing bituminous paving is dry and in suitable condition to support paving and imposed loads.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot mix asphalt surface course to level sags and fill depressions in existing pavements.

B. Crack and Joint Filling: Complete in accordance with the specifications of Section 469 of the most current editions of PennDOT Publication 408.

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3.3 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade and all existing bituminous material are ready to receive paving.

1. Clean existing pavement surface of loose and deleterious material immediately before installing any bituminous material or paving fabric. Cleaning shall be completed with a power broom or mechanical sweepers capable of collecting the material and disposing of it offsite. If, in the opinion of the Owner the cleaning is not adequate, the Contractor shall repeat the procedure until it is deemed satisfactory.
2. All joints in existing concrete pavements and all larger cracks in bituminous pavement (1/2" wide or larger) shall be thoroughly cleaned to a depth of one (1) inch and filled with an approved sand and asphalt grout mix.
3. The existing pavement surface shall be brought to a uniform grade and cross section as specified. The surface of the existing pavement shall be brought to the same transverse slope and longitudinal cross section as the finished pavement section using scratch coat of bituminous binder at a variable thickness.

B. Tack Coat: Apply in accordance with the specifications in Section 460 of the most current edition of PennDOT Publication 408, not exceeding 0.02 gallon per square yard variation.

1. The tack coat shall be applied at the specified rate and uniform manner of 0.02 to 0.07 gallon per square yard at a surface temperature of 40 degrees and rising.
2. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
3. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
4. The tack coat shall be applied to all paving areas of the cartway, driveway edges, catch basins, inlets, manholes, curbs and utility boxes.

C. After the subgrade and/or existing pavement surfaces have been prepared as specified herein, the Contractor shall check all frames, covers, grates, water valve boxes and all other miscellaneous castings that are located in the proposed pavement area to insure that all such items have been accurately positioned and set to the proper slope and elevation. All covers and grates are to be set flush with the required finished pavement surface. No depressions or mounds will be permitted in the pavement to accommodate inaccuracies in the setting of these appurtenances. All corrective work that may be necessary shall be performed at the Contractor's sole cost and expense.

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D. Where new pavements are to meet existing pavements (except as specified herein under Bituminous Concrete Overlays), the Contractor shall line cut the existing pavements with an approved pneumatic, saw cutting or mechanical cutting tool so that there will be a vertical butting surface between the old and new pavements. There shall be a one (1) foot offset in each pavement course to permit each successive course to overlap the lower existing course. Line cutting of existing pavements shall be along neat, straight and even lines, and shall be performed in such a manner so as not to damage the adjacent pavement to remain. The Owner shall approve the acceptability of the line cutting device and the method of operation prior to new asphalt placement.

E. All vertical surfaces of curbs, structures, gutters, and existing pavement in contact with new bituminous mixtures shall be painted with a uniform coating of an approved bituminous emulsion or priming material. Extreme care shall be exercised in the application of this material to prevent splattering or staining of surfaces that are to remain exposed. Work that is stained as a result of the Contractor's operations shall be repaired and/or replaced at the Contractor's sole cost and expenses.

F. For milling operations, the Contractor shall provide a milling machine designed and built for milling existing bituminous pavements with an automatic grade and slope control system. The Contractor shall mill to provide a finished surface free from gouges, grooves and ridges and that conforms to the surface tolerance requirements of Section 409.3(l) in the most current edition of PennDOT Publication 408. Immediately after milling, remove milled material. When indicated that milled material is to be retained by the Contractor, satisfactorily dispose of milled material at an approved off-site facility off the Owner’s property immediately after milling. When indicated that milled material is to be retained by the Owner, deliver milled material to the designated stockpiling location immediately after milling. Carefully remove the existing bituminous material around utility facilities within work areas. Repair or replace utility facilities damaged by the milling operation to the satisfaction of the Facility Owner at no additional cost to the Owner. Control the rate of milling to avoid tearing of the mat. If directed, separate oversized and chunky milled material. Maintain the milled surface free of all loose materials and dust. Place the first overlaying bituminous course within five (5) calendar days from the start of milling operations. Failure to overlay a milled section of roadway within five (5) calendar days will result in a penalty of five hundred ($ 500.00) dollars per calendar day until overlay operations begin. Work stoppages caused by the Owner, Facility Owners, and documented weather delays will not count towards the five (5) calendar days for calculating the penalty.

G. The Contractor shall cut or mill keyway into the existing pavement to provide a tight, smooth joint. The keyway length shall be a minimum of fifteen (15) feet per inch of vertical change or as directed by the Owner.

H. Milling operations conducted on City of Pittsburgh primary and secondary streets shall follow all utility paving specifications listed in the City of Pittsburgh, Department of Public Works, Right of Way Procedures Manual (January 2015 with updates if applicable) at no additional cost to the Owner.

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3.4 HOT MIX ASPHALT PAVING EQUIPMENT

A. Trucks: Trucks used to transport hot mix bituminous material to the project site shall conform to Section 401.0(c) in the most current edition of PennDOT Publication 408.

3.5 HOT MIX ASPHALT MATERIAL INSTALLATION

A. Place the bituminous paving material in accordance to the Details and PennDOT Publication 408.

B. Install the bituminous materials in accordance with the following:

1. All hot mix asphalt materials shall be installed in accordance with the most current edition of PennDOT Publication 408.
2. Do not place bituminous paving when the surface is wet or when its air or surface temperature is less than 40 degrees Fahrenheit.
3. No hot mix asphalt material shall be installed if the temperature of the material is less than 275 degrees Fahrenheit or greater than 325 degrees Fahrenheit. All temperatures must be shown on the Bill of Lading. If these requirements are not met, the bituminous material shall be rejected and removed from the project site.
4. All asphalt trucks are to remain covered and/or tarped until ready to dump into the paver. Any truck with an uncovered partial load waiting for unloading will not be permitted to dump into the paver.
5. No traffic shall be permitted on newly compacted hot mix asphalt material until its temperature is lower then 140 degrees F.
6. No kerosene is to be used on the paving equipment.
7. The edge of the overlay shall be sealed with PG 64-22 twelve (12”)-inches wide with six (6”)-inches on the overlay and six (6”)-inches on the existing pavement.
8. A twelve (12”)-inch pass of PG 64-22 shall be placed along concrete curbs and the gutter section of bituminous curbs. Sand gutter line when sealing past driveways and sidewalks and at all roadway joints in order to prevent tracking.
9. All sealing must be completed within two (2) working days after completion of asphalt placement.

3.6 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with the same texture and smoothness as adjacent sections of the hot mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of six (6”)-inches.
3. Offset transverse joints, in successive courses, a minimum twenty four (24”)-inches.
4. Construct transverse and longitudinal joints per the most current edition of PennDOT Publication 408.

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B. Install Joint Sealant in accordance with the following:

1. All edges of the new pavement, including around inlet, manhole and utility box castings shall be sealed with PG 64-22.
2. On pavements with bituminous wedge curbs, apply PG 64-22 twelve (12")-wide with four (4")-inches applied to the wedge curb.
3. On pavements with concrete curbs, apply PG 64-22 twelve (12")-inches with two (2")-inches applied to the inside face of the curb.
4. All joints at driveways and sidewalks shall be sanded to prevent tracking.
5. All joints shall be sealed within two (2) working days of completion of asphalt placement.

3.7 COMPACTION

A. Complete compaction as per the specifications in Section 401 in the most current edition of PennDOT Publication 408.

B. Compact hot mix asphalt paving with hot, hand tampers or vibratory compactors in areas inaccessible to rollers.

C. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot mix asphalt. Compact by rolling to the specified density and surface smoothness.

D. Erect barricades to protect paving from traffic until the mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

A. Thickness: In accordance with Section 401 in the most current edition of PennDOT Publication 408.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base and Binder Course: 1/4 inch
2. Wearing Surface: 1/8 inch

C. Crowned Surfaces: Test using appropriate methods and procedures acceptable to the Owner to insure the required crown cross section is obtained.

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3.9 FIELD QUALITY CONTROL

A. Hot Mix Asphalt Pavement: The testing agency shall conduct compaction and depth tests as follows:

1. The Contractor shall be required to provide tests for density for all layers of bituminous material by following the requirements set for in Section 409.9b HMA in the most current edition of PennDOT Publication 408 for nuclear gage testing. The test shall be performed by a licensed nuclear gage operator as witnessed by the Owner utilizing the following procedure set forth in Section 409 in the most current edition of PennDOT Publication 408. The Contractor shall complete the following with regards to density testing:

    a. Use a nuclear gage meeting the requirements of PTM No 402.
    b. Use a nuclear gage calibrated in accordance with AASHTO Test Method T-238-86. Submit certification of annual calibration of gages and documentation of licensed operators training to the Owner prior to the placement of any material.
    c. Use the control strip technique specified in PTM No. 402, Section 7.2.3., to determine the optimum rolling pattern for each material course. Record all counts and plot the rolling pattern growth curve on form TR 4276-B.
    d. The Contractor shall submit the testing results to the Owner on a daily basis.

2. The Contractor will be paid for material placed based on the above required testing and in accordance with the most current edition of PennDOT Publication 408. The Owner retains the right to verify density testing in accordance with the above testing procedure in order to confirm the results.

3.10 TEST FOR SURFACE IRREGULARITIES

A. Use a template cut to the required cross section of the finished base course. Equip the template with metal or other vertical extensions attached to each end, so the bottom of the template will be at the elevation of the top of the base course. Test the cross section for surface irregularities at intervals of not more than twenty (25) feet

B. Use a ten (10) foot straight edge to test for longitudinal irregularities in the surface of the base course. Hold the straight edge parallel to the road centerline in contact with the surface. Move the straight edge from one side of the base course to the other. Advance along the base course in five (5) foot increments.

C. Correct all surface irregularities exceeding one-half (1/2”)-inch loosening the surface and removing or adding material as required. Compact the repaired area and surrounding surface by rolling.

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D. Tests for Materials

1. All materials used in permanent pavement construction shall be subject to all testing and certifications as required by the PennDOT procedures and regulations. All tests shall be performed by the Contractor, his suppliers or independent testing laboratories, at no cost additional cost to the Owner.
2. Aggregate - Supplier's certifications, plus one (1) grab sample per ten thousand (10,000) produced tons to be tested by an independent laboratory.
3. Hot Mix Asphalt Materials - Daily plant certification plus one (1) grab sample per day for each type of material placed for an extraction test by an independent testing laboratory.
4. The City reserves the right to test the paving material at the Asphalt Testing Laboratory located at 4501 Centre Avenue, Pittsburgh, PA.

END OF SECTION 02741

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SECTION 02743 – DRIVEWAY RESTORATION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Bituminous driveway restoration.
2. Concrete driveway restoration.
3. Stone or aggregate driveway restoration.

B. Related Sections include the following:

1. Division 2 Section “Earthwork” for aggregate subbase and base courses.
2. Division 2 Section “Hot Mix Asphalt Paving” for bituminous asphalt pavement.
3. Division 2 Section “Cement Concrete Pavement” for concrete pavement.

1.3 DEFINITIONS

A. Hot Mix Bituminous Paving Terminology: Refer to ASTM D 8 for definitions of terms.

B. PennDOT.: Pennsylvania Department of Transportation

PART 2 - PRODUCTS

2.1 BITUMINOUS DRIVEWAY RESTORATION

A. All products shall conform with the materials listed in Section 02741 “Hot Mix Asphalt Paving” for the installation of bituminous materials

2.2 CONCRETE DRIVEWAY RESTORATION

A. All products shall conform to the materials listed in Section 02751 “Cement Concrete Pavement” for the installation of concrete material.

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2.3 STONE OR AGGREGATE DRIVEWAY RESTORATION

A. All products shall conform to aggregate materials listed in Section 02741 “Hot Mix Asphalt Paving” for the installation of stone or aggregate material.

PART 3 - EXECUTION

3.1 BITUMINOUS DRIVEWAY RESTORATION

A. The Contractor shall prepare the edge of the existing driveway by saw cutting the pavement to achieve a straight edge, removing the asphalt material and subbase and hauling it to an approved offsite dump site.

B. The Contractor shall remove adequate existing driveway material to allow for the installation of the following: three (3) inches compacted depth PennDOT 2A limestone base; four (4) inches compacted depth 19.0 mm Superpave binder and one and a half (1 1/2) inches compacted depth 9.5 mm Superpave wearing course (0 to < 0.3 ESAL’s, PG 64-22, SRL “H” or better). The Contractor shall be directed by the Owner as to the limits of driveway removal required in order to achieve an adequate grade for a smooth transition.

C. The Contractor shall proof roll the subgrade material in accordance with Section 02741 “Hot Mix Asphalt Paving” prior to installing the aggregate base.

D. The Contractor shall install three (3) inches compacted depth of PennDOT 2A limestone base in accordance with Section 02741 “Hot Mix Asphalt Paving”.

E. The Contractor shall install four (4) inches compacted depth of 19.0 mm Superpave binder and one and a half (1 1/2) inches compacted depth of 9.5 mm Superpave Wearing Course in accordance with Section 02741“Hot Mix Asphalt Paving”.

F. The Contractor shall seal all new joints in the asphalt paving with PG 64-22 in accordance with Section 02741 “Hot Mix Asphalt Paving”.

3.2 CONCRETE DRIVEWAY RESTORATION

A. The Contractor shall remove the damaged existing concrete slab to the next existing joint or as directed by the Owner. The Contractor shall haul the removed material to an approved off-site dump.

B. The Contractor shall remove adequate existing driveway material to allow for the installation of four (4) inches compacted depth AASHTO #57 limestone base and six (6) inches of 4000 psi concrete. The Contractor will be directed by the Owner as to the limits of driveway removal required in order to achieve an adequate grade for a smooth transition.

C. The Contractor shall protect adjacent slabs from damage during restoration. Any damage to adjacent slabs shall be repaired at the Contractor’s sole cost and expense.

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D. The Contractor shall proof roll the subgrade material in accordance with Section 02751 "Cement Concrete Pavement" prior to installing the aggregate base.

E. The Contractor shall install four (4) inches compacted depth of AASHTO No. 57 limestone in accordance with Section 02751 "Cement Concrete Pavement".

F. The driveway shall be reinforced with welded wire fabric 6x6-W2.9xW2.9 (or most current designation) with a minimum cover of three (3) inches

G. The Contractor shall install six (6) inches of 4000 psi air entrained (5% +/- 1%) concrete in accordance with Section 2751 "Cement Concrete Pavement".

H. Driveways shall be neatly saw-cut prior to beginning restoration work. Saw cutting shall be included in the price of the driveway restoration.

I. Contraction joints shall be spaced at a maximum of five (5) foot intervals and formed with a device to have the completed joint at least ½" deep. Expansion joints shall be spaced no more than fifty (50) feet apart and formed with ¼" pre-molded filler to the full depth of the slab. The ¼" pre-molded filler shall also be placed adjacent to curbs, sidewalks, other driveways, manhole castings, buildings and pavements. If the driveway abuts a curb, the joints on the driveway shall match the joints on the curb.

J. The surface of the slab shall be brought to a uniform plane surface by means of a wood screed riding on forms. The surface shall then be finished with a wood or magnesium float and finished to match the existing concrete. The tool marks for joints and edges shall match the marks in the existing driveway. Neither dry cement nor water shall be added to the surface during the finishing process.

K. On any tooled joints or edges of concrete do not use the jointing or edging tool until the surface water has evaporated from the concrete. Bull float and broom the surface, finish the joint and edges and use the broom to remove the tool marks on the surface.

L. After placement, the concrete shall be cured per Section 02751 "Cement Concrete Pavement".

M. Sealing of Joints

1. All expansion joints and joints against structures shall be joints, both expansion shall be sealed.

2. The sealant shall be "Sikaflex-1A Polyurethane, Elastomeric Sealant/Adhesive" (or Owner approved equal). Sealant color shall be selected from the range of available colors by the Owner prior to application.

3. All joints must be sound, clean, dry and free from oil and grease. Curing compound residues and any foreign material must be thoroughly removed. A roughened surface will also enhance the bond. Install bond breaker tape or back rod to prevent bond at the base of the joint.

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4. Apply Sikaflex-1A at a temperature between forty (40) degrees Fahrenheit and one hundred (100) degrees Fahrenheit with a gun using the twenty (20) ounce "uni-pac" sausage.

N. Replace rain conductors in kind if found under a driveway. Place a piece of No. 9 gauge wire mesh reinforcing one (1) foot over the pipe for reinforcement. In addition, a construction joint shall be placed over the rain conductor location. No additional compensation will be considered for the removal and/or replacement of roof or driveway drains under the driveway.

O. Restore and/or raise to grade all gas valves, water valves, sewer vents, or other utility valve boxes encountered during driveway restoration. No additional compensation will be considered for work associated with this requirement.

P. Insulated protection of the concrete shall be required dependent on weather conditions at the time of pouring and during the curing period. A polyethylene plastic sheeting shall be considered as the adequate minimum protection required for concrete during adverse weather conditions. The Owner reserves the right to require additional protective measures such as blanketing. No additional compensation will be considered in the event protective measures above the minimum are required by the Owner.

3.3 STONE OR AGGREGATE DRIVEWAY RESTORATION

A. The Contractor shall install a minimum of six (6) inches of in kind stone or aggregate material. The gradation, color and texture of the replacement material shall match the existing material as closely as practical.

B. The Contractor will be directed by the Owner as to the limits of driveway removal required in order to achieve an adequate grade for a smooth transition.

END OF SECTION 02743

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SECTION 02751 - CEMENT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:

1. Curbs
2. Sidewalks
3. Driveways
4. Concrete Encasement

B. Related Sections include the following:

1. Division 2 Section "Earthwork" for subgrade preparation, grading, and subbase course.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Qualification Data: For manufacturer

D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

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E. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

F. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

2. On-site batching of concrete will not be permitted.

B. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

C. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.

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3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves with a radius one hundred (100) feet or less.

2. Forms shall be of metal or new wood at least ten (10) feet long.

3. Wood forms shall be rigid enough not to bow and deflect when concrete is placed. Worn, broken or distorted forms shall not be used.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

C. Each form shall be braced and staked in at least three (3) places for each ten (10) foot length, closer if necessary to keep from deforming when concrete is placed.

D. Forms must extend the full depth of the concrete curb, sidewalk or driveway.

E. The entire front and rear face of the curb must be formed. No wild pours or partial forming will be allowed.

2.3 STEEL REINFORCEMENT

A. The Contractor shall submit data sheets for all steel reinforcement.

2.4 SYNTHETIC FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.

1. Products:

a. Monofilament Fibers:

1) Axim Concrete Technologies; Fibrasol IIP.
2) Euclid Chemical Company (The); Fiberstrand 100.
3) FORTA Corporation; Forta Mono.
4) Grace, W. R. & Co.--Conn.; Grace MicroFiber.
5) Metalcrete Industries; Polystrand 1000.

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b. Fibrillated Fibers:

1) Axim Concrete Technologies; Fibrasol F.
2) FORTA Corporation; Forta.
3) Euclid Chemical Company (The); Fiberstrand F.
4) Grace, W. R. & Co.--Conn.; Grace Fibers.

2.5 CONCRETE MATERIALS AND MIXTURES

A. Cementitious Material: Use one of the following cementitious materials, of the same type, brand, and source throughout the Project:

1. Portland Cement: ASTM C 150, Type I, non-air Entraining Portland Cement.

B. Normal Weight Aggregates: ASTM C 33 coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least ten (10) years satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate (1530 lbs/cu.yd) must be limestone for reinforced concrete pavement, concrete curb, concrete sidewalk, reinforced concrete drives and any exposed concrete in structures. To obtain approval the aggregate mix design must be submitted two (2) weeks before contemplated use.

2. Fine Aggregate: Type A aggregate; 1220 lbs/cu.yd.

C. Water: ASTM C 94/C 94M or 33 gallons/cu.yd.

D. Twenty eight (28)-day strength: 4000 psi.

E. Slump shall be four (4")-inches plus or minus one (1")-inch.

F. Air Entraining Admixtures shall be in accordance with AASHTO Designation M-154 (ASTM C-260-01)

G. Entrained air content shall be 5.0% with a tolerance of plus or minus 1.0%

H. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 2.0 lb/cu. yd.. *Note: Synthetic Fiber is in addition to any traditional steel reinforcement required in the concrete.*

I. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

J. The above requirements for concrete shall be superseded by the City of Pittsburgh Concrete Specifications for Class "P", Class "PP", Class "A" and Class "AA" concrete if the concrete is

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to be placed within City of Pittsburgh right-of-ways. All listed strength and use requirements shall be strictly followed for work with City right-of-ways at no additional cost to the Owner.

2.6 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Curing and Sealing Compound: ASTM C 309, Type 1, Classes A and B; ASTM C 1315, Type 1, Class A; and AASHTO M 148, Type 1 Classes A and B. Must meet US EPA maximum allowable VOC requirements.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber (AASHTO–M213)

B. Concrete Joint Sealant: Sikaflex-1a (or approved equal). The sealant shall be a one part polyurethane, elastomeric sealant/adhesive meeting Federal Specification TT-S-00230C, Type II, Class A and ASTM C-920, Type S, Grade NS, Class 35 use T, NT, O, M, G and I. Color shall be limestone or as chosen by the Owner.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements, and as follows:

1. Types I and II, non-load bearing or IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrade and subbase for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subgrade surface with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding as follows or as dictated by field conditions:

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1. Completely proof-roll subgrade in one direction and repeat in perpendicular direction. Limit vehicle speed to three (3) mph.
2. Proof-roll with a loaded tandem-axle dump truck weighing not less than fifteen (15) tons.
3. Subgrade with soft spots and areas of pumping or rutting exceeding depth of one-half (1/2")-inch shall be repaired prior to placement of concrete.
4. Concrete curb and sidewalk subbases shall be compacted using a mechanical whacker to seventy (70%) relative density per ASTM D 4253 and ASTM D 4254.

C. Proceed with concrete pavement operations only after non-conforming conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. The subgrade shall be compacted

C. Concrete slabs shall be a minimum of eight (8) inches thick for roadways, six (6) inches thick for driveways and four (4) inches thick for sidewalks. The aggregate bed shall be a minimum of six (6) inches thick for roadways, four (4) inches thick for driveways and four (4) inches thick for sidewalks. The aggregate bed shall be AASHTO 57 crushed limestone aggregate. Specific requirements for work with City of Pittsburgh right-of-ways shall supersede the above listed depths if applicable.

D. All concrete shall be per this Specification or by the City of Pittsburgh Concrete Specifications as applicable.

3.3 SUBGRADE REPAIR

A. After the existing pavement and subbase have been removed to subgrade, the Owner will determine if soft spots exist and, if so, mark the limits of soft spots to be corrected.

B. If soft spots are marked, the Contractor shall excavate such areas and replace excavated unsuitable materials with PennDOT Class IV, Type A geotextile fabric placed under a minimum of twelve (12") inches of AASHTO No.1 limestone aggregate with a two (2) inch PennDOT 2A limestone aggregate "choke". The fabric shall wrap over the top of the placed aggregate prior to the placement of the required aggregate subbase. All unsuitable materials shall be removed from the site at no additional cost to the Owner.

3.4 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least twenty (24) hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

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3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Concrete sidewalks and driveways shall be reinforced with 6x6 – W2.9 x W2.9 wire mesh with a minimum cover of two (2) inches and three (3) inches respectively.

F. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

G. Concrete slabs shall be constructed per PennDOT Publication 408 (most current edition), PennDOT RC standards and applicable plan Details. All concrete slabs within City of Pittsburgh right of ways shall be constructed according to all applicable City of Pittsburgh Standards of Construction (most current edition).

3.6 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. All joints in new concrete shall be sealed including the joints in straight and rolled curbs, sidewalks, driveway and other concrete structures. The joints between old and new concrete must also be sealed.

C. Contraction joints in the reinforced concrete pavement and/or base shall be constructed by sawing with a special concrete saw using one or more circular blades, cooled and lubricated with water.

D. Expansion joints in reinforced concrete pavement and/or base shall be constructed with slip dowels, and minimum 3/4" thick expansion joint filler as detailed. A steel plate, slip dowels and minimum 3/4" joint filler can be used as an alternate. Spacing shall be at all points of curve, points of tangent and at street intersections. All expansion joints shall be sealed with “Sikaflex-1A” as soon as possible after construction of the joint, as well as joints between new and old concrete.

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E. Contraction joints in concrete curbs shall be made every ten (10) feet and a contraction joint shall be in line with each contraction joint in the sidewalk if one abuts said curb. They shall not exceed 1/4" in thickness and shall be formed with steel plates and mastic 1/8" in thickness. Expansion joints 1/2" thick, shall be formed at not more than 20 foot intervals.

F. Contraction joints in concrete sidewalks shall be spaced at a minimum of five (5) foot intervals and formed with a device to have the completed joint at least 3/4" inch deep. Expansion joints shall be spaced no more than twenty (20) feet apart and formed with 1/4 inch pre-molded filler to the full depth of the slab. The 1/4 inch pre-molded filler shall also be placed adjacent to curbs, other sidewalks, buildings or pavement. If the sidewalk abuts a curb the joints on the sidewalk shall match the joints in the curb.

G. Contraction joints in concrete driveways shall be spaced at a maximum of ten (10) foot intervals and formed with a device to have the completed joint at least 1.25" deep. Expansion joints shall be spaced no more than fifty (50) feet apart and formed with 1/4" thick pre-molded filler to the full depth of the slab. The 1/4" pre-molded filler shall also be placed adjacent to curbs, sidewalks, other driveways, buildings or pavements. If the driveway abuts a curb the joints on the driveway shall match the joints in the curb.

H. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.

I. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of fifty (50) feet unless otherwise indicated or directed.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

J. On any tooled joints or edges of concrete do not use the jointing or edging tool until the surface water has evaporated from the concrete (sheen disappears). Bull float and broom the surface, then finish the joint and edges and use broom to remove the tool marks on the surface.

3.7 SEALING OF CONCRETE JOINTS

A. All expansion joints and joints against structures shall be sealed.

B. The sealant shall be "Sikaflex-1A Polyurethane, Elastomeric Sealant/Adhesive" (or Owner approved equal). Sealant color shall be selected from the range of available colors by the Owner prior to application.

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C. All joints must be sound, clean, dry and free from oil and grease. Curing compound residues and any foreign material must be thoroughly removed. A roughened surface will also enhance the bond. Install bond breaker tape or back rod to prevent bond at the base of the joint.

D. Apply Sikaflex-1A at a temperature between forty (40) degrees Fahrenheit and one hundred (100) degrees Fahrenheit with a gun using the twenty (20) ounce "uni-pac" sausage.

3.8 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. No concrete shall be placed prior to April 15th or after December 1st except with written permission of the Owner and only if the Contractor is prepared to comply with the cold weather requirements specified in PennDOT Specification 408 (most current edition).

D. When the air temperature is be expected to drop below forty (40) degrees Fahrenheit at any time during the day or night for the first twenty (24) hours following the placement of concrete, an additional three (3) bales of straw hay, weighing approximately 100 pounds each, shall be spread for each thirty five (35) square yards of concrete placed and then covered with a tarpaulin. The concrete shall be maintained at a temperature of not less than fifty (50) degrees Fahrenheit and not more than eighty (80) degrees Fahrenheit. Gradually lower the temperature to the surrounding area for at least three (3) additional days.

E. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

F. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

G. Do not add water to concrete during delivery or at project site.

H. Do not add water to fresh concrete after testing.

I. No private, public or contractor vehicles and/or equipment shall be placed or moved on concrete pavement until fourteen (14) days have elapsed from time of pour, and then only when earth shoulders are placed against the pavement edges. Opening to traffic shall not constitute a final acceptance of pavement from centerline. The Contractor shall provide the Owner with breaks at 7, 14, and 28 days from the date of the pour to determine the strength.

J. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

K. The concrete shall be placed in forms in horizontal layers not to exceed five (5) inches and vibrated sufficiently to eliminate all voids.

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L. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.

1. Remove and replace concrete that has been placed for more than fifteen (15) minutes without being covered by top layer or use bonding agent if approved by Owner.

M. The crown in any pavement or base shall be measured from the high side edge where one edge is higher than the other except where otherwise noted.

N. Screed pavement surfaces with a straightedge and strike off.

O. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

P. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.

Q. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.

R. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.9 TRENCH REPAIR IN CITY OF PITTSBURGH CONCRETE STREETS

A. Under this item the Contractor will be required to repair all trenches in City of Pittsburgh concrete streets to the complete satisfaction of the City using all applicable City provisions and details.

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B. If a curb or sidewalk is disturbed during the bituminous street restoration, it shall be replaced in kind and will be paid for under the appropriate item of the specifications.

C. The concrete streets proposed to be disturbed due to a point repair, manhole installation, etc. shall be saw cut prior to excavation. Saw cutting shall be included in the price of the concrete street restoration. No additional compensation will be provided for saw cutting.

D. Payment for the above will be made on a square yard basis (or as determined by the Owner), complete in place, with a maximum trench width of eight (8) feet This item will also be used to pay for any saw cutting and repaving around inlets to be replaced. Required dowels or mesh are also included under this item.

3.10 CONCRETE SIDEWALKS

A. All concrete sidewalks within the City of Pittsburgh right of way shall be replaced according to approved City of Pittsburgh Details and Manuals. All other concrete sidewalks shall be replaced according to this Specification and applicable details.

B. Forms shall be of metal or new wood at least ten (10) feet long. Each form shall be braced and staked in at least three (3) places for each ten (10) foot length and closer if necessary to keep from deforming when concrete is placed. They shall be thoroughly cleaned and coated with non-staining oil. Wood forms shall be rigid enough not to bow and deflect when concrete is placed. Worn, broken or distorted forms shall not be used.

C. The sidewalks proposed to be disturbed due to a construction shall be saw cut prior to excavation. Saw cutting shall be included in the price of the sidewalk restoration and no additional compensation will be provided for the saw cutting.

D. Contraction joints shall be spaced at a minimum of five (5) foot intervals and formed with a device to have the completed joint at least 1/2 inch deep. Expansion joints shall be spaced no more than twenty (20) feet apart and formed with 1/4 inch pre-molded filler to the full depth of the slab. The 1/4 inch pre-molded filler shall also be placed adjacent to curbs, other sidewalks, buildings or pavement. If the sidewalk abuts a curb the joints on the sidewalk shall match the joints in the curb.

E. Concrete sidewalks shall be reinforced with 6x6 – W2.9 x W2.9 wire mesh with a minimum cover of two (2) inches and three (3) inches respectively.

F. The surface of the slab shall be brought to a uniform plane surface by means of a wood screed riding on forms. The surface shall then be finished with a wood or magnesium float and fine broom finished. The tool marks for joints and edges shall match the marks in the existing walk. Neither dry cement nor water shall be added to the surface during the finishing process.

G. On any tooled joints or edges of concrete do not use the jointing or edging tool until the surface water has evaporated from the concrete. Bull float and broom the surface, then finish the joint and edges and use the broom to remove the tool marks on the surface.

H. After twenty eight (28) days (or as recommended by the manufacturer or directed by the Owner), apply an approved sealer.

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I. The concrete shall be thoroughly vibrated to eliminate voids within the placed concrete.

J. Sealing of Joints

1. All expansion joints and joints against structures shall be sealed.

2. The sealant shall be "Sikaflex 1A Polyurethane, Elastomeric Sealant/Adhesive" (or Owner approved equal). Sealant color shall be selected from the range of available colors by the Owner prior to application.

3. All joints must be sound, clean, dry and free from oil and grease. Curing compound residues and any foreign material must be thoroughly removed. A roughened surface will also enhance the bond. Install bond breaker tape or back rod to prevent bond at the base of the joint.

4. Apply Sikaflex 1A at a temperature between forty (40) degrees Fahrenheit and one hundred (100) degrees Fahrenheit with a gun using the twenty (20) ounce "uni-pac" sausage.

K. Insulated protection of the concrete shall be required dependent on weather conditions at the time of pouring and during the curing period. A polyethylene plastic sheeting shall be considered as the adequate minimum protection required for concrete during adverse weather conditions. The Owner reserves the right to require additional protective measures such as blanketing. No additional compensation will be considered in the event protective measures above the minimum are required by the Owner.

L. Replace rain conductors in kind if found under a sidewalk. Place a piece of No. 9 gauge wire mesh reinforcing one (1) foot over the pipe for reinforcement. In addition, a construction joint shall be placed over the rain conductor location. No additional compensation will be considered for the removal and/or replacement of roof or driveway drains under a sidewalk.

M. Restore and/or raise to grade all gas valves, water valves, sewer vents, or other utility valve boxes encountered during driveway restoration. No additional compensation will be considered for work associated with this requirement.

3.11 CONCRETE CURB RESTORATION

A. The contractor shall be required to replace damaged concrete straight curb, curb and gutter or roll curb. Straight curb shall be replaced in kind at the same width as was removed. No additional compensation will be granted relative to the width of the curb. The straight curb shall be installed in accordance with the detail provided. All curbs within the City of Pittsburgh right of way shall be replaced according to the applicable approved City of Pittsburgh detail.

B. Private concrete curb disturbed during construction shall be replaced in kind and in accordance with the detail provided.

C. Curbs proposed to be disturbed during construction shall be saw cut prior to excavation. Saw cutting shall be included in the price of the curb restoration and no additional compensation will be considered for saw cutting.

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D. Forms shall be of metal or new wood at least ten (10) feet long. Each form shall be braced and staked in at least three (3) places for each ten (10) foot length and closer if necessary to keep from deforming when concrete is placed. They shall be thoroughly cleaned and coated with non-staining oil. Wood forms shall be rigid enough not to bow and deflect when concrete is placed. Worn, broken or distorted forms shall not be used.

E. Effort shall be made to minimize damage to curbs.

F. The Contractor shall be responsible for providing AASHTO #57 crushed limestone aggregate for a suitable base for the curb in accordance with the Detail.

G. A 2 ply tar paper must be placed between the AASHTO base and the concrete curb.

H. Control joints shall be placed at ten (10) feet on center.

I. Expansion joints shall be spaced no more than fifty (50) feet apart and formed with 1/4 inch pre-molded filler to the full depth of the slab. The 1/4 inch pre-molded filler shall also be placed adjacent to curbs, other sidewalks, buildings or pavement. If the curb abuts a sidewalk the joints on the curb shall match the joints in the sidewalk.

J. A four (4") inch minimum diameter PE slotted underdrain may be placed behind the curb in accordance with the Detail and connected to the storm sewer system as directed by the Owner.

K. The concrete shall be thoroughly vibrated to eliminate voids within the placed concrete.

L. The finish on the concrete shall match the finish of the existing curb.

M. Sealing of Joints

1. All expansion joints and joints against structures shall be sealed.

2. The sealant shall be "Sikaflex 1A Polyurethane, Elastomeric Sealant/Adhesive" (or Owner approved equal). Sealant color shall be selected from the range of available colors by the Owner prior to application.

3. All joints must be sound, clean, dry and free from oil and grease. Curing compound residues and any foreign material must be thoroughly removed. A roughened surface will also enhance the bond. Install bond breaker tape or back rod to prevent bond at the base of the joint.

4. Apply Sikaflex 1A at a temperature between forty (40) degrees Fahrenheit and one hundred (100) degrees Fahrenheit with a gun using the twenty (20) ounce "uni-pac" sausage.

N. After twenty eight (28) days (or as recommended by the manufacturer or directed by the Owner), apply an approved sealer

O. If any rain conductors exist through the curb, they shall be replaced in kind. No additional compensation will be provided for the restoration of roof/driveway drains through the curb.

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P. Insulated protection of the concrete shall be required dependent on weather conditions at the time of pouring and during the curing period. A polyethylene plastic sheeting shall be considered as the adequate minimum protection required for concrete during adverse weather conditions. The Owner reserves the right to require additional protective measures such as blanketing. No additional compensation will be considered in the event protective measures above the minimum are required by the Owner.

3.12 CONCRETE ENCASEMENT FOR UTILITIES

A. Under this item the Contractor shall be required, if necessary, and as approved by the Owner in writing to install concrete encasement around utility lines that are exposed within twelve (12) inches of a proposed sewer.

B. The installation of concrete encasement shall be completed with an eight (8) inch minimum bed of air entrained 4000 psi high early strength concrete placed below an existing utility line. The concrete must then extend up the sides of the utility line and placed to a minimum depth of at least eight (8) inches above the utility line.

C. The concrete shall be allowed to cure for a minimum of twenty (24) hours prior to backfilling. The Owner reserves the right to extend the curing period until the concrete has cured sufficiently so that the encasement does not become damaged during backfilling. The curing period may vary depending on weather conditions.

D. The Contractor shall use caution during backfilling to prevent damage to the concrete encasement.

E. The Contractor shall be required to take all necessary precautions for curing concrete in hot and/or cold weather at no additional cost to the Owner.

3.13 FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations.

C. The surface of concrete sidewalks shall be brought to a uniform plane surface by means of a wood screed riding on forms. The surface shall then be finished with a wood or magnesium float and stiff textured broom finished perpendicular to line of traffic. The tool marks for joints and edges shall match the marks in the existing walk. Neither dry cement nor water shall be added to the surface during the finishing process.

D. The portion of the curb to be exposed to the elements shall be finished smooth with a wood or magnesium float. All minor defects shall be filled with cement mortar. No watered brush finish or plastering of the curb will be permitted. All joints and exposed edges shall be tooled to a radius of 1/4" but no tool marks will be permitted to show on the finished curb. Final finish shall be made with a coarse broom.

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E. The surface of the concrete driveway slab shall be brought to a uniform plane surface by means of a wood screed riding on forms. The surface shall then be finished with a wood or magnesium float and fine broom finished. The tool marks for joints and edges shall match the marks in the existing driveway. Neither dry cement nor water shall be added to the surface during the finishing process.

F. On any tooled joints or edges of concrete do not use the jointing or edging tool until the surface water has evaporated from the concrete. Bull float and broom the surface, then finish the joint and edges and use the broom to remove the tool marks on the surface.

3.14 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 pounds per square foot by depth before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

3.15 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot long, unleveled straightedge not to exceed 1/4 inch.
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
8. Contraction Joint Depth: Plus 1/4 inch, no minus.
9. Joint Width: Plus 1/8 inch, no minus.

3.16 BACKFILLING

A. The Contractor shall not backfill against walks, driveways, curbs, etc. until concrete forms have been removed, concrete cured and written authorization has been given by the Owner. All debris shall be removed from top to bottom of all excavations prior to all backfilling operations. In lawn or ground covers areas, backfilling shall be done with clean earth placed in six (6) inch compacted layers.

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3.17 TESTING

A. The Contractor shall engage a qualified professional to perform concrete testing. All results shall be forwarded to the Owner for review.

B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding five (5) cubic yards but less than twenty five (25) cubic yards plus one set for each additional fifty (50) cubic yards or fraction thereof.

2. Testing Frequency: Obtain at least one composite sample for each one hundred (100) cubic yards or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five (5) compressive-strength tests for each concrete mixture, testing shall be conducted from at least five (5) randomly selected batches or from each batch if fewer than five (5) are used.

3. Slump: ASTM C 143/C 143M; one (1) test at point of placement for each composite sample, but not less than one (1) test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; (ASTM C 173/C 173M, volumetric method, for structural lightweight concrete) one (1) test for each composite sample, but not less than one (1) test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C 1064/C 1064M; one test (1) hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one (1) test for each composite sample.

6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one (1) test for each composite sample, but not less than one (1) test for each day's pour of each concrete mixture.

7. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two (2) sets of two (2) standard cylinder specimens for each composite sample.
    b. Cast and field cure two (2) sets of two (2) standard cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two (2) laboratory-cured specimens at seven (7) days and one set of two (2) specimens at twenty eight (28) days.

    a. Test one (1) set of two (2) field-cured specimens at seven (7) days and one (1) set of two (2) specimens at twenty eight (28) days.

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b. A compressive-strength test shall be the average compressive strength from a set of two (2) specimens obtained from same composite sample and tested at age indicated.

9. When strength of field-cured cylinders is less than eighty five (85%) percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

10. Strength of each concrete mixture will be satisfactory if every average of any three (3) consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than five hundred (500) psi.

11. Test results shall be reported in writing to Owner, concrete manufacturer, and Contractor within forty eight (48) hours of testing. Reports of compressive-strength tests shall contain project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at twenty (28) days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both seven (7)- and twenty eight (28)-day tests.

12. Non-destructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Owner but will not be used as sole basis for approval or rejection of concrete.

13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Owner. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Owner.

14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

15. Correct deficiencies in the Work indicated by insufficient results shown by testing and/or inspection at no additional cost to the Owner.

3.18 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Drill test cores, where directed by Owner, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least fourteen (14) days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

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D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two (2) days before date scheduled for Substantial Completion inspection or as directed by the Owner.

END OF SECTION 02751

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SECTION 02764 - PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.
2. Joints between cement concrete and asphalt pavement.

B. Related Sections include the following:

1. Division 2 Section "Hot Mix Asphalt Paving" for constructing joints between concrete and asphalt pavement.
2. Division 2 Section "Cement Concrete Pavement" for constructing joints in concrete pavement.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

1. For primers and substrate preparation needed for adhesion.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for sealants.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

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1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 degrees F.
2. When joint substrates are wet or covered with frost.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles. Products not listed, but considered as “or equal” by the Contractor, may be submitted for review and approval by the Owner.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

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2.3 COLD-APPLIED JOINT SEALANTS

A. Grade NS Silicone Sealant for Concrete: Moisture-cured, one-component polyurethane-based, non-sag elastomeric sealant meeting Federal Specification TT-S-0023C, Type II, Class A; ASTM C-920, Type 6, Grade NS, Class 35 and certified to the NSF/ANSI Standard 61 for potable water.

B. Color: White, colonial white, aluminum gray, limestone, black, dark bronze, capitol tan, stone and medium bronze. Owner to select color prior to application.

2.4 HOT-APPLIED JOINT SEALANTS

A. Sealant for Concrete and Asphalt: Performance graded asphalt cement binder meeting AASHTO M320.

2.5 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.6 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of backer materials.
2. Do not stretch, twist, puncture, or tear backer materials.
3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

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E. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 02764

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SECTION 02080 - PIPED UTILITIES - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping joining materials.
2. Transition fittings.
3. Piped utility demolition.

1.3 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

B. HDPE: High Density Polyethylene

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

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PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Rain conductors shall match the diameter of the existing pipe and be PVC Schedule 40 pipe with fittings.

B. All other piped utilities shall match the existing piping material.

2.2 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

B. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

C. Solvent Cements for Joining Plastic Piping:

1. PVC Piping: ASTM D2564. Include primer according to ASTM F656.

2.3 TRANSITION FITTINGS

A. Transition Fittings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Spears Manufacturing Co.

2. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

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C. Flexible Transition Shielded Couplings for Underground Non-pressure Drainage Piping:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cascade Waterworks Mfg. Co.
b. Fernco, Inc. – Strong Back RC Series.
c. Mission Rubber Company.
d. Plastic Oddities.
e. Approved Equal.

2. Description: Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear rings, ends of the same size as piping to be joined, and corrosion-resistant metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 PIPED UTILITY DEMOLITION

A. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.

B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

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3.2 PIPING INSTALLATION

A. Install piping according to the following requirements and Division 2 Sections specifying piping systems.

B. Plans indicate general location and arrangement of piping systems. Adjust as required.

C. Install piping at indicated slopes.

D. Install piping free of sags and bends.

E. Install fittings for changes in direction and branch connections.

F. Select system components with pressure rating equal to or greater than system operating pressure.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 2 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Non-pressure Piping: Join according to ASTM D2855.

E. Plastic Non-pressure Piping Gasketed Joints: Join according to ASTM D3212.

F. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

G. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

END OF SECTION 02080

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SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Preparing sub-grades for slabs on grade, walks, pavements, lawns and grasses and landscaping.

B. Related Sections include the following:

1. Division 2 Section “Trench Excavation and Backfill for Sewers and Utilities” for trench excavation and backfilling of sewer and utility trenches.

1.3 DEFINITIONS

A. Backfill: Soil Material or aggregate material used to fill a trench excavation.

1. Initial backfill (Pipe Zone): Aggregate material placed under, beside, and over pipes in a trench to depths indicated on the Standard Details and per pipe manufacturer’s recommendations.

B. Base Course: Course placed between the subgrade course and sidewalks, concrete pavement and hot mix asphalt paving.

C. Borrow: Satisfactory soil material, free of organic or other deleterious material imported from off the project site for use as fill or backfill.

D. Drainage Course: Course of washed granular material meeting PennDOT 2A or AASHTO #57 limestone requirements supporting the slab on grade that also minimizes upward capillary flow of pore water.

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E. Bulk Excavation (if applicable): Completion of all excavation ("cuts") and structural fills to the lines and grades as shown on the Drawings.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Owner. Authorized additional excavation and replacement material will be paid for according to Contract provisions.
2. Satisfactory Material: Soil whose composition is satisfactory for use in embankment construction. In general, any mineral (inorganic) soil, blasted or broken rock, and similar materials of natural or man-made origin including mixtures thereof.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the Owner. Unauthorized excavation, as well as remedial work directed by the Owner, shall be at the Contractor's sole expense.
4. Unsatisfactory Material: Any soil containing vegetation or organic matter, such as muck, peat, organic silt, topsoil or sod, which is not satisfactory for use in embankment construction or for support of permanent structures. Certain manmade deposits such as land-fill material may also be determined to be unsatisfactory material.

F. Trench Excavation: Removal and replacement of material in order to install new piping and structures. For purposes of this Specification, all trench excavation shall be defined as "unclassified". See additional paragraphs in this Section for further definition.

G. Fill: Soil materials used to raise existing grades.

H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base, drainage fill, or topsoil materials.

I. Topsoil: Natural or cultivated surface-soil layer containing not less than two (2%) percent nor more than ten (10%) percent of organic matter, as specified in AASHTO designation T194. The material contains sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than two (2) inches in diameter. Topsoil shall be free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

J. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

K. Final backfill: Aggregate material or fill placed over initial backfill to fill a trench to grades indicated on drawings.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Each type of geotextile.

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1.5 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities unless permitted in writing by the Facility Owner and the Owner and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Facility Owner and the Owner not less than two (2) days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without the Facility Owner's written permission.
3. Obtain PA One Call Number prior to beginning work.

B. Demolish and completely remove from site existing underground utilities indicated to be removed unless indicated otherwise. Coordinate with Facility Owners to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow materials when sufficient satisfactory soil materials are not available from bulk excavations.

B. Base or Subbase Material: AASHTO No. 57 limestone or PennDOT 2A limestone as required.

C. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least ninety (90%) percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

D. Drainage Course: AASHTO No. 57 limestone.

E. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

F. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

G. Sand: ASTM C 33, fine aggregate, natural, or manufactured sand.

H. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, GC, SW, SP, SM, SC, ML and CL or a combination of these groups; free of rock or gravel larger than three (3) inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

I. Unsatisfactory Soils: ASTM D 2487 Soil Classification Groups OL, CL, MH, OH and PT expansive or carbonaceous shales and soils that cannot maintain an optimum moisture content of three (3) percent at the time of compaction.

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2.2 GEOTEXTILES

1. Subsurface Drainage Geotextile: Shall comply with the requirements of a Class 1 geotextile in Section 735 in the current edition of PennDOT Publication 408.
2. Separation Geotextile: Shall comply with the requirements of a Class 4 Type A geotextile in Section 735 in the current edition of PennDOT Publication 408.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by bulk earthwork operations.

B. Preparation of subgrade for bulk earthwork and trenching operations shall include removal of trees, vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface.

3.2 DEWATERING

A. Prevent surface water and ground water from entering bulk excavations and trench excavations. Do not allow water to pond and collect on prepared subgrades. Do not allow water to flood project site and/or surrounding properties.

B. Protect subgrades and trenches from softening, undermining, washout, and damage by rain or water accumulation.

C. Provide and maintain all temporary drainage and dewatering systems, such as pumps, sumps and discharge lines as required during bulk excavation and trench excavation at no additional cost to the Owner.

D. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations and trenches. Do not use excavated trenches as temporary drainage ditches.

E. During grading operations, pits, cuts, excavation areas and/or embankments and subgrades shall be shaped, sloped and maintained to facilitate drainage of surface water. Existing drainage routes shall not be choked or obstructed until new ones are established. Temporary culverts, pumps or other equipment shall be used to facilitate drainage of fills during construction.

F. Care shall be exercised during excavations to avoid discharge of surface flows across watershed lines.

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3.3 BULK EXCAVATION REQUIREMENTS (IF APPLICABLE)

A. The Contractor shall be responsible for bulk excavation (if applicable) of all material encountered regardless of type. All bulk excavation shall be considered as unclassified. The Contractor shall be responsible for any and all required excavation, including trench excavation, through any and all types of encountered material including soil, rock, and pavement materials (whether evident on the surface or not).

B. The Contractor shall excavate all materials as required to the dimensions and grades indicated on the Drawings.

C. The Contractor shall complete excavation and fill embankment procedures to the subgrade surface elevations which conform to the finished grades.

D. The Contractor shall be responsible at all times for carrying out all excavation operations in a safe and prudent manner so that all persons and property will be protected from hazard.

E. The Contractor shall prepare and submit a construction schedule for bulk excavation and trenching operations prior to beginning work.

F. The Contractor shall be responsible for the offsite disposal of all surplus excavated or trenched material. Prior to commencement of work, the Contractor shall advise the Owner of the quantity of surplus material, if any, he estimates will be disposed of off-site. The Contractor shall provide the Owner with a copy of the approved grading permit and Erosion and Sedimentation Control Plan for the off-site spoil site.

G. In the event the Contractor disposes of too much excavated material, he shall replace the material as necessary and required at his sole cost and expense. Material to be replaced shall meet the requirements for satisfactory material as specified herein and shall be subject to the approval of the Owner.

H. The existing surface, subsurface and base may consist of any or all of the following materials: asphalt, plain concrete, brick pavers, cobblestone pavers, reinforced concrete, coarse aggregate, cinders, sand, slag, unclassified fill previously placed, rock and in-situ natural soils. Removal of the existing surface, subsurface and base shall include the removal of any materials encompassing manholes, utility boxes, utility lines, and trench lines.

I. All excavations and trenching shall be considered as unclassified. No additional compensation, other than time, will be considered for excavation through <u>any</u> encountered subsurface materials.

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J. The Contractor shall provide all necessary measures to control dust through the use of water, calcium chloride, or other material approved by the Owner, at such locations and during such periods as directed or as be required by the Owner.

1. Calcium Chloride shall be spread in pellet or flake form by approved devices so that uniform distribution is attained over the entire area being treated.
2. Watering equipment shall consist of pipelines, tanks, tank trucks or other approved devices capable of applying a uniform spread of water over the surface. A suitable device for regulating the flow and positive shut-off of the water shall be provided for positive control by the operator.
3. The Owner will advise the Contractor of any unsatisfactory procedures used for dust control. If the unsatisfactory procedures are not corrected promptly, the Owner may suspend the performance of any or all construction until the condition has been corrected.
4. Payment for dust control shall be incidental.

3.4 EXCAVATION FOR CONCRETE WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades to a tolerance of one-half (½) of an inch.

3.5 DISPOSAL OF MATERIAL OUTSIDE OF THE WORK SITE

A. The Contractor shall dispose all waste and excess materials off-site and shall be responsible for all costs incurred therefore.

B. The Contractor must first obtain a written permit from the off-site property owner on whose property the disposal is to be made. He shall file with the Owner said permit or a certified copy thereof, together with a written release from the property owner, absolving the Owner from any and all responsibility in connection with the disposal of material on said off-site property.

C. During the disposal of waste and excess materials the Contractor shall comply with all Federal, State and Local governmental rules, regulations, laws and ordinances concerning such disposal of waste and excess materials.

3.6 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavations under pavement, sidewalks, landscaping areas, utilities, sewer lines and other construction areas with satisfactory soil to subgrade in accordance with the soil fill requirements at no additional cost to the Owner.

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3.7 BACKFILL

A. Place and mechanically compact backfill in excavations and trenches promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage.
2. Removal of concrete form work.
3. Removal of trash and debris.
4. Removal of temporary shoring and bracing.
5. Installation of permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of water, mud, frost, snow, or ice.

C. Place on-site satisfactory soil final trench backfill material in maximum twelve (12")-inch loose lifts mechanically compacted to ninety five (95%)-percent modified Proctor density per ASTM D1557.

3.8 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
3. Slope grades to direct water away from buildings and to prevent ponding.

3.9 GEOTEXTILE INSTALLATION

A. The Contractor shall be required to install Class 4 Type A geotextile fabric on the subgrade prior to installing the stone subbase.

1. The Contractor shall install the Class 4 Type A geotextile fabric in accordance with the requirements set forth in Section 212 in the most current edition of the PennDOT Publication 408. The maximum overlap between rolls is twelve (12) inches with no additional compensation for the cost of the overlapping or pins required for installation.
2. The geotextile shall be pinned to the sub-base using eight (8) penny aluminum nails spaced twelve (12) inches center to center.
3. Trucks shall not be permitted to travel over the fabric when aggregate is being installed. The aggregate shall be placed on the fabric by dumping the trucks and then blading the aggregate onto the fabric with a front loader. The aggregate must be dropped onto the fabric and not shoved over it.
4. Protect the geotextile fabric from traffic and other damage and install the subbase material on it the same day.

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3.10 SUBBASE FOR CEMENT CONCRETE PAVEMENT AND WALKS

A. Concrete Sidewalks and Driveways subbase shall be in accordance with applicable Specification Sections and Details.

B. Shape subbase to required crown elevations and cross-slope grades.

C. Place subbase six (6) inches or less to compacted thickness in a single layer.

D. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than seventy percent (70%) density as per ASTM D4253 and D4254.

3.11 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

2. Stockpile topsoil for re-use in Owner-designated areas.

3.12 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by the Owner. Reshape and re-compact.

C. Where settling occurs before project correction period elapses, remove finished surfacing, backfill with additional competent material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

2. All corrective work shall be conducted at the Contractor’s sole expense.

END OF SECTION 02300

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SECTION 02310 – TRENCH EXCAVATION AND BACKFILL FOR SEWERS AND UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes trench excavation and backfill for sewers and utility trenches, with the following components:

1. Excavation Requirements
2. PennDOT 2A Limestone
3. AASHTO No. 57 Limestone
4. Select On-site Final Backfill

B. Related Sections include the following:

A. Division 1 Section “Earthwork” for additional requirements.
B. Division 2 Section “Hot Mix Asphalt Paving” for installation of bituminous asphalt pavement.

1.3 DEFINITIONS

A. PennDOT: Pennsylvania Department of Transportation

B. Backfill: Soil material or aggregate material used to fill an excavation.

1. Aggregate Backfill: PennDOT 2A Limestone or AASHTO No. 57 Limestone
2. Final Backfill: On-site material approved by the Owner

C. Bedding Course: Six (6”)-inches of AASHTO No. 57 Limestone placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil, free of organic or other deleterious material imported from off-site for use as backfill.

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E. Trench Excavation: Removal of all material encountered above subgrade elevations and to lines and dimensions indicated regardless of type encountered.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Owner. Authorized additional excavation and replacement material will be paid for according to applicable Contract provisions.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the Owner. Unauthorized excavation, as well as remedial work directed by the Owner to correct unauthorized excavation, shall be at the Contractor's sole cost and expense.

F. Fill: Soil materials used to raise existing grades.

G. Pipe Zone: The area from the pipe invert to one (1) foot above the crown of the pipe for the full width and length of the trench.

H. Utilities: On-site underground pipes, conduits, ducts and cables within the project limits.

1.4 SUBMITTALS

A. Product Data: For the following:

1. PennDOT 2A Limestone
2. AASHTO No. 57 Limestone

PART 2 - PRODUCTS

2.1 AGGREGATE MATERIALS

A. PennDOT 2A Limestone and/or AASHTO #57 Limestone meeting specifications set for in Section 703 in the most current edition of PennDOT Publication 408 for PennDOT 2A and/or AASHTO No. 57 Limestone.

B. Sand: ASTM C33, fine aggregate, natural, or manufactured sand.

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2.2 SOIL MATERIALS

A. Soil Material: Fine, clean earth soil material free from large stones, clods, topsoil, sod, frozen earth, wood or any other objectionable material as determined by the Owner.

B. Unsuitable Soil Material at Bottom of Trench: Soil material at the bottom of the trench unable to support the pipe and backfill, as determined by the Owner.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Where the location and depth of existing utilities are of concern in maintaining grade, the Contractor may be directed to make exploratory excavations to verify that the design grades can be achieved or for making adjustments as approved by the Owner.

B. The Contractor shall be responsible for the protection of all utilities in the trench zone. All damage to gas, water, telephone, power, cable or sewer lines shall be repaired immediately according to applicable Contract provisions and Facility Owner standards. In no event shall any utility service remain interrupted overnight.

3.2 TRENCH EXCAVATION

A. The Contractor shall protect the installation of the pipe at all times during construction.

B. Trench excavation shall conform to the line and grade of the sewer or utilities as shown on the Drawings and according to minimum manufacturer's recommended trench widths.

C. All excavations shall be kept free from water, snow and ice during construction.

D. Mats shall be placed for excavation equipment where damage could be caused to existing pavements.

E. The minimum trench width shall be the outside diameter of the pipe plus twelve (12) inches on both sides of the pipe to ensure proper compaction of the bedding and backfill or as recommended by the pipe manufacturer. The maximum trench width shall conform to current ASTM and OSHA requirements predetermined by the depth of the excavation and pipe size or as required by site conditions. No additional compensation will be considered for required trench widths caused by existing site conditions or necessary to meet ASTM, OSHA or pipe manufacturer requirements.

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F. The bottom of the trenches shall be prepared to conform to the grade of the pipe and the bottom of the foundation of structures. Special precautions shall be exercised to insure that pipes, when installed, will not rest on rock, masonry or any other material that would present a non-uniform foundation. Where two or more pipes are to be laid in the same trench, the Contractor shall excavate the trench so that all pipes are laid in conformance with the specified pipe bedding, or better.

G. Excavation below Required Grade: Excavation below the grade of pipes or subsurface structures shown on the drawings necessitated by changes in grades in accordance with the directions of the Owner will be paid for under "Additional Trench Excavation", as hereinafter defined. Excavation carried below the required level without authorization by the Owner shall be backfilled at the Contractor's expense with aggregate material as approved by the Owner. Compaction of such backfill material shall be as specified elsewhere herein.

H. Excavation in Paved Areas: When excavations are to be made in paved surfaces, the paved surfaces shall be neatly cut one (1) foot beyond each side of the trench and ahead of the excavation by means of pneumatic tool, saw cutting or other approved tools to provide a clean, uniform edge, with minimum disturbance of remaining pavements. The pavements so removed shall not be used for trench backfill, but shall be disposed of off-site in an approved manner.

I. Surplus Excavated Material: The Contractor shall remove all excess excavated material from the site or haul it to an on-site Owner-approved stockpile for removal before project completion.

3.3 MATERIAL EXCAVATION AND BACKFILL

A. Authorized Changes and/or Alterations: The Owner may, as a result of unforeseen conditions arising during the progress of the work, order the grade or location of any pipe or other structure changed from that established on the Drawings.

B. Credit to Owner: Should such changes or alterations result in a reduction in the quantity of earth excavation, a credit to the Owner for the reduction in the amount of earth trench excavation occasioned by such change shall be made.

C. Payment for trench excavation, aggregate bedding/backfill and select on-site backfill shall be included in the pipe and manhole bid prices.

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3.4 AGGREGATE PIPE BEDDING

A. Aggregate Bedding: Bedding in the "pipe zone" shall consist of a minimum of six (6)-inches of approved AASHTO #57 limestone installed below the pipe for the entire trench width. In addition, a minimum of twelve (12")-inches of approved AASHTO No. 57 limestone shall be installed above the crown of the pipe as well as aggregate placed in the trench alongside the pipe from the invert to the crown. The bedding shall be placed in six (6")-inch loose lifts and compacted using mechanical compaction equipment to seventy (70%)-percent relative density per ASTM D 4253 and ASTM D 4254.

3.5 TRENCH BACKFILL FOR SEWERS AND SEWER STRUCTURES

A. Under non-paved areas and outside eight (8)-feet of structures and/or curbs, the backfill shall be approved select on-site material placed to within four (4")-inches from the final proposed elevation to allow for topsoil placement and compaction. Select on-site material shall be placed in eight (8")-inch loose lifts mechanically compacted to ninety five (95%) modified Proctor density per ASTM D 1557.

B. Under pavement and within eight (8)-feet of structures and/or curbs:

1. Backfill shall be approved PennDOT 2A limestone placed in six (6")-inch lifts to the subgrade elevation of the proposed impervious surface from twelve (12")-inches above the crown of the pipe compacted using mechanical compaction equipment to seventy (70%)-percent relative density per ASTM D 4253 and ASTM D 4254.

C. Backfilled areas which settle shall be repaired at the Contractor's sole expense.

3.6 UNSUITABLE MATERIALS

A. If unsuitable material as determined by the Owner is found at the trench bottom, the Contractor shall be required to excavate below grade and backfill the trench with AASHTO No. 57 limestone meeting the specifications set forth in the most current edition of PennDOT Publication 408, Section 703.2(c), and Table C. Payment for excavation and placement of such material shall be by applicable contract provisions. No payment for unsuitable replacement will be allowed unless specifically directed by the Owner.

3.7 TRENCH BACKFILL FOR UTILITIES

A. The Contractor shall backfill trenches for utilities in accordance with the requirements of the Facility Owner having jurisdiction for the utility being installed.

END OF SECTION 02310

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SECTION 02620 - SUBDRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes subdrainage systems for the following:

1. Under slab areas.
2. Curb drains.
3. Landscaped areas.

1.3 DEFINITIONS

A. PE: Polyethylene plastic.

B. PVC: Polyvinyl chloride plastic.

C. Sub-drainage: Drainage system that collects and removes subsurface or seepage water.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Drainage conduits.
2. Geotextile filter fabrics.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SOIL MATERIALS

A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Division 2 Section "Earthwork."

2.3 PERFORATED WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:

1. NPS 3 to 6: ASTM F405 and AASHTO M252, Type CP, snap and/or split couplers with Type A or Type B perforation pattern.

B. Perforated PVC Sewer Pipe and Fittings:

1. NPS 3 to 6: ASTM D2729 solvent weld drain pipe belled end with standard perforation pattern.

2.4 GEOTEXTILE FILTER FABRICS

A. Description: Use fabric consisting of long chain polymeric filaments or yarns such as polyethylene, polyamide, polyvinyledene-chloride, polypropylene, or polyester formed into a stable network so that the filaments or yarns retain their position to each other. Use Class 1 geotextile (either woven or non-woven) meeting all physical requirements shown on Table A, Section 735 of PennDOT Publication 408 (most recent revision).

1. Source of Supply: Use supplier listed on PennDOT Bulletin 15 (Qualified Products List for Construction.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and above ground obstructions before beginning installation. Protect all utilities and structures to avoid disruption and damage.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.3 PIPING APPLICATIONS

A. Underslab Subdrainage Piping:

1. Perforated PE pipe and fittings, couplings, and coupled joints.

B. Curb Drain

1. Curb drains shall be constructed using AASHTO #57 limestone aggregate to the detailed dimensions. Prior to placing the aggregate, the trench shall be thoroughly compacted and shaped to uniform grade for proper drainage. Four (4) inch, six (6) inch or eight (8) inch PE perforated drain tubing shall be placed where specified or detailed.

2. Any and all other items of construction, including geotextile and tar paper, shall be placed according to the applicable Detail.

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3.4 UNDERSLAB DRAINAGE INSTALLATION

A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least six (6") inches between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than four (4") inches

D. Install horizontal drainage panels as follows:

1. Coordinate placement with other drainage materials.
2. Lay perforated drainage pipe at inside edge of footings.
3. Place drainage panel meeting CSI Section 33 46 00 over drainage pipe with core side up. Peel back fabric and wrap fabric around pipe. Locate top of core at bottom elevation of floor slab.
4. Butt additional panels against other installed panels. If panels have plastic flanges, overlap installed panel with flange.
5. Install all panels according to manufacturer's recommendations.
6. Use in conjunction with Owner-approved waterproofing system if required.

3.5 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Underslab Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of one (1%) percent.
2. Lay perforated pipe with perforations down.
3. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
4. All drainage piping must outlet into an existing storm structure or connect to existing drainage piping.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install PE and PVC piping according to ASTM D 2321 and manufacturer's published guidelines.

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3.6 PIPE JOINT CONSTRUCTION

A. Join perforated, PE pipe and fittings with couplings for soil-tight joints according to manufacturer's recommendations and all applicable AASHTO and ASTM standards.

B. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.7 IDENTIFICATION

A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installation of green warning tapes directly over piping.

1. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.8 FIELD QUALITY CONTROL

A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.9 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 02620

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SECTION 02741 – HOT MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hot mix asphalt paving
2. Cold milling of existing bituminous pavement
3. Aggregate base
4. Keyways

1.3 DEFINITIONS

A. Hot Mix Bituminous Paving Terminology: Refer to ASTM D8 for definitions of terms.

B. Hot Mix Asphalt Paving: Bituminous paving or material

C. PennDOT: Pennsylvania Department of Transportation.

D. City: City of Pittsburgh. The Contractor shall become familiar with and strictly follow the City of Pittsburgh, Department of Public Works, Right of Way Procedures Manual (January 2015 with updates if applicable) for all procedures and requirements for work within City rights of way at no additional cost to the Owner.

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1.4 SUBMITTALS

A. Job Mix Designs and Certifications:

1. PennDOT certification and job mix formulas from the supplier for the bituminous materials for the proposed Work seven (7) days prior to the pre-construction conference.
2. PennDOT Form TR 465 must be supplied for each day the bituminous material is delivered to the job.
3. PennDOT Form CS-4171 (Certificate of Compliance) and Form TR-448A (Job Mix Formula Report) being computer print outs for the weight of aggregate and asphalt cement content along with accumulated total tonnage listed and the temperature of the mix leaving the plant must be submitted daily.
4. Material Supplier's Bill of Lading indicating the temperature of the material is leaving the plant, the type of material, the net weight of material in the truck and a cumulative total tonnage of material being installed must be submitted on a daily basis.
5. Tack Coat: PennDOT certification and source of material must be submitted seven (7) days prior to the pre-construction meeting. Material Supplier's Bill of Lading must be submitted on a daily basis.

B. Qualification Data: PennDOT pre-qualification certifications from all Contractors and Suppliers meeting the appropriate classifications for the project and a minimum of three (3) references for previous projects completed or as listed on Pennsylvania State Contract 5610-36 for work with the City of Pittsburgh right of ways.

C. Material Test Reports: For each bituminous paving material by a company qualified and certified by PennDOT to complete the tests required by this specification.

D. Material Certificates: For each paving fabric, signed by manufacturers.

E. City Requirements: All bituminous (asphalt) for the City of Pittsburgh streets shall be in full accordance with the City of Pittsburgh, Department of Public Works, Right of Way Procedures Manual (January 2015 with updates if applicable).

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver geotextile materials to the project site in original packaging with the manufacturer's labels containing the brand name and type of material. Store geotextile materials and other paving fabrics in accordance with Section 735 in the most current edition of PennDOT Publication 408.

B. The temperature of the hot-mix asphalt paving mix being delivered shall not be more than fifteen (15) degrees below the minimum temperature shown on the material supplier's Bill of Lading and not above the maximum specified temperature.

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1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply bituminous materials, geotextiles or paving fabrics unless the following requirements are met:

1. The subbase or existing bituminous material is dry as determined by the Owner.
2. The existing pavement has been cleaned in accordance with Section 401 of the most current edition of PennDOT Publication 408.
3. Tack Coat: Minimum air and surface temperature of 40 degrees F and rising in accordance with Section 460 in the most current edition of PennDOT Publication 408.
4. Bituminous Base Course: Minimum surface and air temperature of 35 degrees F and rising at time of placement in accordance with Section 305 in the most current edition of PennDOT Publication 408.

5. Superpave Bituminous Binder and Wearing Surface: Minimum surface and air temperature of 40 degrees F and rising at time of placement in accordance with Section 409 in the most current edition of PennDOT Publication 408. Binder and wearing courses shall not be installed between October 31 and April 1 without written permission of the Owner.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. Coarse Aggregate: Shall conform to the requirements in Sections 401 and 703 in the most current edition of PennDOT Publication 408.

B. Fine Aggregate: Shall conform to the requirements in Sections 401 and 703 in the most current edition of PennDOT Publication 408.

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2.2 ASPHALT PAVING MATERIALS

A. Asphalt Cement: Shall conform to the requirements in Section 702 in the most current edition of PennDOT Publication 408 for AASHTO MP1, PG 64-22.

B. Tack Coat: Shall conform to the requirements in Section 460 in the most current edition of PennDOT Publication 408 for emulsified asphalt, Class AE-T.

C. Superpave Base, Binder and Wearing Surface: Superpave Asphalt Mixture Design, , PG 64-22, 0 to 0.3 million ESAL's, 9.5, 19 and 25 mm mix complying with the requirements in Section 409 in the most current edition of PennDOT Publication 408. The bituminous wearing surface shall incorporate coarse aggregate having a Skid Resistance Level (SRL) designation of "H" or better, supplied from sources approved for this classification as defined and listed in PennDOT Bulletin No. 14.

D. Joint Sealant: Shall conform to the requirements for AET emulsified asphalt in Section 401 in the most current edition of PennDOT Publication 408.

E. City Asphalt Paving Materials: Shall conform to City of Pittsburgh, Department of Public Works, Right of Way Procedures Manual (January 2015 with updates if applicable).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subbase and existing bituminous paving is dry and in suitable condition to support paving and imposed loads.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot mix asphalt surface course to level sags and fill depressions in existing pavements.

B. Crack and Joint Filling: Complete in accordance with the specifications of Section 469 of the most current editions of PennDOT Publication 408.

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3.3 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade and all existing bituminous material are ready to receive paving.

1. Clean existing pavement surface of loose and deleterious material immediately before installing any bituminous material or paving fabric. Cleaning shall be completed with a power broom or mechanical sweepers capable of collecting the material and disposing of it offsite. If, in the opinion of the Owner the cleaning is not adequate, the Contractor shall repeat the procedure until it is deemed satisfactory.
2. All joints in existing concrete pavements and all larger cracks in bituminous pavement (1/2" wide or larger) shall be thoroughly cleaned to a depth of one (1) inch and filled with an approved sand and asphalt grout mix.
3. The existing pavement surface shall be brought to a uniform grade and cross section as specified. The surface of the existing pavement shall be brought to the same transverse slope and longitudinal cross section as the finished pavement section using scratch coat of bituminous binder at a variable thickness.

B. Tack Coat: Apply in accordance with the specifications in Section 460 of the most current edition of PennDOT Publication 408, not exceeding 0.02 gallon per square yard variation.

1. The tack coat shall be applied at the specified rate and uniform manner of 0.02 to 0.07 gallon per square yard at a surface temperature of 40 degrees and rising.
2. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
3. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
4. The tack coat shall be applied to all paving areas of the cartway, driveway edges, catch basins, inlets, manholes, curbs and utility boxes.

C. After the subgrade and/or existing pavement surfaces have been prepared as specified herein, the Contractor shall check all frames, covers, grates, water valve boxes and all other miscellaneous castings that are located in the proposed pavement area to insure that all such items have been accurately positioned and set to the proper slope and elevation. All covers and grates are to be set flush with the required finished pavement surface. No depressions or mounds will be permitted in the pavement to accommodate inaccuracies in the setting of these appurtenances. All corrective work that may be necessary shall be performed at the Contractor's sole cost and expense.

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D. Where new pavements are to meet existing pavements (except as specified herein under Bituminous Concrete Overlays), the Contractor shall line cut the existing pavements with an approved pneumatic, saw cutting or mechanical cutting tool so that there will be a vertical butting surface between the old and new pavements. There shall be a one (1) foot offset in each pavement course to permit each successive course to overlap the lower existing course. Line cutting of existing pavements shall be along neat, straight and even lines, and shall be performed in such a manner so as not to damage the adjacent pavement to remain. The Owner shall approve the acceptability of the line cutting device and the method of operation prior to new asphalt placement.

E. All vertical surfaces of curbs, structures, gutters, and existing pavement in contact with new bituminous mixtures shall be painted with a uniform coating of an approved bituminous emulsion or priming material. Extreme care shall be exercised in the application of this material to prevent splattering or staining of surfaces that are to remain exposed. Work that is stained as a result of the Contractor's operations shall be repaired and/or replaced at the Contractor's sole cost and expenses.

F. For milling operations, the Contractor shall provide a milling machine designed and built for milling existing bituminous pavements with an automatic grade and slope control system. The Contractor shall mill to provide a finished surface free from gouges, grooves and ridges and that conforms to the surface tolerance requirements of Section 409.3(l) in the most current edition of PennDOT Publication 408. Immediately after milling, remove milled material. When indicated that milled material is to be retained by the Contractor, satisfactorily dispose of milled material at an approved off-site facility off the Owner’s property immediately after milling. When indicated that milled material is to be retained by the Owner, deliver milled material to the designated stockpiling location immediately after milling. Carefully remove the existing bituminous material around utility facilities within work areas. Repair or replace utility facilities damaged by the milling operation to the satisfaction of the Facility Owner at no additional cost to the Owner. Control the rate of milling to avoid tearing of the mat. If directed, separate oversized and chunky milled material. Maintain the milled surface free of all loose materials and dust. Place the first overlaying bituminous course within five (5) calendar days from the start of milling operations. Failure to overlay a milled section of roadway within five (5) calendar days will result in a penalty of five hundred ($ 500.00) dollars per calendar day until overlay operations begin. Work stoppages caused by the Owner, Facility Owners, and documented weather delays will not count towards the five (5) calendar days for calculating the penalty.

G. The Contractor shall cut or mill keyway into the existing pavement to provide a tight, smooth joint. The keyway length shall be a minimum of fifteen (15) feet per inch of vertical change or as directed by the Owner.

H. Milling operations conducted on City of Pittsburgh primary and secondary streets shall follow all utility paving specifications listed in the City of Pittsburgh, Department of Public Works, Right of Way Procedures Manual (January 2015 with updates if applicable) at no additional cost to the Owner.

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3.4 HOT MIX ASPHALT PAVING EQUIPMENT

A. Trucks: Trucks used to transport hot mix bituminous material to the project site shall conform to Section 401.0(c) in the most current edition of PennDOT Publication 408.

3.5 HOT MIX ASPHALT MATERIAL INSTALLATION

A. Place the bituminous paving material in accordance to the Details and PennDOT Publication 408.

B. Install the bituminous materials in accordance with the following:

1. All hot mix asphalt materials shall be installed in accordance with the most current edition of PennDOT Publication 408.
2. Do not place bituminous paving when the surface is wet or when its air or surface temperature is less than 40 degrees Fahrenheit.
3. No hot mix asphalt material shall be installed if the temperature of the material is less than 275 degrees Fahrenheit or greater than 325 degrees Fahrenheit. All temperatures must be shown on the Bill of Lading. If these requirements are not met, the bituminous material shall be rejected and removed from the project site.
4. All asphalt trucks are to remain covered and/or tarped until ready to dump into the paver. Any truck with an uncovered partial load waiting for unloading will not be permitted to dump into the paver.
5. No traffic shall be permitted on newly compacted hot mix asphalt material until its temperature is lower then 140 degrees F.
6. No kerosene is to be used on the paving equipment.
7. The edge of the overlay shall be sealed with PG 64-22 twelve (12”)-inches wide with six (6”)-inches on the overlay and six (6”)-inches on the existing pavement.
8. A twelve (12”)-inch pass of PG 64-22 shall be placed along concrete curbs and the gutter section of bituminous curbs. Sand gutter line when sealing past driveways and sidewalks and at all roadway joints in order to prevent tracking.
9. All sealing must be completed within two (2) working days after completion of asphalt placement.

3.6 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with the same texture and smoothness as adjacent sections of the hot mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of six (6”)-inches.
3. Offset transverse joints, in successive courses, a minimum twenty four (24”)-inches.
4. Construct transverse and longitudinal joints per the most current edition of PennDOT Publication 408.

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B. Install Joint Sealant in accordance with the following:

1. All edges of the new pavement, including around inlet, manhole and utility box castings shall be sealed with PG 64-22.
2. On pavements with bituminous wedge curbs, apply PG 64-22 twelve (12")-wide with four (4")-inches applied to the wedge curb.
3. On pavements with concrete curbs, apply PG 64-22 twelve (12")-inches with two (2")-inches applied to the inside face of the curb.
4. All joints at driveways and sidewalks shall be sanded to prevent tracking.
5. All joints shall be sealed within two (2) working days of completion of asphalt placement.

3.7 COMPACTION

A. Complete compaction as per the specifications in Section 401 in the most current edition of PennDOT Publication 408.

B. Compact hot mix asphalt paving with hot, hand tampers or vibratory compactors in areas inaccessible to rollers.

C. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot mix asphalt. Compact by rolling to the specified density and surface smoothness.

D. Erect barricades to protect paving from traffic until the mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

A. Thickness: In accordance with Section 401 in the most current edition of PennDOT Publication 408.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base and Binder Course: 1/4 inch
2. Wearing Surface: 1/8 inch

C. Crowned Surfaces: Test using appropriate methods and procedures acceptable to the Owner to insure the required crown cross section is obtained.

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3.9 FIELD QUALITY CONTROL

A. Hot Mix Asphalt Pavement: The testing agency shall conduct compaction and depth tests as follows:

1. The Contractor shall be required to provide tests for density for all layers of bituminous material by following the requirements set for in Section 409.9b HMA in the most current edition of PennDOT Publication 408 for nuclear gage testing. The test shall be performed by a licensed nuclear gage operator as witnessed by the Owner utilizing the following procedure set forth in Section 409 in the most current edition of PennDOT Publication 408. The Contractor shall complete the following with regards to density testing:

    a. Use a nuclear gage meeting the requirements of PTM No 402.
    b. Use a nuclear gage calibrated in accordance with AASHTO Test Method T-238-86. Submit certification of annual calibration of gages and documentation of licensed operators training to the Owner prior to the placement of any material.
    c. Use the control strip technique specified in PTM No. 402, Section 7.2.3., to determine the optimum rolling pattern for each material course. Record all counts and plot the rolling pattern growth curve on form TR 4276-B.
    d. The Contractor shall submit the testing results to the Owner on a daily basis.

2. The Contractor will be paid for material placed based on the above required testing and in accordance with the most current edition of PennDOT Publication 408. The Owner retains the right to verify density testing in accordance with the above testing procedure in order to confirm the results.

3.10 TEST FOR SURFACE IRREGULARITIES

A. Use a template cut to the required cross section of the finished base course. Equip the template with metal or other vertical extensions attached to each end, so the bottom of the template will be at the elevation of the top of the base course. Test the cross section for surface irregularities at intervals of not more than twenty (25) feet

B. Use a ten (10) foot straight edge to test for longitudinal irregularities in the surface of the base course. Hold the straight edge parallel to the road centerline in contact with the surface. Move the straight edge from one side of the base course to the other. Advance along the base course in five (5) foot increments.

C. Correct all surface irregularities exceeding one-half (1/2”)-inch loosening the surface and removing or adding material as required. Compact the repaired area and surrounding surface by rolling.

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D. Tests for Materials

1. All materials used in permanent pavement construction shall be subject to all testing and certifications as required by the PennDOT procedures and regulations. All tests shall be performed by the Contractor, his suppliers or independent testing laboratories, at no cost additional cost to the Owner.
2. Aggregate - Supplier's certifications, plus one (1) grab sample per ten thousand (10,000) produced tons to be tested by an independent laboratory.
3. Hot Mix Asphalt Materials - Daily plant certification plus one (1) grab sample per day for each type of material placed for an extraction test by an independent testing laboratory.
4. The City reserves the right to test the paving material at the Asphalt Testing Laboratory located at 4501 Centre Avenue, Pittsburgh, PA.

END OF SECTION 02741

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SECTION 02743 – DRIVEWAY RESTORATION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Bituminous driveway restoration.
2. Concrete driveway restoration.
3. Stone or aggregate driveway restoration.

B. Related Sections include the following:

1. Division 2 Section “Earthwork” for aggregate subbase and base courses.
2. Division 2 Section “Hot Mix Asphalt Paving” for bituminous asphalt pavement.
3. Division 2 Section “Cement Concrete Pavement” for concrete pavement.

1.3 DEFINITIONS

A. Hot Mix Bituminous Paving Terminology: Refer to ASTM D 8 for definitions of terms.

B. PennDOT.: Pennsylvania Department of Transportation

PART 2 - PRODUCTS

2.1 BITUMINOUS DRIVEWAY RESTORATION

A. All products shall conform with the materials listed in Section 02741 “Hot Mix Asphalt Paving” for the installation of bituminous materials

2.2 CONCRETE DRIVEWAY RESTORATION

A. All products shall conform to the materials listed in Section 02751 “Cement Concrete Pavement” for the installation of concrete material.

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2.3 STONE OR AGGREGATE DRIVEWAY RESTORATION

A. All products shall conform to aggregate materials listed in Section 02741 “Hot Mix Asphalt Paving” for the installation of stone or aggregate material.

PART 3 - EXECUTION

3.1 BITUMINOUS DRIVEWAY RESTORATION

A. The Contractor shall prepare the edge of the existing driveway by saw cutting the pavement to achieve a straight edge, removing the asphalt material and subbase and hauling it to an approved offsite dump site.

B. The Contractor shall remove adequate existing driveway material to allow for the installation of the following: three (3) inches compacted depth PennDOT 2A limestone base; four (4) inches compacted depth 19.0 mm Superpave binder and one and a half (1 1/2) inches compacted depth 9.5 mm Superpave wearing course (0 to < 0.3 ESAL’s, PG 64-22, SRL “H” or better). The Contractor shall be directed by the Owner as to the limits of driveway removal required in order to achieve an adequate grade for a smooth transition.

C. The Contractor shall proof roll the subgrade material in accordance with Section 02741 “Hot Mix Asphalt Paving” prior to installing the aggregate base.

D. The Contractor shall install three (3) inches compacted depth of PennDOT 2A limestone base in accordance with Section 02741 “Hot Mix Asphalt Paving”.

E. The Contractor shall install four (4) inches compacted depth of 19.0 mm Superpave binder and one and a half (1 1/2) inches compacted depth of 9.5 mm Superpave Wearing Course in accordance with Section 02741“Hot Mix Asphalt Paving”.

F. The Contractor shall seal all new joints in the asphalt paving with PG 64-22 in accordance with Section 02741 “Hot Mix Asphalt Paving”.

3.2 CONCRETE DRIVEWAY RESTORATION

A. The Contractor shall remove the damaged existing concrete slab to the next existing joint or as directed by the Owner. The Contractor shall haul the removed material to an approved off-site dump.

B. The Contractor shall remove adequate existing driveway material to allow for the installation of four (4) inches compacted depth AASHTO #57 limestone base and six (6) inches of 4000 psi concrete. The Contractor will be directed by the Owner as to the limits of driveway removal required in order to achieve an adequate grade for a smooth transition.

C. The Contractor shall protect adjacent slabs from damage during restoration. Any damage to adjacent slabs shall be repaired at the Contractor’s sole cost and expense.

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D. The Contractor shall proof roll the subgrade material in accordance with Section 02751 "Cement Concrete Pavement" prior to installing the aggregate base.

E. The Contractor shall install four (4) inches compacted depth of AASHTO No. 57 limestone in accordance with Section 02751 "Cement Concrete Pavement".

F. The driveway shall be reinforced with welded wire fabric 6x6-W2.9xW2.9 (or most current designation) with a minimum cover of three (3) inches

G. The Contractor shall install six (6) inches of 4000 psi air entrained (5% +/- 1%) concrete in accordance with Section 2751 "Cement Concrete Pavement".

H. Driveways shall be neatly saw-cut prior to beginning restoration work. Saw cutting shall be included in the price of the driveway restoration.

I. Contraction joints shall be spaced at a maximum of five (5) foot intervals and formed with a device to have the completed joint at least ½" deep. Expansion joints shall be spaced no more than fifty (50) feet apart and formed with ¼" pre-molded filler to the full depth of the slab. The ¼" pre-molded filler shall also be placed adjacent to curbs, sidewalks, other driveways, manhole castings, buildings and pavements. If the driveway abuts a curb, the joints on the driveway shall match the joints on the curb.

J. The surface of the slab shall be brought to a uniform plane surface by means of a wood screed riding on forms. The surface shall then be finished with a wood or magnesium float and finished to match the existing concrete. The tool marks for joints and edges shall match the marks in the existing driveway. Neither dry cement nor water shall be added to the surface during the finishing process.

K. On any tooled joints or edges of concrete do not use the jointing or edging tool until the surface water has evaporated from the concrete. Bull float and broom the surface, finish the joint and edges and use the broom to remove the tool marks on the surface.

L. After placement, the concrete shall be cured per Section 02751 "Cement Concrete Pavement".

M. Sealing of Joints

1. All expansion joints and joints against structures shall be joints, both expansion shall be sealed.

2. The sealant shall be "Sikaflex-1A Polyurethane, Elastomeric Sealant/Adhesive" (or Owner approved equal). Sealant color shall be selected from the range of available colors by the Owner prior to application.

3. All joints must be sound, clean, dry and free from oil and grease. Curing compound residues and any foreign material must be thoroughly removed. A roughened surface will also enhance the bond. Install bond breaker tape or back rod to prevent bond at the base of the joint.

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4. Apply Sikaflex-1A at a temperature between forty (40) degrees Fahrenheit and one hundred (100) degrees Fahrenheit with a gun using the twenty (20) ounce "uni-pac" sausage.

N. Replace rain conductors in kind if found under a driveway. Place a piece of No. 9 gauge wire mesh reinforcing one (1) foot over the pipe for reinforcement. In addition, a construction joint shall be placed over the rain conductor location. No additional compensation will be considered for the removal and/or replacement of roof or driveway drains under the driveway.

O. Restore and/or raise to grade all gas valves, water valves, sewer vents, or other utility valve boxes encountered during driveway restoration. No additional compensation will be considered for work associated with this requirement.

P. Insulated protection of the concrete shall be required dependent on weather conditions at the time of pouring and during the curing period. A polyethylene plastic sheeting shall be considered as the adequate minimum protection required for concrete during adverse weather conditions. The Owner reserves the right to require additional protective measures such as blanketing. No additional compensation will be considered in the event protective measures above the minimum are required by the Owner.

3.3 STONE OR AGGREGATE DRIVEWAY RESTORATION

A. The Contractor shall install a minimum of six (6) inches of in kind stone or aggregate material. The gradation, color and texture of the replacement material shall match the existing material as closely as practical.

B. The Contractor will be directed by the Owner as to the limits of driveway removal required in order to achieve an adequate grade for a smooth transition.

END OF SECTION 02743

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SECTION 02764 - PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.
2. Joints between cement concrete and asphalt pavement.

B. Related Sections include the following:

1. Division 2 Section "Hot Mix Asphalt Paving" for constructing joints between concrete and asphalt pavement.
2. Division 2 Section "Cement Concrete Pavement" for constructing joints in concrete pavement.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

1. For primers and substrate preparation needed for adhesion.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for sealants.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

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1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 degrees F.
2. When joint substrates are wet or covered with frost.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles. Products not listed, but considered as “or equal” by the Contractor, may be submitted for review and approval by the Owner.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

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2.3 COLD-APPLIED JOINT SEALANTS

A. Grade NS Silicone Sealant for Concrete: Moisture-cured, one-component polyurethane-based, non-sag elastomeric sealant meeting Federal Specification TT-S-0023C, Type II, Class A; ASTM C-920, Type 6, Grade NS, Class 35 and certified to the NSF/ANSI Standard 61 for potable water.

B. Color: White, colonial white, aluminum gray, limestone, black, dark bronze, capitol tan, stone and medium bronze. Owner to select color prior to application.

2.4 HOT-APPLIED JOINT SEALANTS

A. Sealant for Concrete and Asphalt: Performance graded asphalt cement binder meeting AASHTO M320.

2.5 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.6 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of backer materials.
2. Do not stretch, twist, puncture, or tear backer materials.
3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

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E. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 02764

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DIVISION S

SUSTAINABLE LANDSCAPE DESIGN GUIDELINES

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DIVISION S

SUSTAINABLE LANDSCAPE DESIGN GUIDELINES

S.1 GENERAL

A. The University of Pittsburgh is dedicated to achieving a unified, safe, *sustainable campus landscape* at the Pittsburgh Oakland campus, and at the four Western Pennsylvania regional campuses, including the Pymatuning Laboratory of Ecology. These sustainable landscape design guidelines will help lead to the creation of campus landscapes that reflect the core values of the University, including a commitment to the health and well-being of the University community, the wise stewardship of its natural systems, a unified campus aesthetic brought about by integrating intrinsically beautiful natural systems into the dynamic, urban and suburban campus conditions, and by creating harmony with the historical architecture and culturally significant landscapes and places that comprise the University of Pittsburgh.

B. At the discretion of the University Of Pittsburgh Facilities Management Division, designers may be required to collaborate with the University in seeking SITES certification, http://www.sustainablesites.org/certification for specific projects. In addition, other sustainable initiatives, such as LEED (Leadership in Energy and Environmental Design), http://www.usgbc.org/leed, Living Building Challenge and Living Community Challenge (International Living Futures Institute), https://living-future.org may be considered.

C. These guidelines are not prescriptive, but, rather provide the designer with a framework of *best practices* and performance goals to create sustainable landscape design outcomes rather than prescribe specific solutions and technologies. The designer shall comply with these guidelines in the design of exterior landscapes at the Pittsburgh Oakland Campus, and the regional campuses at Bradford, Johnstown, Titusville, and Greensburg, and the Pymatuning Laboratory of Ecology. On some projects certain guidelines may or may not apply. In these cases the designer shall confirm which guidelines are applicable to specific projects with Facilities Management's designated project manager and the Senior Manager of Grounds.

D. These guidelines apply to design of landscapes only. Sustainable guidelines for construction activities, and operation and maintenance are not included in the scope of this document.

S.2 BENEFITS OF A SUSTAINABLE LANDSCAPE

A. Promote the University and attract and retain students and staff.

B. Conserve water, improve storm water management and soil health.

C. Attract pollinator insects and create wildlife habitats.

D. Reduce *heat island effect* by increased shade from tree canopies.

E. Increase biodiversity and biomass through use of native plants.

F. Reduce use of harmful chemicals, pesticides, and herbicides.

G. Reduce landscape maintenance costs.

H. Improve air quality and sequester carbon.

I. Provide edible plants for food.

J. Improve mental and physical health and well-being.

K. Create a living laboratory and outdoor classrooms for collaborative research.

L. Return benefits in the form of goods and services from healthy ecosystems, such as clean air and water, and healthy soil.

M. Project an image, vis-a-vis first impressions of the campus, of a caring, welcoming, innovative campus with a vision that includes sustainability.

N. Improve building energy efficiency.

O. Make a positive impression on alumni and donors.

P. Demonstrate innovative sustainable practices.

S.3 SUSTAINABLE LANDSCAPE DESIGN PRINCIPLES

A. Do no harm by avoiding changes to the site that will degrade the natural environment and promote reuse and improvement of sites with previous disturbance or development. Minimize site disturbance including earthwork and grading. Ensure future resource supply and mitigate climate change by conserving water, eliminating pollutants, and recycling.

B. Do not create risk to human and environmental health (the Precautionary Principle). Examine options, even if it means taking no action.

C. Support local sustainability policies and practices.

D. Let the principles of *sustainability* guide design decisions. Strive to support preservation, conservation, and regeneration. Maximize the benefits of *ecosystem services* by preserving existing environmental features, conserving resources, and regenerating lost or damaged ecosystem services.

E. Support a living process: A rain garden with plants and healthy soil cleans and recharges pollutant laden runoff better than a storm sewer system.

F. Consider *regenerative systems* that provide future generations with a sustainable environment. Encourage biodiversity; provide multiple ecosystem services such as cleaning air and water, providing *habitat* for plants, pollinator insects and wildlife, as well as storing carbon.

G. In surface parking lots strive to increase planting areas beyond municipal requirements to provide more pollinator plantings and bee nesting areas, and use storm water collection systems such as bioswales and vegetated islands to improve storm water management.

H. Collaborate with the University Facilities Management Division in the design decision process. The University shall determine the make-up of user groups who may participate in the design process such as: University staff, students, community groups, municipal and state officials, and other stakeholders.

I. Promote opportunities for education and research in sustainable land care, green infrastructure, and native plants. Utilize interpretive signage to educate the campus community and general public on sustainability practices.

J. Respond to principles of *Biophilia* (Pittsburgh is a Biophilic City) (http://biophiliccities.org/): Focus design on aspects of the natural world that have contributed to human health and productivity. Connect the human inherent need to affiliate with nature in the built environment. Explore inclusion of art in the landscape sensitive to harmony with natural systems.

K. Respond to principles of permaculture by developing opportunities for permanent edible landscapes. Strive to create food forests using native trees and shrubs such as: paw paw, persimmon, serviceberry, hazelnut, blueberry, strawberry, hickory, black walnut, American chestnut, black chokeberry, American plum, New Jersey tea, and indigenous viburnums.

L. Consider the principles of the Triple Bottom Line of Sustainability (people, planet, profit) in making design decisions (John Elkington, "Towards the Sustainable Corporation: Win-Win-Win Business Strategies for Sustainable Development," California Management Review 36, no. 2 (1994): 90-100.):

1. People - promote health and happiness, refuge, attraction of prospective students, relationship to adjacent neighborhoods and the City, crime prevention, traffic calming.

2. Planet - consider environmental impacts on the site; look at health of ecosystems, biodiversity, environmental pollutants such as ozone, Sulphur dioxide, nitrogen oxides, excessive soil nutrients, solid and hazardous waste management, invasive/noxious plants, impact on municipal infrastructure, storm sewer overflow.

3. Profit – examine the cost of excessive landscape maintenance, energy usage, cost of unnecessary chemicals, fertilizers, pesticides, herbicides, water usage. Look at cost of underemployment, job growth, job creation, taxes.

M. Promote functional plantings that provide shade to buildings and pavement, screen offensive views and frame quality views, direct pedestrian movement, block unfavorable winds and direct favorable winds. Select plants that require minimal pruning, cutback, and replanting.

1. Where appropriate, plant trees in staggered groups and groves to mimic natural woodland conditions. Honor and compliment historical design styles of architecture and landscape architecture as directed by University of Pittsburgh Facilities Management.

2. Limit large masses of single plant species.

3. Strive for a rich, diverse, composition of plants including canopy trees, understory trees, shrubs, and herbaceous plants. Maximize the types and numbers of understory, shrub and herbaceous/grass planting at transitional edge/ecotone conditions between woodlands and meadows or lawns.

N. Strive to create a unified aesthetic, with emphasis on simplicity, and contextual relationships to both the dynamic, urban environment of the Pittsburgh Oakland campus and the rural/suburban environments of the regional campuses, as well as the existing campus architecture and other campus cultural and landscape settings.

O. Strive to design landscapes that are easily maintained using the principles of sustainable landscape maintenance, such as NOFA (Northeast Organic Farm Associations of Connecticut) Standards for Land Care (http://www.nofamass.org). Reduce complex, time consuming maintenance processes and methods.

P. Strive to design a cost-effective landscape that addresses life-cycle costs.

Q. Use high quantities of native flowering perennials with large, vibrant, colorful flowers to maximize the visual impact of native plantings, especially from late April to early May and in mid to late August when Pitt students, families,

visitors, and prospective students are more likely to experience the outdoor landscape.

R. Support design decisions that reduce use of tall plants around foundation of buildings, especially where plants are a hindrance to the view of exceptional architecture. Do not obstruct windows or doors with plantings.

S. Consider reducing the use of plants for hedges that require excessive trimming. Separate plantings from walkways with appropriate plants that will not grow to impede pedestrian movement.

T. Strive to protect and enhance University of Pittsburgh campuses' ecosystem services which include goods and services of direct or indirect benefit such as:

1. Local and global climate regulation (shading, windbreaks, carbon sequestration).
2. Air and water cleansing (reduce pollutants in air and water).
3. Conservation and management of water and storm water runoff on site (improve ground water recharge).
4. Control of soil erosion and protection of soil.
5. Providing pollinator plantings for reproduction of plants and crops. Strive for 20% of planting area allotted for bee nesting habitat.
6. To increase ecosystem stability, protect existing wildlife habitat and create appropriate wildlife cover such as: non-hazardous *snags*, logs, dry-stacked stone walls, birds and bat houses, brush shelters, bee nesting blocks and boxes, and sand piles.
7. Encourage waste decomposition services through natural microbial activity and composting that recycle nutrients to soil on site.
8. Enhance human well-being through interaction with nature.
9. Produce food, fuel, and medicinal materials for human health from plants.

U. Review planting design concepts and designs with Campus Architect, Project Manager, Senior Manager of Grounds, and the University of Pittsburgh Police for safety and crime prevention goals.

V. Encourage the planting of deer resistant plants where necessary, particularly at regional campuses where destructive deer browsing is more likely. Control

mosquitos by grading and design that eliminates standing water conditions within the minimum mosquito breeding cycle of four days.

W. Strive to create an ecological "sense of place" based on the plants and rocks conspicuously identifiable as endemic to the local region. For example at the Oakland campus in Pittsburgh and the Greensburg campus, white oak, beech, sycamore, and fossiliferous Ames limestone and Pottsville quartz sandstone for use in hardscape (walls and pavement) would invoke an identifiable sense of place. Similarly, hemlock, beech, sugar maple, black birch, black cherry and Loyalhanna limestone would be identifiable with Johnstown, Bradford and Titusville regional campuses.

X. Include in the landscape design documents the requirement to enforce sustainability guidelines during construction and in operation and maintenance of sustainable landscapes. (Sustainable landscape guidelines for construction, operation and maintenance are Not included in scope of this document).

S.4 COMPLIANCE

A. Comply with Oakland Civic Center Designated Historic District review processes and requirements. (See map Appendix F)

B. Comply with or exceed applicable ordinances for landscaping and screening, street tree standards, landscaping for parking areas, and steep slope treatment in City of Pittsburgh Zoning Code, Title IX. (http://pittsburghpa.gov/dcp/zoning/zoning-code).

C. Honor and harmonize landscape design with historic architectural and landscape architectural context as identified by University of Pittsburgh Facilities Management Division. Review all designs with University of Pittsburgh Facilities Management Division, Senior Manager of Grounds.

D. Comply with PWSA, Allegheny County Conservation District, Pennsylvania Department of Environmental Protection (DEP), and Army Corps of Engineers regulations for storm water management, *Best Management Practices (BMP)* and soil erosion and sedimentation pollution control.

E. Respond to Sustainability, Tracking, Assessment, and Rating System (STARS) version 2.1 for Water Use (OP 22), Rainwater Management (OP 23), Landscape Management (OP9), Biodiversity (OP 10), and Campus as a Living Laboratory (AC 8).

F. Respond to best practices for sustainable landscape design contained in the Standards for Organic Land Care, Practices for the Design and Maintenance of Ecological Landscapes by the Northeast Organic Farming Association.

G. Deliver operations and maintenance manuals for specific sustainable landscape systems to University of Pittsburgh Facilities Management Division and the Senior Manager of Grounds.

S.5 DESIGN PROCESS REQUIREMENTS

A. Use the latest As-Built Topographic Survey and Property Survey of the project site that complies with the ASLA (American Society of Landscape Architects) requirements for as built topographic surveys, or as directed by University of Pittsburgh Facilities Management Division.

B. Strive to assemble an *integrated design team* consisting of design professionals who are knowledgeable in sustainable landscape design and construction practices and other professionals knowledgeable in vegetation, storm water and hydrologic engineering, soils, landscape ecology, historic buildings, sustainable use of materials, human health and well-being (as determined by the type of project).

C. Prepare a *Design Program* for the project that identifies design criteria and information such as: a hierarchy of needs, uses, activities, circulation, spatial relationships, and area requirements, among others, for the sustainable landscape design project as determined by the University of Pittsburgh and other stakeholders such as students, staff, local community and others. Include applicable sustainable design criteria, neighborhood adjacencies, relationships, and codes. Prepare a brief program narrative that succinctly states the design problem and objectives to solve it. Use an integrative and collaborative design approach. Identify project sustainability principles and performance goals.

D. Prepare a Site Analysis (see Pre-Design Site Assessment) that inventories the physical (natural) systems of the site, and social/cultural systems that apply to the project. Identify existing site factors, including but not limited to: ecosystems, vegetation, microclimate, soil, slope, drainage, wind, solar orientation, and shadows. Identify applicable pedestrian and vehicular circulation, historical features, and use areas. (See S-6, Pre-Design Site Assessment). Identify severe wind areas, noise and light pollution sources, traffic congestion, unsafe conditions, and drainage patterns and problem areas. Identify ecosystem services that apply to the site and prepare a brief narrative showing how these services can improve quality of life for students, faculty and staff, and the general community. Develop a map of opportunities and constraints for designing a sustainable landscape on the site.

E. Prepare a Conceptual Design that synthesizes the program with the opportunities and constraints of the site analysis. Prepare a conceptual design narrative that explains the concept.

F. Prepare a design development narrative that explains the design and describes the components and sustainable outcomes of the design.

S.6 PRE-DESIGN SITE ASSESSMENT

Map and assess existing site conditions and resources. Identify opportunities and constraints for sustainable landscape outcomes. Prepare a narrative and create a comprehensive map or individual maps at the same scale and orientation for each of the following (where applicable):

A. Site Context: Assess site location in relationship to community and connectivity including but not limited to: walkability, proximity to public transit, bicycle networks (if applicable).

B. Identify opportunities to protect and improve soil, water, and vegetative ecosystem services.

C. Hydrology (see Section S.8): identify existing hydrologic conditions including but not limited to: existing water courses, wetlands, FEMA 100-yr floodplain, topography/piped and surface drainage patterns, potential pollution sources, municipal storm water systems, and basement flooding conditions. Include data on local precipitation amounts. Discuss opportunities and constraints to employ Best Management Practices to capture and reuse rainwater.

D. Soils (see Section S.9): Identify existing healthy and disturbed soils. Identify slope gradient and orientation. Identify Soil Protection Zones that preserve healthy, permeable soils, and areas of compaction and erosion. Where feasible test soils and assess results of laboratory analysis related to organic matter content, compaction, infiltration, and soil chemical and biological characteristics. (Note: for previously developed sites or brownfield sites, comply with Federal and State laws and secure a certified environmental professional assessment for soil contamination testing and report on pollution by chlorinated pesticides and herbicides, lead, arsenic, heavy metals, airborne and other pollutants. Assess impact on public health for potential users of the site, and for on-site food production).

E. Vegetation (see Section S.10): If applicable, Identify existing vegetation, native plant community types of EPA level III *Ecoregion*, and habitats for state and federal threatened and endangered species. Inventory existing vegetation including native plant species and non-native plants species*, invasive plants*, plant communities, turf-grass and other monocultures, and data on individual tree specimens (measure tree trunk (*diameter at breast height DBH).* Identify plants and plant communities to be preserved. Discuss invasive plant removal

strategies, including removal of mature trees that are considered invasive. Consider risk of catastrophic wildfire. Identify vegetation protection zones.

F. Materials (see Section S.11): Identify and evaluate existing on-site materials such as walls, structures, features, paving, and other amenities for salvage, reuse, recycle, or safely leaving-in-place. Identify local suppliers of salvaged, recycled or reused materials, and potential sustainable suppliers and/or manufacturers of local or regional soil, plant, leaf compost, lumber, metal, stone and other materials.

G. Social Factors (see Section S.12): Identify social factors including but not limited to: cultural significance of existing historic buildings and structures, objects and cultural landscapes, views to and from the site, view corridors, site landmarks, off site connections and pedestrian routes, historic/special large shade trees, significant tree specimens, water features, natural and created, (note significance and/or special requirements or regulations).

H. Climate and Energy – Identify and discuss microclimate considerations such as wind directions, sun exposure and shade, partial shade and deep shade conditions, winter salt spray locations.

H. Bird-Building Collision Risk – Discuss risks of bird-building collision and steps to reduce risk in accordance with US Fish and Wildlife Service document, "Reducing Bird Collisions with Buildings and Building Glass Best Practices." (https://www.fws.gov/migratorybirds/pdf/management/reducingbirdcollisionswithbuildings.pdf.).

S.7 SITE CONTEXT - PITTSBURGH OAKLAND CAMPUS

A. Landscape Typologies – Refer to Appendix E, Pittsburgh Oakland Campus Landscapes Map for general types of landscapes that comprise the campus. Each landscape exhibits a character and a response to the existing urban and natural conditions that affect it. Based on these conditions certain, general sustainable design goals are identified for the landscape types.

1. Cathedral of Learning, Heinz Chapel, William Pitt Union Landscape:

a. High quality green space. Modified, historic quadrangles/pedestrian malls - Conform landscape design to existing historical and culturally significant architecture and landscape architecture and respect this highly visible and iconic landscape.

b. Where appropriate integrate native plants that will harmonize with historic character and existing functional and aesthetic uses of plantings.

c. Create opportunities for "low-impact, green" storm water infrastructure.

d. Introduce new, native trees and develop an age-structure of mature and young trees that addresses the on-going replacement of mature trees in decline.

e. Introduce *interpretive signage* to instruct and advocate for sustainable landscape design.

f. Maximize views to campus noteworthy architecture from surrounding streets, and maximize aesthetic impact of highly visible plantings.

g. Maximize accessibility and sense of welcome at pedestrian edges and entrances to this landscape.

2. Frick Fine Arts and Mervis Hall Landscape:

a. Same as Cathedral of Learning above.

b. Remove invasive plant species in adjacent wooded area between Joncaire Street and Frick Fine Arts Building.

c. Manage existing woods to restore to native woodland.

3. Hillman Library and Posvar Hall Landscape:

a. Large plazas - reduce paved, impervious pedestrian and vehicular surfaces.

b. Increase plantings along streets. Group trees and create understory plantings where possible.

c. Large roof areas - explore opportunities for roof gardens.

d. Pedestrian mall – maintain spatial quality, reduce pavement, introduce informal groupings of native trees.

e. Seek out and evaluate opportunities to replace lawn with native plantings.

4. High Density, Academic - Medical Landscape:

a. Sidewalk, streetscape-dominated environments – increase tree canopy with young, native trees. Increase root growing zone under trees in sidewalks. Consider removing unhealthy, non-native trees and shrubs where applicable.

b. At sloped lawn areas adjacent to sidewalks - reduce lawn and replace with native herbaceous and grass plants.

c. Consider opportunities for extensive green roof system on existing building roofs – using low depth soil with sedums and grasses.

d. Maximize pervious areas of native plantings in courtyard spaces.

5. Eberly Hall – University Drive Landscape:

a. Steep hillside landscapes – reduce lawn on steep slopes and introduce native canopy and understory trees to create wooded slopes. Integrate *successional vegetation* to gradually return grass slopes to woodlands/urban forests.

b. Remove invasive plants on hillsides and replace with successional plantings that will evolve into native woodlands.

c. Reduce paved, impervious surfaces where possible.

d. Remove pavement in surface parking areas where possible and introduce native trees and native pollinator perennial/grass plantings.

e. Incorporate DEP Best Management Practices such as bioswales and rain gardens at foot of hillsides to intercept runoff.

6. Sutherland Hall and Allequippa Street (O/C) Parking Lot Landscape:

a. Reduce lawn and pavement at building entry plazas where feasible. Replace with native plantings to create shade and or capture runoff.

b. Large surface parking areas – reduce heat island effect by introducing native canopy trees to create shade, and native pollinator perennial/grass plantings to improve storm water management through bio-retention strategies.

c. Steep hillside landscapes – reduce lawn and remove/manage invasive plants on steep slopes, and introduce native canopy and understory trees to create wooded slopes. Integrate successional vegetation to gradually return grass slopes to woodlands.

d. Incorporate bioswales and rain gardens at foot of hillsides to intercept runoff.

7. Petersen Events Center and Fitzgerald Fieldhouse Landscape:

   a. Existing wooded areas and scattered tree plantings – opportunity to manage and evolve into native woodlands.

   b. Recreational open space – use lawn areas for recreational activities. Replace unnecessary lawn areas with native plant communities such as successional woodland and meadows, and/or create non-mown edges and areas within existing lawns.

   c. Pedestrian plazas at building entry points – Increase tree canopy and reduce lawn and non-native shrub massing where possible. Replace with native herbaceous and grass plantings.

   c. Replace mulched hillsides with native tree/successional plantings.

   d. Incorporate bioswales and rain gardens at foot of hillsides to intercept runoff.

8. Multi-Unit Residential Landscape:

   a. Reduce lawn areas on hillsides and other areas where lawn is not needed. Replace with native herbaceous plants communities.

   b. Look for opportunities to replace non-native shrub/mulch plantings with native plant communities.

9. Petersen Sports Complex and Trees Field

   a. Steep hillside landscapes inundated with invasive plant species occupy the fill embankments between the sports fields and adjacent streets.

   b. Remove/manage invasive plants on steep, wooded slopes, and introduce successional vegetation to gradually return grass slopes to native woodlands/urban forests.

   c. Extensive retaining wall systems surround large areas of sports fields. Opportunity to reduce heat island effect reflectance by introducing vertical planting systems, both edible and inedible.

10. Site Context – All Campuses

   a. Enhance edges and entrances from surrounding community/urban framework to create visually positive,

welcoming image to pedestrian and visitors to the campus.

b. Re-establish areas of vegetated floodplain on brownfield or previously developed sites and manage invasive plant species where necessary.

c. Identify Vegetation and Soil Protection Zones.

d. Identify, protect, and conserve aquatic ecosystems including wetlands (Riverine, Lacustrine, palustrine). Prohibit development on wetland sites.

e. Conserve habitats for threatened and endangered species, including the recently listed rusty patched bumble bee (Bombus affinis).

f. Give preference to redeveloping degraded sites. Reduce pressure on undeveloped land and restore ecosystem services to damaged sites.

g. Locate projects within existing developed areas instead of undeveloped areas.

S.8 SUSTAINABLE LANDSCAPE DESIGN - WATER

A. Strive to replicate natural hydrologic conditions and manage precipitation on site by exceeding the requirements for low impact development and conservation design as outlined in the latest edition of the Pennsylvania Storm Water Best Management Practices Manual. For State BMP's refer to PA DEP website: http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-8305.

B. Address storm water management and watershed analysis on a case by case basis. Support strategies to manage storm water on site, promote on-site infiltration, increase evapotranspiration, and reduce precipitation runoff volumes and pollutant discharges. Use plants and healthy soils as filters, such as *bioswales* and *rain gardens*, constructed wetlands, *riparian buffers*, or simple shallow depressions to intercept runoff. Select appropriate vegetation that will tolerate periods of precipitation inundation and drought. Select plants that reduce pollutant loading. For Federal storm water best practices refer to EPA LID website http://www.epa.gov/owow/NPS/lid/. For state regulations refer to Pennsylvania DEP Bureau of Watershed Management: http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/Facts/fs2248.htm

C. Protect and restore floodplain functions and provide riparian buffers 100 feet

wide minimum per PA DEP Riparian Forest Buffer Guidance on each side of streams. Locate projects on sites that do not contain any land in the 100-year floodplain. (http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-82308/394-5600-001.pdf).

D. Reduce impervious surfaces and consider opportunities for permeable pavement where applicable. Drain impervious surfaces into on-site landscape areas. Reduce storm water collection and removal from site. Avoid creating chutes off impervious surfaces that will cause erosion in the landscape areas.

E. Create living landscapes using soil and vegetation features such as vegetated roofs (http://www.greenroofs.org/), green walls, rain gardens, and bioswales.

F. Improve water retention quality of soil by addition of organic matter through addition of compost.

G. Use rainwater harvesting systems such as cisterns and ponds for plant irrigation and cooling tower and steam condensate makeup water. Reduce runoff volumes to municipal combined sewer systems.

H. Minimize material that could be a source of water pollutants such as treated lumber, galvanized steel, zinc, and copper materials. Minimize use of synthetic fertilizers, pesticides, herbicides, and de-icing salts that have adverse effects on plants.

I. Conserve water resources and minimize energy use by reducing or eliminating the use of potable water, natural surface water, and ground water/well withdrawals for landscape irrigation after the establishment period. Provide temporary irrigation for plants only during the establishment period. Hand watering during establishment of new plantings is preferred.

J. Plant during the optimal planting season to minimize use of excess water for irrigating plants.

K. Use low-water-use native plant species that will thrive in the Pittsburgh, PA climate with approximately 40" of annual rainfall.

L. Re-use grey water that meets local and state regulations. Re-use captured water, and condensate water where applicable.

M. Through on-site infiltration, evapotranspiration, and harvest use, retain or treat the maximum precipitation volume possible beyond the 60th percentile precipitation event.

N. Consider the design and maintenance of water features as amenities with natural ecosystems, water sources, and native plant communities. Employ low impact development strategies and Best Management Practices that emphasize

site design to mimic natural infiltration. Locate storm water amenities where they are highly visible to maximize human interaction, educational, and health and well-being opportunities.

O. Restore and protect aquatic ecosystems such as the Tunungwant Creek trout habitat at the University of Pittsburgh Bradford campus, or where applicable. Develop restoration and management practices that accommodate natural materials, natural processes, and re-establishment of native plant and animal habitats.

P. Minimize use of turf-grasses and select species with improved disease and insect resistance and lower water and fertilization after establishment.

Q. Rehabilitate lost or degraded stream channels, wetlands and associated native plant communities. Protect riparian and shoreline buffers where required by law and/or where feasible exceed requirements.

R. Encourage the use of educational/interpretive signage explaining hydrological and water conservation systems.

S.9 SUSTAINABLE LANDSCAPE DESIGN - SOILS

A. Support healthy plants, biological communities, and water storage and infiltration by restoring damaged soils, protecting healthy soils, and by limiting soil disturbance during construction.

B. Healthy soil provides ecosystem services in the form of water infiltration and filtration, carbon sequestration, increased vegetation biomass, reduction in potable water usage for irrigation and reduction in fertilizer and pesticide use. Healthy soil implies no disturbance/contamination from human development; soil horizons, *organic matter* content, cation exchange, and *bulk densities* are similar to referenced soil (as defined in appropriate Pennsylvania County Soil Survey); and presence of native plant communities are indicative of reference soil.

C. Maintain healthy soil ecosystems by preventing soil compaction, chemical contamination, avoiding excessively steep slopes, and by preventing the loss of organic matter and biological activity in the soil.

D. Identify and protect healthy soils and vegetation by mapping soils and creating *soil protection zones* that prevent disturbance during construction. Use fences or other physical barriers to create boundaries and prevent intrusion.

E. Limit/eliminate soil compaction. Where feasible, till or aerate compacted soil, or remove if necessary. Consider reusing compacted soil in earth mounds on site.

F. Salvage healthy top soil from site construction areas. Completely remove topsoil in the upper most soil horizon and avoid mixing with subsoil. Stockpile topsoil and protect from erosion in accordance with Soil Erosion and Sedimentation Pollution Control Plan (approved by County Conservation District).

G. Comply with Environmental Assessments (performed by others as directed by University Facilities Management) that identify contaminated soils and treatment of those soils

H. Where feasible test soils in order to determine chemical properties, classification, contaminants, organic matter and nutrient content in planting areas.

I. Restore *severely disturbed soils* resulting from construction or previous development. Restore soils to minimum 12" depth by amending with organic matter, tilling or ripping to reduce compaction and restoring nutrient profile of the soil.

K. Amend topsoil with *mature stable compost* from local sustainable and renewable sources, and with organic matter comprising 1-5% by weight of the topsoil. Amend topsoil on-site.

1. Compost shall have a carbon-to-nitrogen ratio below 25:1, pollutant concentration limits below US EPA regulations, and no viable weed seeds or invasive plant propagules.

L. Where feasible, balance quantities of cut and fill in the grading of the site and reuse existing soils in design instead of importing soils. Protect stockpiled soil by seeding or covering. Provide erosion and sedimentation pollution controls and best management practices in accordance with local and state laws.

S.10 SUSTAINABLE LANDSCAPE DESIGN - VEGETATION AND PLANTING

A. Non-native, invasive plants are expressly prohibited. Use native, *appropriate plant species*. Non-native, non-invasive plants are permitted on a case by case basis as determined by the University Senior Manager of Grounds. See Appendix B for recommended list of native plants, and http://www.dcnr.state.pa.us/forestry/plants/nativeplants/index. Also see "Terrestrial and Palustrine Plant Communities of Pennsylvania:" http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_001872.pdf

B. Use of appropriate native plants provides ecosystem services such as pollutant interception, water management, habitat for pollinator species, and aesthetic

and educational value. The use of native plants improves biodiversity by increasing vegetative cover, reducing pesticide use, conserving water, and reducing energy costs. Conserve and/or preserve existing native and high value plantings.

C. Reduce use of non-native, non-appropriate resource-intensive plantings. Reduce use of unnecessary, non-functional, turf-grass lawn areas by converting these areas to meadows or other types of native plant communities.

1. Remove existing lawn by sheet mulching (applying two to three layers of moistened, corrugated cardboard. Cover cardboard with a 2-3"layer of composted leaves. Leave cardboard in place until lawn grasses and weeds are smothered and killed).

2. Tilling, stripping and use of herbicides are prohibited.

D. Preserve existing native vegetation, especially high priority, healthy, mature trees and native plant communities. Allow *snags* to stand where they do not pose a hazard. Preserve historic, aesthetic, culturally significant vegetation, unless it is invasive.

1. Protect trees over 24" diameter above breast height (DBH) and native trees that are part of a forest community or woodlot.

2. Avoid locating buildings, pavement and general development around high priority trees. Avoid locating construction staging areas near same.

3. Provide tree protection fencing around the drip line of the existing tree canopy or 1.5 feet per each inch of trunk diameter (DBH). No construction work shall begin until tree protection fencing is in place. Fencing shall be maintained for the duration of the project.

E. *Control invasives* - by preventing, detecting, and managing invasive plants within the project area. Where feasible, identify and remove invasive species within the project area and coordinate with University Senior Manager of Grounds. See Pennsylvania DCNR Invasive Plant List, Appendix C, and http://www.dcnr.state.pa.us/forestry/plants/invasiveplants/.

F. Maintain and protect existing historic landscapes and plantings during construction, except invasive plants.

G. Comply with City of Pittsburgh and/or other municipalities at regional campuses - street tree planting regulations and standards. For example, in the City of Pittsburgh 30 SF is required for street tree planting area within sidewalks alongside streets. Strive to exceed municipal street tree for planting area and number of trees required. Coordinate tree and light pole locations to minimize tree canopy interference with street and pedestrian lighting.

H. Incorporate edible plantings where appropriate. Coordinate with University for soil testing and research on the historical use of a site that is under consideration for locating edible plantings. Consider alternative spaces for food production such as raised beds and containers where soils are known to be contaminated and have not been remediated.

I. Use appropriate native plants preferably designed to function as plant communities that will thrive in the climate and conditions of the EPA Level III Ecoregion: https://nctc.fws.gov/courses/csp/csp3200/resources/documents/epa_region_3_eco_desc.pdf. Also, see Appendix D, (Pennsylvania Ecoregions) showing where the campuses are located: University of Pittsburgh Oakland campus - Ecoregion 70c, Pittsburgh Low Plateau; University of Pittsburgh, Bradford - 62d, Glaciated Allegheny High Plateau; University of Pittsburgh, Johnstown - 69b, Uplands and Valleys of Mixed Land Use; University of Pittsburgh at Titusville - 62d; University of Pittsburgh at Greensburg - 70b, Monongahela Transition Zone; Pymatuning Laboratory of Ecology - 61b, Mosquito Creek/Pymatuning Lake Lowlands.

1. *Native plant communities* are assemblages of plant species whose composition and structure is typical of indigenous plant communities in a particular Ecoregion. Native plants are adapted to a particular region and maintain an evolved ecosystem of animals, microbes, and plants that grow best in a particular soil and climate. Hybrids, varieties, and cultivars of species native to this ecoregion are acceptable, too. Native plant communities include: wetlands, woodlands, woodland edges, grasslands, riparian buffers, successional old fields and woodland meadows. These areas may be further divided into specific terrestrial and palustrine plant communities (Terrestrial & Palustrine Plant Communities of Pennsylvania, by Joan Fike, Pennsylvania Natural Diversity Inventory). Some examples of native plant communities that she has identified include:

    a. Mixed Mesophytic Forest of the Appalachian Plateau

    b. Northern Hardwood Forest

    C. Sugar Maple Basswood Forest and Red Maple Forest

    d. Tuliptree-Beech-Maple Forest

    e. Red Oak, Mixed Hardwood Forest

    f. Dry Oak - Mixed Hardwood Forest

    g. Side-Oats - Gramma Calcareous grassland

h. Birch-Black Gum Rocky Slope Woodland

i. Dry White Pine, Hemlock, Oak Forest

j. Red-Cedar – Redbud Shrub-land

k. Little Bluestem – Pennsylvania Sedge Opening

l. Bottomland Oak – Hardwood Palustrine Forest

m. Red Maple – Mixed Shrub Palustrine Woodland

J. Give preference to native species/cultivars of native species that have been propagated in a local nursery from plants and seeds originally found in a local ecoregion. Plants native to the Eastern North America and not known to be invasive are permitted. Non-native, non-invasive plant species appropriate to a particular ecosystem and microclimate are allowed on a case by case basis. Maximize the use of native plants grown from certified organic sources. Select native plants that match the site, soil, moisture requirements, growing conditions, and ecological characteristics of a particular site. Give preference to plants grown from certified organic sources.

1. Plants treated with neonicotinoids are prohibited due to their systemic nature and long persistence and, therefore harmful impacts on non-target organisms, most notably bees and other pollinators and beneficial insects.

2. Provide for appropriate spacing between plants to achieve full coverage at maturity. Select plants that require minimal pruning and/or shearing and maintenance requirements.

K. Lawns and Lawn Alternatives:

1. Use cool season, sod-forming lawn grasses for recreation, athletic and special use areas, only. Limit the area of lawn as much as possible.

2. Use disease and insect-resistant grass seed cultivars with a variety of approved cultivars in the mix. Avoid a monoculture grass with only one species of grass used.

3. Mow to maintain a height of 3" or more. Mow to remove no more than one third the height of the grass leaf blade.

4. Pursue opportunities to leave areas of lawn un-mowed.

5. Tolerate weeds and nitrogen-fixing plants such as clover in the lawn.

6. Use lawn alternatives, such as "No Mow" seed mixes consisting of various species of fine fescues (festuca species) or Buffalo Grass (Bouteloua dactyloides).

7. Do not plant lawns in wetlands or riparian buffers.

8. Create lawn strips around native, naturalistic plantings to project an image of neatness and order.

9. Use native ground covers and low prostrate shrubs in place of lawns as a textural contrast and where and spatial and visual openness is desired.

L. Recommended Native Plant List (partial list). See Appendix B. Designer may supplement with other native plants and native plant cultivars subject to approval by University Senior Manager of Grounds. Use of non-native plants for certain historically and culturally significant conditions are subject to approval by University Senior Manager of Grounds.

M. Exceptions to the use of native plants:

1. Annual flowering plants for use in special planting arrangements to compliment certain architectural settings or cultural places.

2. Seasonal flowering bulbs such as daffodils and tulips.

3. Certain cultivars of native plants.

4. Special conditions such as green roofs or planters.

5. Edible, medicinal, or educational landscapes.

6. Non-native ornamental plants are permitted (subject to approval by University Senior Manager of Grounds) for use in harmonizing with existing historical architecture and/or cultural settings, special situations, unique events, memorial, dedications, commemorations and the like.

N. Use of synthetic fertilizers, pesticides, and herbicides is prohibited, except for starter fertilizer for use in establishing lawn grasses and the like.

O. Invasive Plants are strictly prohibited. (See Appendix C for Pennsylvania Department of Conservation and Natural Resources list of invasive species)

P. Permitted Soil Amendments:

1. Agricultural lime (dolomitic and calcitic)

2. Compost for use as mulch and as topsoil amendment shall be weed-free, organic matter source derived from agricultural, leaf, or yard trimmings, non-toxic to humans or plants and free of man-made foreign matter. Compost shall be certified by U.S. Composting Council's Seal of Testing Assurance Program.

3. *Compost tea* produced and applied in accordance with NOFA standards.

4. Cover crops and green manures, bone meal, fish hydrolysate, alfalfa meal. No more than 1 lb. of soluble nitrogen per 1000 sf of application.

5. Organic fertilizers and herbicides (allowed under National Organic Program)

Q. Mulching:

1. Mulch bare ground as soon as possible to prevent erosion and maintain until vegetative cover is achieved.

2. Provide a 3-4 inches layer around woody plants and 1-2 inches around herbaceous plantings.

3. Use compost certified by U.S. Composting Council's Seal of Testing Assurance Program, that exceeds EPA Class A standard 40 CFR for chemical contaminants and less than 1% physical contaminants - derived from partially decomposed leaves, un-composted, shredded leaves, and wood chips.

4. Shredded hardwood bark mulch is permitted around trees and shrubs only. Mulch volcanos at base of trees are prohibited. Dyed mulches and rubber mulches are prohibited.

R. Seasonal Interest: Design plantings for maximum color and interest when students are in classes on campus, and in the spring, especially late April and early May for graduation, and mid to late August (colloquially known as "Arrival Survival").

S. Sustainable Planting Design Documentation:

1. Planting Plan - delineating the layout of proposed, native plantings and planting details.

2. Plant List - with plant species botanical and common names, sizes, quantities, seeded areas, plant spacing and other remarks. Show existing and proposed topographic contours, vegetation and soil protection zone boundaries surrounding new native plantings, as well as native plantings to be restored or preserved. Show proposed buildings, pavement, structures, fencing, and amenities, and include background as-built topographic survey information.

3. Existing Tree and Vegetation Plan - identifying existing trees and vegetation to be protected and/or preserved during construction.

4. Existing Tree Salvage and Demolition Plan - showing all trees and vegetation to be relocated and/or removed.

5. Plant Warranty: Contractor agrees to repair or replace planting material and accessories that fail in materials, workmanship, or growth within a one year period from date of substantial completion. Failures of plant growth/health include: death and unsatisfactory growth except for defects resulting from neglect by Owner, abuse or damage by others, or unusual phenomenon, acts of nature or incidents beyond the Contractor's control. Remove and replace dead or unhealthy plants during the warranty period. Plant at prescribed periods (i.e.: March 15 – May 15, and September 1 – October 15). Replace plants that are visibly unhealthy at end of warranty period. Provide extended warranty equal to original warranty for replacement plants. Warranty plants through one year period until final acceptance.

6. Initial Landscape Maintenance and Management: Begin initial maintenance immediately after planting. Maintenance period for all plants shall be one year. Provide maintenance by skilled employees of the contractor. Maintenance shall include weeding, watering, reseeding, replacing dead plans, mowing (use mulching mower), and mulching and any additional work in accordance with Designer's Landscape Management Plan.

7. Landscape Management Plan: – Prepare a Landscape Management Plan based on *NOFA Standards for Organic Land Care* that outlines initial and long-term performance standards for the holistic care of a landscape design project during and after installation.

S.11 SUSTAINABLE LANDSCAPE DESIGN - MATERIALS AND HARDSCAPE

A. Design to promote the use of material resources that are sourced and managed. Reuse salvaged materials. Where feasible a minimum of 20% of all materials, including plants used on site for landscaping should be salvaged materials.

B. Use regional materials. Where feasible, materials, plants, and soils should be sourced within the distances specified: soils and aggregates – 50 miles, plants – 250 miles, and other materials - 500 miles.

C. Where feasible, use sustainably harvested certified wood.

D. Where feasible, maintain or reuse existing structures, hardscape (walls and pavement), and landscape amenities such as benches, tables, and fountains.

E. Strive to *design for disassembly* for reuse and recycling.

F. Maximize use recycled content materials including compost and fertilizer made from recovered organic materials.

G. Where feasible, salvage and recycle construction, demolition, and land clearing waste.

H. Prohibit materials, including but not limited to: chemically treated wood and paper, dyed and chemically treated mulches, plastic and non-woven geotextile fabrics that contain PVC (polyvinyl chloride), synthetic burlaps, galvanized steel, mulch made from recycled rubber tires, synthetic fertilizer, synthetic pesticides and herbicides, sewage sludge, raw manure, triple superphosphate, muriate of potash, synthetically derived sulphates, calcium and magnesium, genetically modified seed.

I. Where feasible give preference to permeable pedestrian and vehicular pavement. Encourage use of *open grid pavement* in minimally used vehicular service pavement conditions.

J. Maximize use of hardscape materials with a minimum Solar Reflective Index of 29. (https://www.epa.gov/sites/production/files/2014-06/documents/coolpavescompendium.pdf).

K. Minimize use of retaining wall systems wherever possible. Select natural stone for use in retaining walls and curbs.

L. Maximize the use of excavated boulders in site landscaping. Do not haul from site.

M. Provide manufacturer's warranty (to University of Pittsburgh Facilities Management Division) for products and systems including but not limited to: permeable pavement systems and other hardscape pavement and wall systems, fences, railings, lighting, decking, shade structures, benches, seating, waste receptacles and the like used in site development.

S.12 SUSTAINABLE LANDSCAPE DESIGN - HUMAN HEALTH AND WELL BEING

A. Where directed by the University, design sustainable landscapes to consider the restorative and health benefits to the user. Gardens of all types, such as community gardens, contemplative gardens, roof gardens, courtyard gardens, vertical gardens, edible gardens, rain gardens, and the like promote community engagement, health and well-being, physical activity and mental restoration:

1. Provide outdoor spaces for various kinds of social interaction and connections to nature.

2. Enhance existing quality views and create new views throughout the landscape. Consider views from surrounding streets into the site as well as from the site to quality *viewsheds*.

4. Scrutinize landscape spaces, plantings and circulation routes to find ways to improve public safety.

B. Respect and protect significant historic and *cultural landscapes* as defined by the University.

1. Support social connections within the campus community by creating gathering and seating spaces for eating, studying, and working, but avoid conflict with University's mission, public safety, or where access could lead to damage of a particular landscape.

2. During site assessment/analysis process identify potentially quiet areas, places with good views, shade, and relaxing activity conducive to mental restoration.

C. Practice universal design to accommodate access by all.

1. Strive to exceed ADA accessibility requirements.

2. Conduct a *walkability audit* to assess the safety and desirability of walking routes.

3. Provide safe lighting levels of all outdoor public use landscape spaces and gardens that do not produce light pollution (comply with applicable codes). All outdoor lighting shall be dark sky compliant LED (***darksky****.org/lighting/lighting-basics*) in-ground luminaires and up lighting are prohibited.

4. Explore crime prevention issues related to the forms and hidden areas created by landscaping. Look for ways to allow the natural heights and forms of plants to remain when considering maintenance procedures.

D. Support outdoor physical activity.

1. Provide lawn spaces for outdoor physical activity and determine use areas for them in the program stage of the design process.

2. Design pathways along natural circulation routes that will discourage pedestrians from leaving paths and cutting corners. Provide paths that are appealing and comfortable for walkers. Provide physically challenging sections of walks where appropriate.

3. Provide places to seat spectators where there could be physical activity such as games and sports.

E. Maximize the use and placement of wayfinding signage and interpretive signage to inform and educate the users and general community about the benefits and workings of sustainable landscapes.

1. Where applicable, provide interpretive signage and individual plant labels identifying the genus and species of plants in sustainable plantings and provide educational signage describing the scientific and cultural background of a particular landscape.

2. Provide wayfinding signage that clearly directs users and visitors to pedestrian and transportation nodes, landscapes, buildings, historic and cultural locations, and other destinations.

F. There are many opportunities to create spaces in the landscape that promote health and well-being including:

1. Design a variety of smaller, restorative spaces located throughout a site rather than one large space. Where possible integrate outdoor landscapes with interior public spaces with windows to establish a connection to nature.

2. Locate landscape spaces away from noise sources and visual distractions such as traffic noise, mechanical systems and unsightly views. Mitigate unwanted noise by using earth mounds, and screen unsightly views with various types of vegetation.

3. Provide a variety of seating options including moveable seating.

4. Create sensory landscapes that focus on beautiful views, fragrant plants, and sound of water, colorful and texturally rich vegetation, and art.

S.13 REGIONAL CAMPUSES

A. In addition to the Pittsburgh campus, the preceding guidelines in their entirety shall also apply to the five Pitt regional campuses in Pennsylvania at: Bradford, Johnstown, Titusville, Greensburg, and the Pymatuning Laboratory of Ecology. Regional campuses and their primarily suburban locations present similar sustainable design challenges to the highly urban Oakland campus, but there are certain differences such as:

1. There are usually larger surface parking areas in relation to campus size. These surface parking areas require shading to reduce heat island effect.

2. Large surface parking areas require low impact, storm water management in conjunction with native plantings to capture and control runoff, particularly where the runoff is near riparian buffers along streams such as in Bradford and Greensburg.

3. Generally, there are larger, existing, woodland areas on the suburban campuses that should be preserved and expanded and integrated into the interiors of the campus. These wooded areas offer opportunities to expand existing native plant communities and create living laboratories.

4. Suburban campuses present unique challenges to preventing the spread of invasive plant species, because there are generally more invasive seed sources than urban areas.

5. Suburban campuses offer more area and more opportunities to recharge rainfall runoff than urban areas.

6. Comply with PA DEP regulations regarding riparian corridors/buffers for the Tunungwant Creek at University of Pittsburgh at Bradford, for Slate Creek at Pitt/Greensburg, and for the Shenango River at Pymatuning Laboratory of Ecology.

END OF DIVISION S

APPENDIX A.

PENNSYLVANIA INVASIVE PLANT LIST

(Pennsylvania Department of Conservation and Natural Resources)

Herbs and Forbs

COMMON NAME	SCIENTIFIC NAME	OTHER COMMON NAMES
Goutweed	Aegopodium podagraria	bishop's weed, snow-on-the-mountain
Garlic mustard	Alliaria petiolata	hedge mustard
Wild chervil	Anthriscus sylvestris	cow parsley, keck, bur chervil
Narrowleaf bittercress	Cardamine impatiens	bushy rock-cress
Musk thistle	Carduus nutans	nodding thistle
Brown knapweed	Centaurea jacea	horse-knobs, rayed knapweed
Black knapweed	Centaurea nigra	common knapweed, hardheads
Spotted knapweed	Centaurea stoebe	
Greater celandine	Chelidonium majus Tetterwort	
Canada thistle	Cirsium arvense	Canadian thistle
Bull thistle	Cirsium vulgare	
Poison hemlock	Conium maculatum	
Crown-vetch	Coronilla varia	
Jimsonweed	Datura stramonium	devil's trumpet, thorn apple
Hairy willow herb	Epilobium hirsutum	great willowherb
Hairy willowherb	Epilobium parviflorum	
Japanese knotweed	Fallopia japonica	fleeceflower, Mexican bamboo
Giant knotweed	Fallopia sachalinensis Sakhalin	knotweed
Goatsrue	Galega officinalis	professor-weed, Italian fitch
Giant hogweed	Heracleum mantegazzianum	giant cow parsnip or parsley
Dames rocket	Hesperis matronalis	dame's violet, dame's gillyflower
Yellow flag iris	Iris pseudacorus	
Moneywort	Lysimachia nummularia	creeping Jenny or Charlie
Purple loosestrife	Lythrum salicaria	swamp loosestrife
Star-of-Bethlehem	Ornithogalum nutans	silver bells, drooping star-of-Bethlehem
Wild parsnip	Pastinaca sativa	garden parsnip
Beefsteak plant	Perilla frutescens	Chinese basil, purple mint
Bristled knotweed	Persicaria longiseta	Asiatic smartweed
Lesser celandine	Ranunculus ficaria	fig buttercup, pilewort

Vines

Chocolate Vine	Akebia quinata	fiveleaf akebia, raisin vine
Porcelain berry	Ampelopsis brevipedunculata	Amur peppervine, porcelain vine
Oriental bittersweet	Celastrus orbiculatus	Asiatic or round-leaved bittersweet
Japanese hops	Humulus japonicus	
Wintercreeper	Euonymus fortunei	Climbing euonymus, fortune's spindle
English ivy	Hedera helix	Common ivy
Japanese honeysuckle	Lonicera japonica	Chinese honeysuckle
Mile-a-minute	Persicaria perfoliata	devil's tear-thumb
Kudzu	Pueraria lobata	vine that ate the South
Black swallow-wort	Vincetoxicum nigrum	Louise's swallow-wort
Pale swallow-wort	Vincetoxicum rossicum	European swallow-wort

APPENDIX A.

PENNSYLVANIA INVASIVE PLANT LIST

Trees

Norway maple	Acer platanoides	
Sycamore maple	Acer pseudoplatanus	
Tree of heaven	Ailanthus altissima	
Mimosa	Albizia julibrissin	Persian silk tree, silktree, silky acacia
European black alder	Alnus glutinosa	Common alder
Japanese angelica tree	Aralia elata	
Paulownia tomentosa	Empress tree	
Callery pear	Pyrus calleryana	
Siberian elm	Ulmus pumila	

Shrubs

Japanese barberry	Berberis thunbergii	red barberry
European barberry	Berberis vulgaris	common barberry
Russian olive	Elaeagnus angustifolia	oleaster, wild olive
Autumn olive	Elaeagnus umbellata	
Winged Euonymus	Euonymus alatus	burning bush
Glossy buckthorn	Frangula alnus	
Shrubby bushclover	Lespedeza bicolor	Shrubby lespedeza
Chinese bushclover	Lespedeza cuneata	Chinese Lespedeza
Japanese privet	Ligustrum japonicum	wax privet
Border privet	Ligustrum obtusifolium	regal privet
Chinese privet	Ligustrum sinense	
Common privet		
Amur honeysuckle	Lonicera maackii	
Morrow's honeysuckle	Lonicera morrowii	
Bell's honeysuckle	Lonicera xbella Bella	
Standish honeysuckle	Lonicera standishii	
Tartarian honeysuckle	Lonicera tatarica	
Common buckthorn	Rhamnus cathartica	purging buckthorn
Jetbead	Rhodotypos scandens	Black jetbead
Multiflora rose	Rosa multiflora	
Wineberry	Rubus phoenicolasius	
Japanese	Spiraea japonica	
Guelder rose	Viburnum opulus var. opulus	cranberrybush viburnum

Aquatic Plants

Carolina fanwort	Cabomba caroliniana	green Cabomba, fish grass
Didymo	Didymoshenia geminata	rock snot
Brazilian water-weed	Egeria densa	

APPENDIX A.

PENNSYLVANIA INVASIVE PLANT LIST

Hydrilla	verticillata	Esthwaite waterweed
Floating seedbox	Ludwigia peploides var.glabrescens	Water primrose
Parrot feather watermilfoil	Myriophyllum aquaticum	Parrotfeather
Eurasian water-milfoil	Myriophyllum spicatum	Eurasian milfoil, spike watermilfoil
Curly pondweed	Potamogeton crispus	crispy-leaved pondweed
European water chestnut	Trapa natans	devil pod
Narrow-leaved cattail	Typha angustifolia	narrow lead cattail, nail rod
Hybrid cattail	Typha x glauca	

Grasses

Poverty brome	Bromus sterilis	
Cheatgrass	Bromus tectorum	June grass
Japanese stiltgrass	Microstegium vimineum	Nepalese browntop, packing grass
Reed canary grass	Phalaris arundinacea	
Common reed	Phragmites australis ssp. australis	
Shattercane	Sorghum bicolor ssp. drummondii	
Johnson grass	Sorghum halepense	

Watch List

Amur maple	Acer ginnala	
Small carpetgrass	Arthraxon hispidus	Joint-head grass
Paper mulberry	Broussonetia papyrifera	
Butterfly bush	Buddleja davidii	Orange-eye butterfly bush
Orange day-lily	Hemerocallis fulva	
Velvet grass	Holcus lanatus Yorkshire fog	
Chinese silvergrass	Miscanthus sinensis	Eulalia, zebra grass, maidenhair grass
White mulberry	Morus alba	Chinese/Russian white mulberry
Wavyleaf basketgrass	Oplismenus undulatifolius	
Japanese pachysandra	Pachysandra terminalis	Japanese spurge, Chinese fever vine
Amur corktree	Phellodendron amurense	
Japanese corktree	Phellodendron japonicum	
Lavella corktree	Phellodendron lavellei	
Golden bamboo	Phyllostachys aurea	Yellow grove bamboo, fish pole bamboo
Rough bluegrass	Poa trivialis	
Ravenna grass	Saccharum ravennae	Hardy pampas grass
Tall fescue	Schedonorus arundinaceus	
Bee-bee tree	Tetradium daniellii	Korean Evodia
Linden viburnum	Viburnum dilatatum	arrowwood
Doublefile viburnum	Viburnum plicatum	Japanese snowball bush
Siebold viburnum	Viburnum sieboldii	Siebold's arrowwod
Bigleaf periwinkle	Vinca major	Greater periwinkle
Common periwinkle	Vinca minor	myrtle
Japanese wisteria	Wisteria floribunda	
Chinese wisteria	Wisteria sinensi	

APPENDIX B.

RECOMMENDED NATIVE PLANT LIST

(* denotes recommended street tree) (+ denotes thornless variety) (# denotes edible plant) (& denotes deer resistant plants)

Canopy Trees

Betula lenta (sweet birch) &

Acer rubrum (red maple) &

Betula nigra (river birch) &

Quercus alba (white oak) #

Nyssa sylvatica (black gum)&

Gleditsia tricanthos 'shademaster'(honeylocust)*&

Carya glabra (pignut hickory)

Acer saccharum (sugar maple)&

Quercus macrocarpa (bur oak)

Ulmus Americana (American elm cultivars) *

Gymnoccladus dioicus (Kentucky coffeetree)*

Prunus serotine (black cherry)

Quercus prunus (chestnut oak)

Quercus rubra (red oak)

Platanus occidentalis (American planetree)

{Prunus serotina (black cherry)

Fagus grandifolia (American beech) #&

Fagus grandifolia (American beech) #&

Liriodendron tulipifera (tuliptree) &

Carya tomentosa (mockernut hickory) #

Quercus bicolor (swamp white oak) #

Betula alleghaniensis (yellow birch)

Carya ovata (shagbark hickory)#

Aesculus glabra (Ohio buckeye)

Aesculus glabra (yellow buckeye)

Robinia oseydiacacua (black locust)

Betula populifolia (gray birch)

Celtis occidentalis (hackberry)* #

Tilia Americana (basswood) * &

Quercus palustris (pin oak)*

Populus grandidentata (big tooth aspen)

Populus tremuloides (quaking aspen)

Quercus cocinea (scarlet oak)

Quercus muehlenbergii (chinkapin oak)

Salix nigra (black willow)&

Betula nigra (river birch)

Acer nigrum (black maple)

Juglans nigra (black walnu

Juglans nigra (black walnut) #

Diospyros virginiana (persimmon) #

Morus rubra (red mulberry)#

Oxydendron arboretum (sourwood)

Evergreen trees

Tsuga Canadensis (eastern hemlock)&

Magnolia virginiana (sweetbay magnolia) &

APPENDIX B.

RECOMMENDED NATIVE PLANT LIST

Pinus strobus (eastern white pine)

Magnolia acuminate (cucumber magnolia)

Magnoia tripetala (umbrella magnolia)

Illex opaca (American Holly) &

Juniperus virginiana (red-cedar) &

Picea glauca (white spruce)&

Pinus rigida (pitch pine)

Understory Trees

Cornus florida (flowering dogwood)&

Cornus sericea (red twig dogwood)

Cercis Canadensis (eastern redbud)&

Crataegus crusgalli (Cockspur hawthorn) +

Crataegus punctate (Dotted hawthorn) +

Carpinus caroliniana (hornbeam)&

Corylus Americana (hazelnut)#&

Ostrya virginiana (hop-hornbeam)

Asimina triloba (paw paw)#&

Amelanchier laevis (smooth serviceberry) #&

Malus coronaria (American crabapple)+#

Prunus virginiana (chokecherry) #

Prunus Americana (American plum)+ #

Shrubs

Kalmia latifolia (mountain laurel)

Rhododendron periclyenoides (pinxter-flower)

Viburnum prunifolium (blackhaw viburnum)#

Potentilla fruticose (shrubby cinquefoil)&

Vaccinum angustifolium (low-bush blueberry)#

Aronia melancoarpa (black chokeberry)#

Corylus cornuta (beaked hazelnut)# &

Hamamelis virginiana (witch-hazel)

Viburnum acerifolium (maple-leaved viburnum)&

Aronia arbutifolia (red chokeberry)&

Itea virginaiana (sweetspire)

Rhus aromatic 'Gro-low (Gro-low sumac)

Viburnum lentago (nannyberry viburnum)#

Viburnum trilobum (highbush cranberry)#

Myrica pennsylvanica (bayberry) &

Viburnum dentatum (Nannyberry) &

Lindera benzoin (spice bush)#&

Rhododendron maximum (rosebay rhododen)&

Clethera alnifolia (sweet shrub)&

Calycanthus floridus (Carolina allspice)&

Cornus racemose (gray dogwood)

Ilex verticillata (winterberry)&

Physocarpus opulifolius (ninebark)

Ceanothus virginiana (New Jersey tea)

APPENDIX B.

RECOMMENDED NATIVE PLANT LIST

Cephalanthus occidentalis (buttonbush)

Cornus alternifolia (pagoda dogwood)

Viburnum alnifolium (hobblebush)#

Viburnum trilobum (American cranberrybush)#

Cornus sericea (Red-osier dogwood)&

Rosa Carolina (Carolina rose)

Gaylussacia baccatta (black huckleberry)#

Viburnum prunifolium (blackhaw viburnum)

Viburnum lentago (nannyberry)#

Vines

Parthenocissus cinquefolia (virginia creeper)

Cladastrus scandens (American bittersweet)

Aristolochia macrophylla (dutchman's pipe)

Herbaceous (Pollinator Species)

Allium cernum (nodding pink onion)

Agastache foeniculum (lavender hyssop)

Aster novae-angliae (New England Aster)&

Asclepias syriaca (common milkweed)

Asclepias tuberosa (butterfly weed)&

Chamaecrista fasciculate (partridge pea)

Dennstaedtia punctilobula (hayscented fern)&

Baptisia australis (blue false indigo)

Dalea purpurea (purple prairie clover)

Echinacea purpurea (purple coneflower)&

Eryngium yuccifolium (rattlesnake master)

Heliopsis hlianthoides (false sunflower)

Heuchera viloa (Alum root)

Liastris spicata (dense spicata)&

Monarda fistulosa (wild bergamot)

Aster laevis (smooth aster)

Silphium lacinatum (compassplant)

Silphium perfoliatum (cupplant)

Verbena hastata (blue vervain)&

Asarum canadense (wild ginger)

Asclepias incarnate (swamp milkweed)

Helianthus occidentalis (western sunflower)

Coreopsis lancelota (tickseed)&

Mitchella repens (partridge-berry)

Trillium grandiflorum (white trillium)

Comptonia perigrina (sweet-fern)

Sanquinaria canadensis (bloodroot)&

Phlox subulata (creeping phlox)

Anemone quinquefolia (wood anemone)

Arisaema triphyllum (jack-in-the-pulpit)&

Polystichum acrostichoides (Christmas fern)

Aster cordifolius (heart leaved aster)

APPENDIX B.

RECOMMENDED NATIVE PLANT LIST

Aster prenanthoides (crooked stem aster)

Aster divaricatus (white woodland aster)

Rudbeckia hirta (black eyed susan)&

Solidago ohionsis (ohio godenrod)

Solidago odora (anise scented goldenrod)&

Carex pennsylvaica (Pennsylvania sedge)

Asclepias quadrifolia (four leaved milkweed)

Asclepias incarnate (red milkweed)&

Penstemon digitalis (beardtongue)&

Aster macrophyllus (big leaved aster)

Aster lateriflorus (calico aster)

Dryopteris marginalis (evergreen wood-fern) &

Podophyllu peltatum (may-apple)

Smilacina racemose (false soloman's seal)

Geranium maculatum (wood geranium)

Monarda didyma (beebalm)&

Iris shrevei (wild iris)

Actaea racemose (black cohosh)&

Grasses

Panicum virgatum (switch grass) &

Andropogon virginicus (broomsedge)&

Eragrostis spectabilis (purple love grass)

Bouteloua curtipendula (side-oats gramma)&

Hierochloe odorata (vanilla sweet grass)

Schizachyrium scoparium (little bluestem)&

Spartina pectinate (prairie cordgrass)

Sorghastrum nutans (indian grass)&

Elymus Canadensis (Canada wild rye)&

Ground Covers

Arctostaphylos uva-ursi (bearberry)

Celastrus scandens (American bittersweet)

Fragaria virginiana (Virginia strawberry)

Gaultheria procumbens (wintergreen)

Parthenocissus quinquefolia (Virginia creeper)

Rhus aromatic (Fragrant sumac)

Asarum canadense (wild ginger)&

Clematis virginiana (virgin's bower)

Pachysandra procumbens (Allegheny spurge)

Juniperus horizontalis (creeping junipers)

Phlox stolonifera (Creeping pholox)

Vaccinum angustifolium (lowbush blueberry)

APPENDIX B.

RECOMMENDED NATIVE PLANT LIST

Moist Meadow/Rain Garden Plants

Chelone glabra (white turtlehead)

Carex muskingumensis (palm sedge)

(Pycnanthemum virginianum (mountain mint)

Coreopsis rosea (rose coreopsis)

Carex vulpinoidea (fox sedge)

Carex muskingumensis (palm sedge)

Eupatorium maculatum (Joe Pye weed)

Filipendaula rubra (Queen of the prairie)

Mimulus ringens (monkey flower)&

Physostegia virginicna (obedient plant)

Sclepias incarnate (red milkweed)

Eupatorium perfoliatum (boneset)

Verbena hastate (blue vervain)

Physotegia virginiana (obedient plant)&

Mimulus ringens (monkeyflower)

Phlox glaberrima (marsh phlox)

Veronia altissima (tall ironweed)

Liastris aspera (rough blazingstar)

Lobelia siphilitica (great blue lobelia)&

Lobelia cardinalis (cardinal flower)

Iris shrevi (wild iris)

Filipendula ruba (queen of the prairie)

APPENDIX C.

DEFINITIONS

100-year floodplain – includes all areas below the 100-year flood elevation of waterways of all sizes, including depression areas, wetlands, areas behind levees, ephemeral and intermittent streams, rivers, lakes, and shoreline and coastal areas.

Appropriate plant species – are plants adapted to site conditions, climate, and design intent. Consider the following attributes in determining whether a plant is appropriate for the site: cold hardiness, heat tolerance, salt tolerance, soil moisture range, plant water use requirements, soil volume requirements, soil pH requirements, sun/shade requirements, pest susceptibility, and maintenance requirements. Native and non-native plants are considered appropriate if they meet the above criteria subject to approval by Senior Manager of Grounds.

Best Practices – is a technique or methodology shown by research or experience to produce optimal results.

Best Management Practices (BMP) – are activities or structural improvements that help reduce the quantity and improve the quality of storm water runoff. BMPs include treatment requirements, operating procedures and practices to control and treat site runoff, and infiltration.

Biophillia – is a hypothesis that humans possess an innate tendency to seek connections with nature and other forms of life.

Bioswale – a linear storm water runoff conveyance system that is used as an alternative to storm sewers to partially treat water quality, attenuate flooding potential, and convey storm water away from critical infrastructure.

Bulk density - is an indicator of soil compaction and soil health. It affects infiltration, rooting depth/restrictions, available water capacity, soil porosity, plant nutrient availability, and soil microorganism activity, which influence key soil processes and productivity. It is the weight of dry soil per unit of volume typically expressed in grams/cm^3. Total volume of surface soil is about 50% solids, mostly soil particles (45%), and organic matter (generally < 5%); and about 50% pore space which are filled with air or water.

Compost tea – is a liquid inoculant made by fermenting compost in water either aerobically or anaerobically, and used to enhance or restore soil and leaf surface microflora (Reference: the Compost Tea Brewing Manual, Soil Food Web, 2005.)

Constructed Wetland – is an artificial wetland created for the purpose of treating storm water runoff.

APPENDIX C.

DEFINITIONS

Control of invasive (plants) – the appropriate eradication, suppression, reduction, or management of invasive plant species populations, the prevention of the spread of invasive (plant) species from areas where they are present and taking steps such as the restoration of native or appropriate plant species and habitats to reduce the effects of invasive (plant) species and to prevent further invasion.

Landscape – is a geographic area including both the cultural and natural resources associated with an historic event, activity, or person or exhibiting other cultural or aesthetic values.

Design for Deconstruction – is the design of buildings or products to facilitate future change and eventual disassembly in (part or whole) for recovery of systems, components and materials.

Design program – is a narrative that provides a clearly stated vision of the project, the desired outcomes of the project.

Diameter at Breast Height (DBH) – is a standard method for determining the trunk diameter of a standing tree, typically measured in inches at 4.5 feet off the ground on the uphill side.

Ecoregion – refers to areas within which ecosystems (and the type, quality, and quantity of environmental resources) are generally similar.

Ecosystem Services – describes the goods and services provided by healthy ecosystems; for example, the pollination of crops by bees, bats, or birds, the flood protection provided by wetlands, or the filtration of air and water by vegetation and soils.

Habitat – is the natural environment in which an organism normally live, made up of physical factors such as soil, moisture, range of temperature, light and biotic factors such as food availability and presence of predators.

Healthy soils – soils that have not been significantly disturbed by previous human development activities, and exhibiting qualities such as soil horizons, bulk densities, organic matter and soil pH similar to the reference soil.

Integrated design team – consists of the University of Pittsburgh Facilities Management representative, professionals knowledgeable in sustainable landscape design, and other team members needed to meet unique requirements of a particular project.

Interpretive signage - is signage designed to inform I instruct the public about the workings of a particular landscape feature, activity or system.

APPENDIX C.

DEFINITIONS

Invasive species – is a plant or animal that is not native to the ecosystem under consideration or that causes or is likely to cause economic or environmental harm to human, animal, or plant health.

Mature stable compost – is a soil amendment that exhibits stable biological breakdown, completeness of aerobic composting, and high suitability for favorable plant growth.

Native plant community – are groups of plant species, composition, and structure typical of communities native to the EPA Level III ecoregion or known to naturally occur within 200 miles of the site. At least two references (or local reference sites) are need to determine the dominant plant species, relative species abundances, and other characteristic elements of a particular plant community.

Neonicotinoids – a systemic agricultural insecticide with a chemical structure similar to nicotine that acts on the central nervous system of insects

Organic matter – in the soil is carbon-containing material composed of both living organisms and dead, decomposing plant and animal matter. Soil organic matter content can be supplemented with compost or other decomposed plant or animal matter.

Permaculture – is the holistic development of agricultural ecosystems intended to be sustainable and self-sufficient.

Open grid pavement – is pavement that is less than 50% impervious and contains vegetation in open cells.

Raingarden – is a depression formed on a natural slope and planted with deep-rooted native plants and grasses designed to hold and absorb rainwater from nearby impervious services.

Riparian Buffer is the portion of the adjacent terrestrial ecosystem that directly affects or is affected by the aquatic environment including streams, rivers, lakes and other aquatic environments. A riparian buffer provides shade, intercepts runoff, and helps prevent erosion.

Snags - In forest ecology a snag refers to a standing, dead or dying tree, often missing a top or most of the smaller branches. In freshwater ecology it refers to trees, branches, and other pieces of naturally occurring wood found sunken in rivers and streams.

Soil Protection Zone – is an area protected by a fence or barrier for the purpose of preventing damage to existing healthy soils, and/or preventing damage caused by compaction to tree roots.

APPENDIX C.

DEFINITIONS

Severely disturbed soils – are soils where topsoil has been removed or is not present. They also include subsoils that are compacted such that the compaction levels exceed the maximum allowable bulk density.

Solar reflective index – is a measure of a material's ability to reject solar heat, as shown by a small temperature rise. Standard black (reflectance 0.05, emittance 0.90) = 0. And standard white (reflectance 0.80, emittance 0.90) = 100. Materials with the highest SRI are the coolest choices for paving.

Successional Vegetation – is a dynamic, competitive, evolutionary process where plant communities replace one another over time, starting with highly reproductive, unstable plant community and evolving towards a stable, community characterized by a high diversity of long-lived plants with low reproductive powers.

Sustainability – is the continuous effort to meet the needs of the present generation without compromising the ability of future generations to meet their needs (1987 UN Brundtland Report).

Sustainability Campus Landscape – is a stable and productive ecosystem that incorporates ecological, social, and economic factors in the design of landscapes in order to create a cohesive aesthetic and a sense of place within the campus. A sustainable landscape protects habitat, promotes native plant communities and biodiversity, provides storm water management, and contributes to the health and well-being of the University and the greater community.

View shed – is an area that is visible from a specific location.

Walkability audit – is a tool designed to broadly assess pedestrian facilities, destinations, and surroundings along and near a walking route and identify improvements to make the route more attractive, safe, and convenient to pedestrians.

Wetlands – are areas that are inundated or saturated by surface or groundwater capable of supporting vegetation adapted to saturated conditions.

Level III and IV Ecoregions of EPA Region 3

Ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources; they are designed to serve as a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components. Ecoregions are directly applicable to the immediate needs of state agencies, including the development of biological criteria and water quality standards and the establishment of management goals for nonpoint-source pollution. They are also relevant to integrated ecosystem management, an ultimate goal of most federal and state resource management agencies.

The approach used to compile this map is based on the premise that ecological regions can be identified through the analysis of the spatial patterns and the composition of biotic and abiotic phenomena that affect or reflect differences in ecosystem quality and integrity (Wiken 1986; Omernik 1987, 1995). These phenomena include geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. The relative importance of each characteristic varies from one ecological region to another regardless of the hierarchical level. A Roman numeral hierarchical scheme has been adopted for different levels of ecological regions. Level I is the coarsest level, dividing North America into 15 ecological regions. Level II divides the continent into 52 regions (Commission for Environmental Cooperation Working Group 1997). At level III, the continental United States contains 104 regions (United States Environmental Protection Agency [USEPA],1998). Level IV is a further subdivision of level III ecoregions. Explanations of the methods used to define the USEPA's ecoregions are given in Omernik (1995), Griffith and others (1994), and Gallant and others (1989).

The level III and IV ecoregion map on this map was compiled at a scale of 1:250,000 and depicts revisions. It revises and subdivides earlier level III ecoregions that were compiled at a smaller scale (USEPA 1998; Omernik 1987). It includes previously published level IV ecoregions (Woods and Omernik, 1996; Woods and others, 1996). It expands level IV coverage to include, for the first time, western West Virginia and the Coastal Plain and Piedmont of Delaware, Maryland, and Virginia. **Compilation of this map was part of a collaborative project with the United States Environmental Protection Agency (EPA) Region III Environmental Services Division, the EPA National Health and Environmental Effects Research Laboratory (NHEERL), and state environmental resource management agencies from Pennsylvania, Virginia, Maryland, and West Virginia.**

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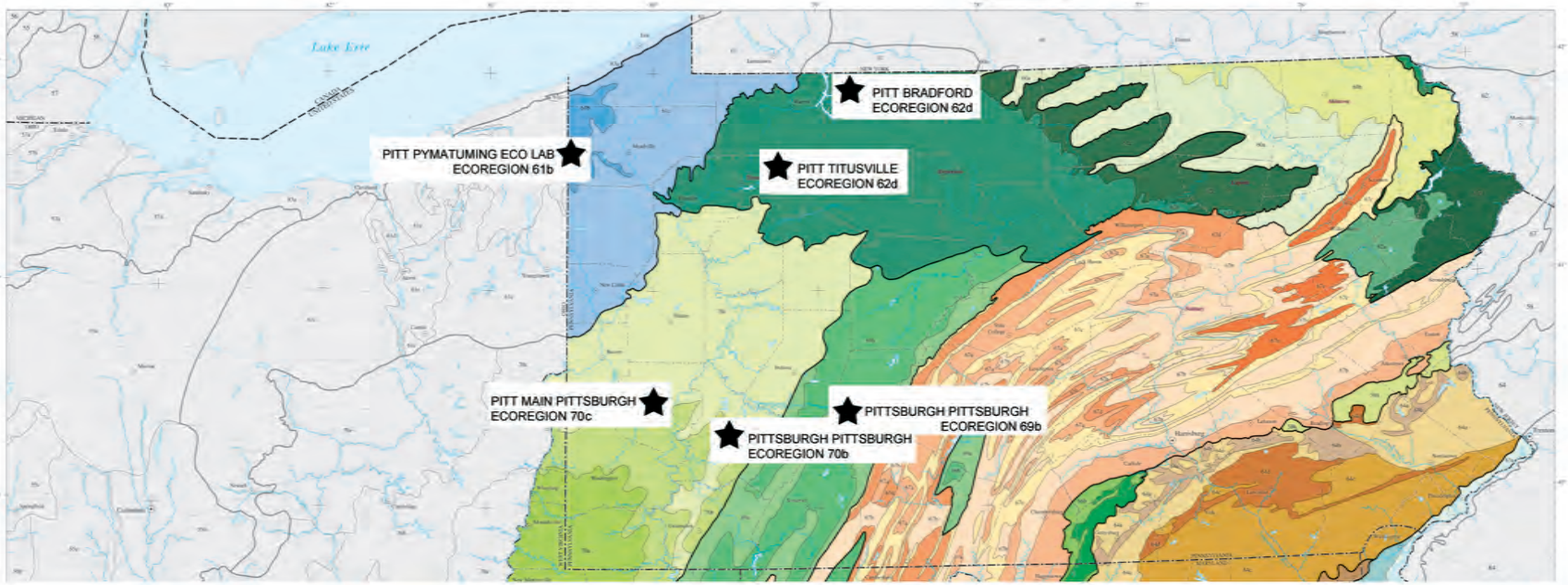
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45 Piedmont
45c Carolina Slate Belt
45e Northern Inner Piedmont
45f Northern Outer Piedmont
45g Triassic Basins

58 Northeastern Highlands
58b Reading Prong

60 Northern Appalachian Plateau
60a Glaciated Low Plateau
60b Northeastern Uplands

61 Erie/Ontario Drift And Lake Plains
61b Mosquito Creek/Pymatuning Lowlands
61c Low Lime Drift Plain

62 North Central Appalachians
62a Pocono High Plateau
62b Low Poconos
62c Glaciated Allegheny High Plateau
62d Unglaciated Allegheny High Plateau
62e Low Catskills

63 Middle Atlantic Coastal Plain
63a Delaware River Terraces and Uplands
63b Chesapeake-Pamlico Lowlands and Tidal Marshes
63c Swamps and Peatlands
63d Virginian Barrier Islands and Coastal Marshes
63e Mid-Atlantic Flatwoods
63f Delmarva Uplands

SCALE 1:1 000 000

Albers Equal Area Projection

64 Northern Piedmont
64a Triassic Lowlands
64b Diabase and Conglomerate Uplands
64c Piedmont Uplands
64d Piedmont Limestone/Dolomite Lowlands

65 Southeastern Plains
65m Rolling Coastal Plain
65n Chesapeake Rolling Coastal Plain

66 Blue Ridge
66a Northern Igneous Ridges
66b Northern Sedimentary and Metasedimentary Ridges
66c New River Plateau
66d Southern Crystalline Ridges and Mountains
66e Southern Sedimentary Ridges
66f Limestone Valleys and Coves

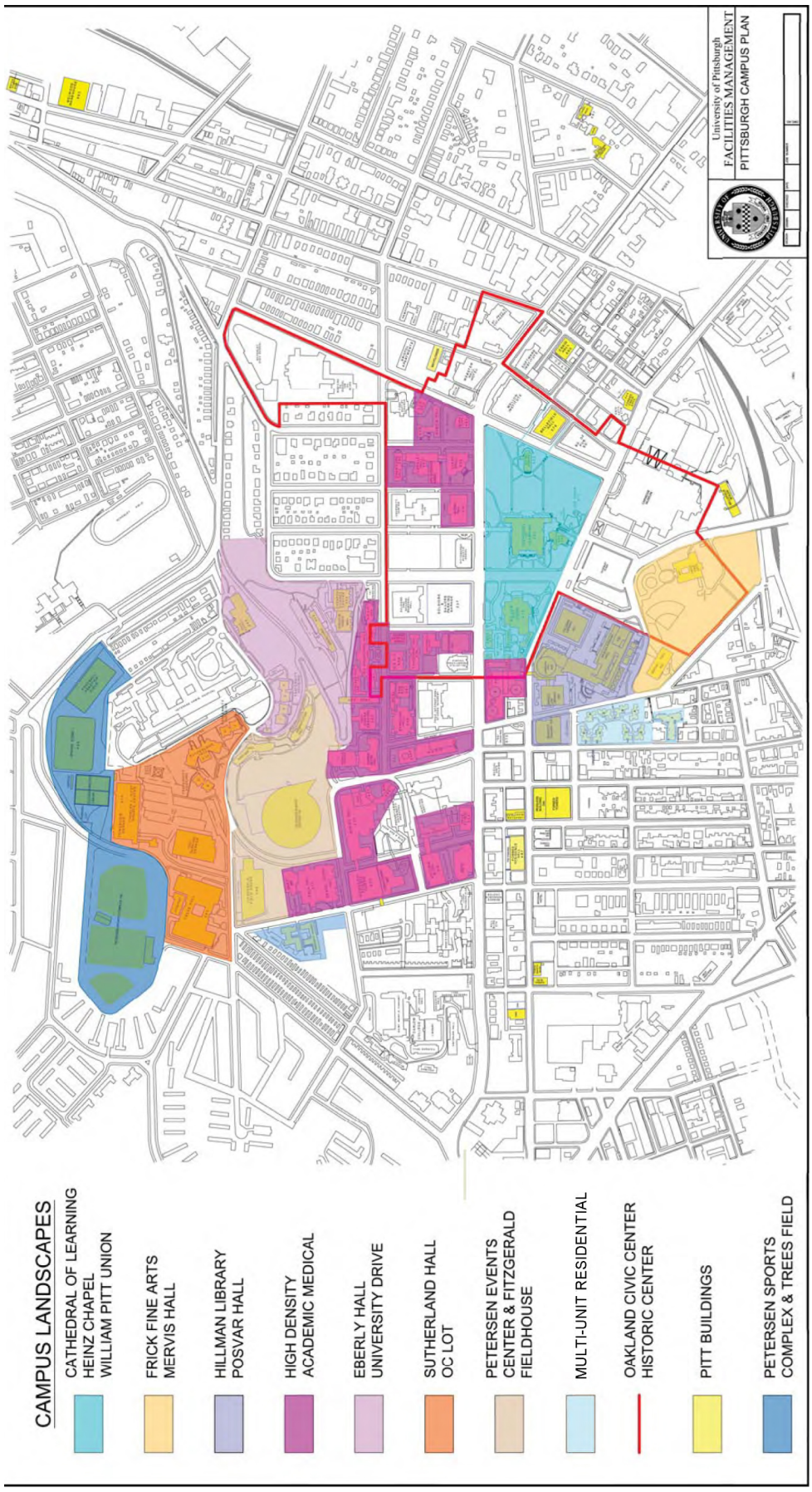
Level III Boundary
Level IV Boundary
State Boundary
County Boundary

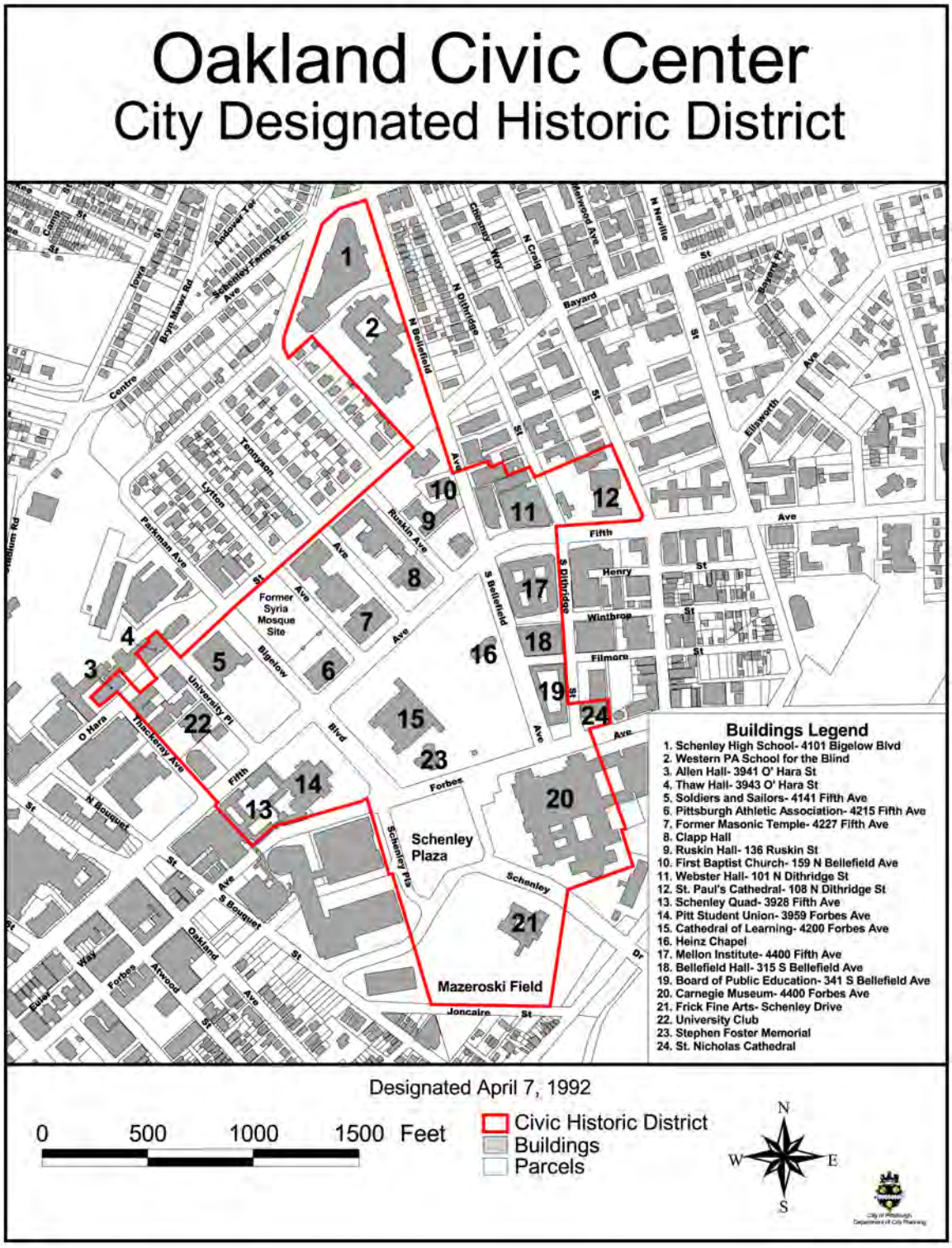
67 Ridge and Valley
67a Northern Limestone/Dolomite Valleys
67b Northern Shale Valleys
67c Northern Sandstone Ridges
67d Northern Dissected Ridges
67e Anthracite Subregion
67f Southern Limestone/Dolomite Valleys and Low Rolling Hills
67g Southern Shale Valleys
67h Southern Sandstone Ridges
67i Southern Dissected Ridges and Knobs

69 Central Appalachians
69a Forested Hills and Mountains
69b Uplands and Valleys of Mixed Land Use
69c Greenbriar Karst
69d Dissected Appalachian Plateau
69e Cumberland Mountain Thrust Block

70 Western Allegheny Plateau
70a Permian Hills
70b Monongahela Transition Zone
70c Pittsburgh Low Plateau

83 Eastern Great Lakes and Hudson Lowlands
83a Erie Lake Plain


University of Pittsburgh
FACILITIES MANAGEMENT
PITTSBURGH CAMPUS PLAN
CAMPUS LANDSCAPES
CATHEDRAL OF LEARNING
HEINZ CHAPEL
WILLIAM PITT UNION
FRICK FINE ARTS
MERVIS HALL
HILLMAN LIBRARY
POSVAR HALL
HIGH DENSITY
ACADEMIC MEDICAL
EBERLY HALL
UNIVERSITY DRIVE
SUTHERLAND HALL
OC LOT
PETERSEN EVENTS
CENTER & FITZGERALD
FIELDHOUSE
MULTI-UNIT RESIDENTIAL
OAKLAND CIVIC CENTER
HISTORIC CENTER
PITT BUILDINGS
PETERSEN SPORTS
COMPLEX & TREES FIELD


Oakland Civic Center
City Designated Historic District
Buildings Legend
1. Schenley High School- 4101 Bigelow Blvd
2. Western PA School for the Blind
3. Allen Hall- 3941 O' Hara St
4. Thaw Hall- 3943 O' Hara St
5. Soldiers and Sailors- 4141 Fifth Ave
6. Pittsburgh Athletic Association- 4215 Fifth Ave
7. Former Masonic Temple- 4227 Fifth Ave
8. Clapp Hall
9. Ruskin Hall- 136 Ruskin St
10. First Baptist Church- 159 N Bellefield Ave
11. Webster Hall- 101 N Dithridge St
12. St. Paul's Cathedral- 108 N Dithridge St
13. Schenley Quad- 3928 Fifth Ave
14. Pitt Student Union- 3959 Forbes Ave
15. Cathedral of Learning- 4200 Forbes Ave
16. Heinz Chapel
17. Mellon Institute- 4400 Fifth Ave
18. Bellefield Hall- 315 S Bellefield Ave
19. Board of Public Education- 341 S Bellefield Ave
20. Carnegie Museum- 4400 Forbes Ave
21. Frick Fine Arts- Schenley Drive
22. University Club
23. Stephen Foster Memorial
24. St. Nicholas Cathedral
Schenley Plaza
Mazeroski Field
Former Syria Mosque Site
Designated April 7, 1992
0 500 1000 1500 Feet
Civic Historic District
Buildings
Parcels
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