



CLASSROOM & TECHNOLOGY DESIGN & CONSTRUCTION MINIMUM REQUIREMENTS

**PREPARED
IN
COLLABORATION
WITH**

**THE SUB-COMMITTEE OF THE
UNIVERSITY COMMITTEE OF
INSTRUCTIONAL FACILITIES**

5/05/05

INDEX FOR:

CLASSROOM & TECHNOLOGY DESIGN & CONSTRUCTION MINIMUM REQUIREMENTS

00.00. INTRODUCTION / GENERAL INFORMATION:..... 1

01.00. ABBREVIATIONS USED: 2

01.10. BACKGROUND AND BUILDING NOISES AT OR NEAR CLASSROOMS: 2

01.11. GENERALIZED CLASSROOM DESIGN CONSIDERATIONS: 3

08.00. DOORS 4

08.50. WINDOWS:..... 4

09.20. WALLS: 5

09.50. CEILINGS: 5

09.60. CLASSROOM FLOORS:..... 5

10.11. CHALKBOARDS and TACK BOARDS: 6

10.42. ROOM SIGNS: 6

11.13. PROJECTION SCREENS: 7

12.49. WINDOW COVERINGS: 7

12.60. FURNISHINGS: 8

13.20. ASBESTOS: 10

15.00. PLUMBING, HEATING, VENTILATION & BUILDING NOISES AT OR NEAR CLASSROOMS: 10

16.00. SWITCH & DEVICE PLATE LAYOUTS ON WALLS OR PODIUMS: 11

16.05. CONVENIENCE & DUPLEX OUTLETS: 11

16.10. CONDUITS, WIREWAYS, LOW VOLTAGE WIRES, OTHER WIRES, WIREMOLD and OTHER UTILITY LINES: 11

16.51. CLASSROOM LIGHTS AND LIGHTING CONTROL: 12

16.52. CLASSROOM EMERGENCY LIGHTS: 13

16.53. CLASSROOM EMERGENCY EXIT LIGHT SIGNS: 14

16.54. CORRIDOR LIGHTING: 14

16.70. TELEPHONES: 14

16.80. SOUND SYSTEM: 14

16.90. AUDIO-VISUAL and TECHNOLOGY: 14

END 16

CLASSROOM & TECHNOLOGY DESIGN & CONSTRUCTION MINIMUM REQUIREMENTS

00.00. INTRODUCTION / GENERAL INFORMATION:

Below are minimal considerations for design and construction of all PSU classrooms/seminar/lecture halls, conference and meeting spaces being designed or planned for new or remodeled work at this time. Such rooms often times are used for instructional or preparation work.

The trend is toward technology in the learning environment. The infrastructure needs to be provided, even if not immediately used or activated.

Please note that very often the technical design and construction documents do not include enough background information identifying expected performance characteristics of the spaces or systems. Please include such commentaries on construction documents.

The most current version of these minimum requirements is available for viewing on the Web at:

<http://clc.its.psu.edu/Classrooms/Design/>

Other web sites that may be helpful:

<http://tips.libraries.psu.edu/mediatech/index2.html>

<http://clc.its.psu.edu/>

http://www.psu.edu/registrar/faculty_staff/enroll_services/gpc.html

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The individuals indicated in **Bold Lettering** above comprise the **Instructional Support Group** from this Committee. These seven individuals are closely involved with all design, construction and operational aspects of the general-purpose classrooms, and are to be heavily involved from the very start of any project with the design

and planning team on all project aspects related to GPCs. The Facilities Coordinator is the primary conduit from OPP to these support members.

The **UCIF Sub-Committee** realizes that the design process is most dynamic and that continuing innovations can and should be weighed against the information included in this document. If such conflicts do occur, all such parameters are to be noted in writing to the **FC** for the **ISG** to consider. The **ISG** will then make recommendations to the **UCIF Sub-Committee** for acceptance or rejection and submit the response in writing or email form.

If conflicts are found between these and other University design and construction requirements, please note the locations of the documents and conflicts, so that the conflicts can be properly addressed and hopefully eliminated in the next update to this Standard.

01.00. ABBREVIATIONS USED:

ADA	Americans with Disabilities Act
AFF	above finished floor
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
CAC	Center for Academic Computing
CD	Compact Disk
DVD	Digital Video Disk
FC	Facilities Coordinator
FR&P	Facilities Resources & Planning
GPC(s)	General Purpose Classroom (Classrooms)
>	greater than
HVAC	Heating, ventilating and air conditioning
ISG	Instructional Support Group
ITS	Information & Technology Services
<	less than
MTSS	Media Technology and Support Services
OPP	Office of Physical Plant
OTC	Office of Telecommunications
PC	Project Coordinator
PM	Project Manager
SSTs	Stacking Student Tables
STC	Sound Transmission Coefficient
TLT	Teaching & Learning Technology
TNS	Telecommunications & Networking Services
TV	Television
UCIF	University Committee on Instructional Facilities
VCR	Video player

01.10. BACKGROUND AND BUILDING NOISES AT OR NEAR CLASSROOMS:

1. **Door Hardware** – To have quiet operation. Include bumpers, gaskets and nylon bushings to muffle closing noises. Minimize noise transmission into classroom from corridors – no door transfer grills.
2. **Room Acoustics** – To be designed for speech with reverb decay of less than:
 - a. 0.6 seconds at the mid-speech frequencies of 250, 500 & 1,000 Hertz for room sizes up to 10,000 cubic feet.
 - b. 0.7 seconds for same range for rooms up to 20,000 cubic feet.
 - c. See following sections for NRC, IIC, NC, etc.

01.11. GENERALIZED CLASSROOM DESIGN CONSIDERATIONS:

1. **General Building Design Considerations Related to General Purpose Classrooms:**

- a. Locate GPCs on ground entry and immediately above levels to isolate class change noise and high traffic functions from office and lab functions.
 - b. Provide long walk-off mat space (at least four full steps) from exterior doors to first classroom doors to trap dirt, mud, salt, snow, moisture, etc.
 - c. **Corridors & Seating Outside Classrooms:**
 - (1). Corridors to be sized for double the loads identified in codes due to the heavy number of students leaving classrooms competing with those trying to get in classrooms.
 - (2). In any case corridors to not be less than 10' wide.
 - (3). Bench type seating is to be provided outside classrooms. The bench length is to total the length of the corridor and can alternate side to side or be continuous on one side, except at doors.
 - (4). Consider cleaning and maintenance requirements when detailing bench seating.
 - (5). **Student Waiting/Meeting Alcoves:**
 - (a) Encouraged along circulation paths serving classrooms, to allow groups to meet and have discussions while waiting for class changes.
 - (b) Such alcoves can be equipped with chalkboards to facilitate student discussions and interactions.
 - (c) Such alcoves should be well designed to contain noise that may be generated in such settings.
 - d. **Classroom design** – should be dictated from the classroom needs and out from there, not by the building thus forcing the classroom into a specific shape formed by the building.
 - (1) Better sight lines can be achieved.
 - (2) Better seating arrangements can be situated.
 - (3) Better technology needs can be addressed.
 - (4) Machinery and other noises can be located remote from the classrooms – and the list can go on and on!
 - e. **Room Dimensional ratios:**
 - (1). For rectangular rooms – width to length – between 1-1/2 to 2 and 3 to 4 with the instructional end on the narrower dimension.
 - (2) Room shape greatly impacts space efficiencies for a particular classroom need – carefully consider and do not use a cookie cutter approach.
 - (3). For auditorium rooms – more fan-shaped with seating, screen and instructional needs dictating the shape. Such spaces need early involvement of the **ISG** for detail needs so that floor and furniture plans, as well as cross sectional drawings can be prepared and used for discussions with the **Instructional Support Group**.
2. **Codes, ADA, accepted standards, controlling authority and agency requirements:**
- a. Comply with or exceed on all new and renovation work.
 - b. PSU requirements in some cases exceed these minimums, thus enhancing the code, ADA, accepted standards, authority and agency requirements. Comply with the PSU enhancements when more stringent.
3. **Visual:**
- a. All student seats to be within 90-degree side-to-side cone established with 45-degree angles to screen centerlines in room and the 35-degree vertical angle defined from the eyes of the closest student viewer to the top of the screen and a horizontal line parallel to the floor that projects through the eyes.
 - b. Seats to be no closer than the dimension of the screen width with 1 to 1-1/2 times the screen width the preferred minimum distance. Example: 8' screens should have seats no closer than 8' to 12'. The 90-degree side-to-side cone and the 35-degree vertical requirement can increase this distance to greater than the 1 to 1-1/2 times requirement.
 - c. No visual obstructions, like columns or podiums, between student seating areas and chalkboards and screens at instructional end of room.
 - d. **Glare:**
 - (1) Glare causes distractions to learning.
 - (2) The contrast ratio for the student viewing area of the front of the room shall not exceed 3 to 1.
 - (3) A light meter is to be used to check this in new and renovated construction in a three-row three-column matrix at the front, with contrasts recorded and noted for correction.

- (4) See requirements for higher density of reflective louvers in recessed lighting fixtures to reduce this problem.

4. Classroom Equipment Storage:

- a. Space to be provided in each classroom for storage of classroom media equipment, such as projection stands, carts, etc.
- b. In classrooms also doubling as computer lab/classrooms, additional space shall be provided for printing tables and lockable storage space for printing supplies, batteries, paper, cartridges, etc.

08.00. DOORS:

1. Classroom Entry/exit Door Locations:

- a. For single doors - at rear sides or back of rooms.
- b. For more than one door – preferred in back of room if configuration allows; if not, greater than 8' back from the instructional wall for one of the doors, with the other at the rear sides or back of a room.

2. General to All Classroom Doors:

- a. Use darkened glass in tall & narrow vision panels allowing wheel chair users to see in and out as well as tall individuals.
- b. Each door leaf to be minimum 36" wide, including those used in pairs at double doors.

3. Hardware:

- a. To comply with PSU and code requirements.
- b. To have totally quiet operational and closing characteristics.
- c. To have only key lock and unlock **CLASSROOM FUNCTION** – no pushbuttons in edge plate, no dogging keys on panic hardware.
- d. To have drop sill plates and edge sound treatment where high noise levels may occur outside of the door (some classes run two periods so should not be disturbed by class changes).
- e. To have silencers or sound strips on the strike jambs and hardware to minimize closing and impact noises.
- f. To have minimum 14" high kick plates on both sides of each door.
- g. **Special Door Hardware** – doors to projection booths, media technology rooms and media technology closets – use five push-button re-settable combination locksets (combination is changed each year).

08.50. WINDOWS:

1. **Interior** – NO glass beside doors where only narrow mullions separate the glass and door areas – separation must be at least 24".
2. **Exterior:** (none preferred in most classrooms – exceptions – those with northern exposures)
 - a. Are to be operable & have key locks mastered alike for a building, to allow staff to open in case of HVAC failure.
 - b. Are to have STC capabilities of > 50.
 - c. Are to be located to not cast beams of light onto projected surfaces or chalkboards at the front instructional area.
 - d. Are to be thermo double or triple glazed units with e-glass to minimize heat loss and gain.
 - e. Limit locations to rear of rooms, as chalkboards are to be on front and side-walls (no windows on front wall or within 15' of front walls).
3. **Window Coverings** – defined below.

09.20. WALLS:

1. General – applying to all classroom walls:

- a. STC = or > 50
- b. All openings, cracks, joints to be caulked to minimize sound transmission.

2. **Inside:**
 - a. All walls surrounding rooms to run tight to structure above ceilings.
 - b. Corridor walls to have double studs staggered to isolate inside and outside wall elements.
 - c. All to have non-cellulose sound blankets.
3. **Exterior walls common with classroom:**
 - a. All penetrations and wall elements to be sealed and designed to minimize noise entry into room.
4. **Finishes:**
 - a. Apply paint on most surfaces (other than pre-finished wood, stone or masonry surfaces).
 - b. Use epoxy like paints for low areas subject to abuse, such as below chair rails.
 - c. Apply chair rails on all non-masonry walls - make of 2 x 6 oak, countersink fasteners & use wood plugs in fastener holes, fill, natural stain, & finish.
 - d. Outside wall corners (such as entry recesses to classrooms) – provide corner guards to 4' AFF applied so that students cannot work them loose.

09.50. CEILINGS:

1. **Heights:**
 - a. **Renovation & Remodels** – keep the finished ceiling as high between screens and ceiling mounted projectors as possible to complement screen viewing, though no less than 9'-6" AFF for rooms with Instructional Technology.
 - b. **New Construction – clear height at instructional end of room:**
 - (1). Up to 75 students – 11' minimum clear height AFF between tech projector and screens.
 - (2). 75 to 150 students – greater than 13' AFF
 - (3). 150 & over students. – greater than 15' AFF
2. **Special Requirements:**
 - a. **Screen cases or housings** – ceiling systems to NOT fasten to recessed screen units.
 - b. **Sight lines** – between screens and any student seating to not be obstructed.
 - c. **Ceiling Materials:**
 - (1) Use non-sagging (humidity resistant) lay-in acoustical tile for most classroom ceiling areas.
 - (2) Lay-in tiles with color and pattern (painted) are desired.
 - (3) Use standard tegular tiles & regular 24 x 24 or 24 x 48 sizes and normal grid members (not narrow designs or metal edged tiles).
 - d. **Obstructions** - keep any ducts and piping along side-walls to avoid recessed screen housings and so area between screens and ceiling mounted projectors is as high as possible.

09.60. CLASSROOM FLOORS:

1. **Multiple floor levels** – no longer desired for instructional stages or seating tiers accessed by steps.
2. **Sloping floors** – under auditorium seating and/or at sloped aisles with flat tiers under seating are acceptable.
3. **Ergonomics** – consideration must be given to sight lines between instructors and students so that eye contact is possible between instructor and all students in all situations – for instructors as tall as 4'-10" as well as those in wheel chairs.
4. **Noise** – floor and other elements surrounding classrooms to have an Impact Isolation Class (IIC) that prevents sound transmission into room from floors or equipment surrounding the classrooms.
5. **Flooring** - as identified in project scope or program.
 - a. If carpet, >12 stitches per inch; yarn weight of 20 to 30 ounces, multi-dark colors to not show spills; stain, moisture & wear resistant, impervious backing material not affected by moisture.
 - b. Use only carpet squares that are pre-glued w/ temporary backing to protect glue.
 - c. If vinyl tile or sheet goods - use the thickest materials.

- d. To complement acoustical needs for room for meeting acoustical requirements defined under **Room Acoustics** and **Noise** above.

10.11. CHALKBOARDS and TACK BOARDS:

1. **Size** –
 - a. 4' high w/ absolutely flat porcelain on steel surfaces.
 - b. All GPCs except large auditoriums are to have chalkboards.
2. **Location**
 - a. Provide chalkboard WRITING surface at the instruction end and at sidewalls (except where student tech stations may be against walls – chalkboards may also be required at rear wall).
 - b. DO NOT place behind technology podium areas where podium will block view of student seating positions.
 - c. Set chalk trays at 36" AFF.
3. **Add-ons:**
 - a. ONLY IN STUDENT TECH LABS – include tack surfaces on each side and back wall to allow special postings.
 - b. In other classrooms – only place 4' h x 4 to 6' wide tack boards near rear entry doors.
 - c. Include top map hook rail with movable map hooks, 1 for each 16" of chalkboard length plus one to have even number, unless told otherwise by the Instructional Support Group.
4. **Definition in construction documents** – include board(s) sizes, mounting information and specifications on construction documents.
5. **Whiteboards:**
 - a. Not generally supported in general-purpose classrooms.
 - b. Special circumstances may require them - only after UCIF **Instructional Support Group** approval.
 - c. If provided, the right markers that do not damage the surface are to be furnished by the users.

10.42. ROOM SIGNS:

1. **Required:**
 - a. Room numbers at all classroom doors - see Sign Standard at OPP.
 - b. OPP Sign Standard defines signage system and type.
2. **Added signs:**
 - a. At each entry door from corridor place "**NO FOODS, CHEW OR DRINKS IN ROOM**".
 - b. Include room number on a sign plate inside the room near the door closest to the front of the room.
 - c. **Room seat count identification** - Apply vinyl number for janitorial and maintenance purposes.
 - (1) **Numbers** – to be 3/4" high & mounted sideways.
 - (2) **Location at door** – on jamb of door just above top hinge plate fastened to frame, so that when door is closed the number does not show.
 - (3) **Which door** – put at rear door if codes require room to have more than one exit. If two or more rear doors ENTER room, place numbers at room center door or the one closest to right of center.
 - d. **GPC Directory** – locate at each building entrance a graphic building plan directory showing viewer and classroom locations by outlines, room numbers and differing colors.

11.13. PROJECTION SCREENS:

1. **Image Area** - provide motorized and manual with seamless, matte white finish, as large as possible, depending on room size.
2. **Quantities** – a minimum of 2 screens should be provided in **all** class, lecture and seminar rooms, even the small ones.
3. **Viewing:**

- a. Align screen so that 45-degree sight lines left and right of the perpendicular centerline cover all student seats within the 90-degree cone.
 - b. The vertical angle for the front seated viewer to the top of the screen to not exceed 35-degree to floor at student viewing height.
4. **Construction Documents** – note angle and dimensions on plan to allow exact placement in field.
 5. **Screen Size** – size screen width to most distant viewer - use a ratio of 1 to 4. Example - 32' to most remote viewer gives an 8' wide screen.
 6. **Screen Mounting Height** – Set high and fully recess the housing to keep bottoms of viewing area 36" or greater above floor.
 7. **Recessed Screen Housing & Ceiling System** – do not tie together. Build box around screen unit not equipped with box so that components of the unit can be dropped out for maintenance without destroying ceiling.
 8. **Motorized Main Screen:**
 - a. Recess into ceilings at ALL locations unless identified otherwise in writing w/ **GPC FC & MTSS**.
 - b. Mount so that in the down position it will clear wall-mounted lights at chalkboards.
 - c. Use engraved **UP, STOP, DOWN** control switch to operate screen movement.
 - d. Do not use momentary screen control switches. Screen units have limit switches that stop operation.
 - e. Screens 8' wide and wider to be motorized, unless defined otherwise by the **Instructional Support Group**.
 - f. Recess fully into the ceiling all main screens used in conjunction with ceiling mounted tech projectors – fabricate 5-sided wood boxes to house the smaller screens not equipped with the wood boxes.
 - g. In rooms over with over 60 student seats, two main screens to be provided – possibly three in auditoriums. In such case the manual second screen is not necessary.
 9. **Manual Second Screen:**
 - a. Size width to room, but no less than 5' wide or 1 to 6 ratio screen width to most remote seating position.
 - b. Identify exact height from bottom of screen housing to floor, again as high as possible and no less than 36" AFF.
 - c. Do not hang screens from T-bars as hangers pull down – mount through tile to structure above ceiling.
 - d. Hang so that screen housing is tight to plane of ceiling.
 10. **Fixed Screens:**
 - a. May be used where bottom is over 7' AFF and wall space from this level to the ceiling is sufficient – exception – in auditorium where all viewers can see a lower bottom (generally in tiered spaces).
 - b. Mostly restricted to auditorium type classroom environments.
 - c. To be angled to minimize keystone effect from cart-mounted overhead projectors – work with **MTSS** for projector location for particular screens.

12.49. WINDOW COVERINGS:

1. Combination Opaque & Translucent Window Coverings
 - a. Windows to have two coverings. One layer is to allow some light entry into room. Second layer is to totally cut all light entry into room.
 - b. Window coverings with plastic parts fail badly - do not use.
 - c. Provide blackout shades at any classroom/seminar/lecture rooms having exterior windows.
 - d. Dual roller blinds, with translucent layer opening density adjusted for light exposure for particular building elevation most desired, such as MechoShades – 55 Rorer Avenue, Hatboro, PA 19040 – Richard Rosenbaum.
 - e. Mount tightly to window frames to prevent light spill around ends.
 - f. If chains are used, they are to be long enough to allow wheel chair bound people to operate.

2. If venetian blinds are necessary, they are to have non-plastic components and heavy duty operating components.
3. Add combination locks to operable windows at spaces with air conditioning.
 - a. Building staff can open windows until non-functioning HVAC systems are operational.

12.60. FURNISHINGS:

1. Student seating:

a. General:

- (1) Locate front row back from room front sufficiently to allow all student positions to be within the 90-degree side-to-side viewing cone and up to the 35-degree vertical viewing angle identified for viewing all screens. See **Visuals** and **Screens** noted previously for more definition.
- (2) Fixed seating attached to rows of tables not accepted unless demonstration unit is accepted and noted in writing by the **UCIF-ISG**.
- (3) Fixed and continuous tables acceptable in auditorium and large classrooms with movable chairs on casters.
- (4) Moving SSTs to be considered for all other classrooms with loose furniture for student positions.
- (5) **Square footage requirements for seating types** – room shape, function, and configuration causes a wide range of square feet for each seating type. In no case is the square footage for a type to be less than the minimum noted below and should fall close to the center of the range for each category.
 - (a) **AUDA** – Auditorium seating with single movable writing surface – 10 to 16 square feet;
 - (b) **AUD2** – Auditorium seating with dual movable writing surfaces – 15 to 20 square feet.
 - (c) **AUD3** – Auditoriums w/ fixed table work/writing surfaces & rolling chairs – 25 to 30 square feet.
 - (d) **FTAB** – Fixed Tables and attached chairs – not desired in new installations (see (2) above);
 - (e) **FTAC** – Fixed Tablet Arm Chairs – no longer to be used in new installations;
 - (f) **FTLC** – Fixed Tables and Loose Chairs – 25 to 42 square feet;
 - (g) **LTAC** – Loose Tablet Arm Chairs – no longer to be used in new installations;
 - (h) **STAB** – Stackable Student Table and Chair – 20 to 27 square feet;
 - (i) **TABL** – Moveable Tables and Chairs – 22 to 85 square feet;
- (6) **Student seating Space Planning Parameters:**
 - (a) **AUDA** – maintain no less than 36" from seat back to seat back, and preferably 42".
 - (b) **AUD2** – keep all seating at no less than 42" seat back to seat back, to allow passage of students when writing tablet surfaces are being used.
 - (c) **AUD3** – clear distance to be maintained from back of front table to front of next table behind adjacent rows (or back walls) to be minimum of 32" (measured horizontally), with 36" preferable and 30" side to side of centers of chairs. 4' minimum clear distance between rows is to be maintained in rows with wheelchairs.
 - (d) **FTLC** – in auditorium arrangements with fixed tables, keep at least 42" for the seating distance between a row's rear table edge and next row's front edge for loose chairs, & 30" side ways for each student position.
 - (e) **STAB** – maintain at least 36" for the seating distance between rows of SSTs and 30" side to side for each student position and no less than 36" for aisles (no less than 48" when chalkboards at side walls) unless distances changed and okayed with the GPC-FC.
 - (f) **TABL** – use a spacing distance front to back of 36" between table edges for sled or wheel based chairs, & 30" of width for each student position.
- (7) **Programmed Seat Counts:**
 - (a) When seat counts are given, that is the number to be placed in the room, even if square footage needs to be larger than programmed.
 - (b) Squeezing the required seat count into too small spaces will not be accepted.
 - (c) Reduced front instructional area or aisles will not be accepted to achieve the required seat count.
 - (d) If the acceptable seat count cannot be achieved this must be documented in writing and graphical form by the architect who will then forward the information to the **FC** via the PM or

PC. The **FC** will convey the situation up the chain for a response that will be documented in writing or by email.

- (8) "**GPC**" – to be painted on the bottom of all loose classroom furniture items in 1-1/2" to 2" high contrasting color block letters.

b. **Seating Types:**

(1) **Auditorium Seating:**

(a) AUDA & AUD2

- (1) 21" and 22" wide seat pans are to be used. If wider sizes become available these should be considered.
- (2) ADA required positions are to also be equipped with writing surfaces and the chairs defined below, to allow full use by other students when wheelchair users are not in the ADA required locations.
- (3) 15% at least, of the auditorium seats, are to have BOTH left and right-handed tablet arms on the same chair for use by both left and right-handed individuals. KI has prototyped such a seat for PSU usage. Contact for space requirements to be sure the programmed and required seat count can be achieved.

(b) AUD3

- (1) Critical to have distances defined above to allow movement when exams underway.
- (2) Table to be minimum 16" front to back and to have full-length front modesty panel.
- (3) Outlets may be required between pairs of seats for power and data – power only in wireless environments.

(2) **Seating with tablet arms**, when used (mostly for auditorium seating):

- (a) Tablet surfaces are to be the largest model available to accommodate laptops and paper, but in no case less than 144 square inches at the writing area.
- (b) >15% in a room are to be for left handed users.
- (c) Tablet surfaces are to have reinforced supports to prevent breaking of tablet arm when sat on by 300-pound individual.

(3) **SSTs** - student stacking tables

- (a) **24" wide x 19" deep x 30" high by CORT** Special Projects Group
11250 Waples Mill Road, Suite 500, Fairfax VA 22030 - 800-565-2678 - Dan Huber
- (b) **26" wide x 20" deep x 30" high by KI** - their Inspiration unit modified for PSU
3457 Babcock Blvd, Pittsburgh, PA 15237 - 412-635-7740 - Dave Whiting
- (c) All SSTs to have "C" support frames, and "PSU blue" tops

(4) **Student and instructor chairs** - stackable

- (a) **Thonet – Wafer Side Chair #5290** – can use any color other than Sand
Office Interior Solutions, 200 E. Calder Way, State College, PA 16801 – Kathy Crilly

(5) **For instructional and student laboratory technology seating stations** – tables, chairs, etc.

- (a) All such seating, tables, podiums, cabinets, etc. are to have full size samples submitted to the **UCIF-ISG** for review and approval before placing such products out to bid.

c. **CLEARANCES:**

- (1) Where possible, keep 5' between the last row of seats and the rear wall to handle projectors and foot traffic.
- (2). At fixed seating, check with **MTSS** to see if space is necessary at the rear wall for projection equipment. If so, do not place seats in this position. Coordinate w/ **UCIF-FC** and **MTSS** for space that should be left clear.

2. **Instructor table:** folding w/ modesty panel by Maywood - Training Table 24 x 60 x 30 H, LMO top, BL edge – 305 Woodcrest Circle, Limerick, PA 19468 – 610-630-3995 – Kevin Christman

3. **Coat hanging racks / strips:**

- a. Provide at least space for 50% of the room occupants.
- b. Locate as close to room rear as possible.
- c. Exceptions may be allowed as cleared with the **Instructional Support Group**.

4. **Trash and Recycling Containers:**

- a. Provide recessed space for such containers at each door to AND from each classroom.
- b. Do not encroach on circulation pathways; in fact provide more space in front of such containers to allow easy access and movement of students past them.

- c. Containers to have a unitized look and not to be random and “mixed” designs.
- d. Colors to work with those used in the surrounding space.
- e. These containers are to be in addition to those provided near drinking fountains, vending machines, newspaper dispensers and other such waste generating sources.
- g. Coordinate functional considerations closely with the **UCIF-FC** and **AI Matyasovsky**, Supervisor of Labor and Equipment, at 863-4719 and cell 777-2954

13.20. ASBESTOS:

1. Asbestos may be encountered.
2. Identify early in design process in the room and at other external locations critical to the project area.
3. Identify piping and conduit routes early in design outside the space being built or remodeled to complement planning, design and construction needs.
4. Contact Mike Burke at Environmental Health & Safety – 814-865-6391 – burke@ehs.psu.edu

15.00. PLUMBING, HEATING, VENTILATION & BUILDING NOISES AT OR NEAR CLASSROOMS:

1. **Pipes:**
 - a. To be dense and well insulated (cast iron pipes) for rain-water, and other pipe conductors close to classrooms. Pipes are not to touch the finished surfaces. Minimize sound transmission into the classroom of running water.
 - b. All pipe penetrations through walls, floors or overhead slabs are to be isolated and caulked at the penetrations to prevent sound transfer.
 - c. If baseboards used, ALL pipes to be hidden by the covering – none below the shroud.
2. **HVAC:**
 - a. **Room Air:**
 - (1) Use air-handling systems with **low velocity discharges**.
 - (2) Design and install systems that isolate machine and other air noises.
 - (3) Size ducts and diffusers large enough **to achieve a noise free “library quiet” environment. ASHRAE minimum requirements are not enough for classrooms.**
 - (4) Noise level is to be no higher than NC = 30.
 - b. **Transfer grills** - not allowed in doors or walls.
 - c. **No open return air plenum space between ceiling and structure** – due to need for electrical components for ceiling mounted technology projectors and document cameras, and wireless computer system receivers/transmitters.
 - d. **Diffuser throw** – orient so that air from diffusers does not hit projection screens.
 - e. **HVAC system for classrooms** – to be independent of rest of building so it can operate the entire year during class hours, whereas the rest of the building system may have the AC functions disabled during late fall, winter and early spring.
3. **Building and machinery noises** – Isolate from Classrooms, be the noise from elevator, HVAC equipment, other kinds of motors or other noise generators (including light fixtures).
4. **Thermostats** – place locking clear covers over all room thermostats to prevent tampering or use different units with setting controls separate (like above ceiling) from the wall sensor units.

16.00. SWITCH & DEVICE PLATE LAYOUTS ON WALLS OR PODIUMS:

1. **Close to Instructional Technology Podium/Desk/Instructor Areas:**
 - a. Concentrate the multiple controls for lights, screens and other components within 4 to 5 feet of the podium in each room. Engrave each device plate for functional area – see below.
 - b. Locate “**Help**” telephones near these controls, too.
 - c. Provide scaled construction elevation on drawings showing positions for all controllers, telephones, and other devices.

2. **At Other Areas:**

- a. Device plates at doors do not need to be engraved. These switches are to operate main body of room lights - only on/off.
- b. If rear booths are provided and control lighting, the device plates are to be engraved with the same wording used near the podium.

16.05. CONVENIENCE & DUPLEX OUTLETS:

1. **In Classrooms:**

- a. Run three channel wire management system across front of classroom & evenly space 5 duplex outlets in the wire management system.
- b. Side walls:
 - (1) Place at least two duplex outlets on each side wall and space no greater than 16' apart in classrooms without student technology.
 - (2) Place three channel wire management system the length of the side walls in classrooms with student technology.
- c. Rear wall:
 - (1) Include at least three duplex outlets on the rear wall evenly spaced out in classrooms without student technology.
 - (2) Place three-channel wire management system the length of the back wall in classrooms with student technology.
- d. Special outlets (may need to be in special fire rated enclosures) above lay-in ceiling:
 - (1) Include power outlets for wireless transmitters/receivers for WI-FI.
 - (2) Locations determined by system needs and coverage area.
- e. Special needs will be further defined for computer lab/classrooms.

2. **At Benches & Alcoves at Classroom Corridors:**

- a. For laptop computer use, space duplex outlets at 5' intervals above benches.
- b. For laptop computer use, provide boxes adjacent to duplex outlets.
- c. Use non-removable screws for the cover plates.

16.10. CONDUITS, WIREWAYS, LOW VOLTAGE WIRES, OTHER WIRES, WIREMOLD and OTHER UTILITY LINES:

1. Note that all such utility products are to be run behind the wall, ceiling, and floor finishes.
2. If exceptions are needed, identify them with the Classroom **FC** early in the design/construction process and are to be limited to "special" surface applications absolutely necessary due to structural issues.
3. Special wire management systems may be allowed on surfaces where they can be well integrated into the intended function and needs of the room. These signal cable and power wireways are to be identified early in the design process.

16.51. CLASSROOM LIGHTS AND LIGHTING CONTROL:

1. **GENERAL:**

- a. Use energy efficient lights, with tight light ray directional control, 3000-degree K bulbs.
- b. Fluorescent fixtures with parabolic louvers to have reduced grid size to minimize horizontal light spill and glare.
- c. **Do not hang any pendant direct/indirect fixtures between existing/new/future ceiling-mounted projectors and screens, nor use any within the front 2/3^{rds} of the room.**
- d. **Foot candles:**
 - (1) Minimum uniform light level at desk height is to be 50 FC, after bulb burn-in and after dirt accumulates, which means that 70 FC needs to be the minimal design level.
 - (2) Final lighting (with all lights fully on and none dimmed) FC measurement to be in 12 spots from front to back, thus:

IL	IC	IR	(Instructor left section, center section and right section)
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FL	FC	FR	(Front row seating, left, center and right at any seat in each section)
CL	CC	CR	(Center row seating, left, center and right at any seat in each section)
BL	BC	BR	(Back row seating, left, center and right at any seat in each section)

- (3) These 12 measurements will be averaged to check the 50 FC in each classroom before project closeout – any “under-designs”, especially at corners, will require additional placements of light fixtures as part of errors and omissions.

e. **Lamp Replacement Serviceability and Maintenance:**

- (1) In auditoriums and rooms with sloped or tiered floors, and high ceilings, maintenance access via catwalks with railings is to be included above the lights for changing burned out light bulbs.
- (2) High ceilings are those that cannot be accessed in all locations with a 10' ladder and require scaffolding to replace burned out bulbs.
- (3) Auditoriums are considered to be any tiered or sloped instructional space with seating for 140 or more students.
- (4) Such classrooms have very heavy use, and bulbs burn out regularly. Such bulbs need to be replaced when they are seen to be burned out – not between semesters as is required when scaffolding is necessary for removing burned-out bulbs and installing new ones.

2. **SCENE CONTROL SWITCHES:**

- a. Do **NOT** use, unless integrated into the computer control system (usually in large rooms) and/or cleared in writing with the **UCIF-Sub-Committee**.
- b. Low voltage lighting control systems can be used, though.

3. **MOTION & SOUND SENSORS:**

- a. Use in all instructional/classroom areas.
- b. Sensors are to automatically shut down all lights about 1 hour after no room activity is sensed.
- c. Sensors are to automatically and **within 1 second** turn on the main room lights when activity or noise occurs in a room and upon entering the room.

4. **GENERAL ROOM LIGHTING:**

a. **LIGHT SWITCH CONTROL LOCATIONS AND TYPE:**

- (1) Place at the instructor's area (see **16.00** above);
- (2) Center on the rear wall **ONLY** in rooms having rear projection capabilities;
- (3) Duplicate in rear projection booth, if any, and
- (4) Place at each room door.
- (5) Use only a single on-off switch at each entry/exit door position tied to main room lights.
- (6) Locate lighting rheostat dimming controls only at the instructional and rear projection (if any) positions.
- (7) Use pilot lights or illuminated panels to help locate all light control switches in the dark at the podium position.

b. **SWITCH CONTROL LABELING AND RELATIVE POSITION:**

- (1) Engrave all light control switch device plates only at instructional podium position and rear projection (if any) positions.
- (2) Possible labels for the lights operated – **FRONT, MIDDLE, MIDDLE BACK, MID DIM, BACK, BACK DIM, PODIUM DIM, TABLE, CHALKBOARD**, etc.
- (3) Lettering to be minimum 3/16" high unless other size authorized in writing by **UCIF - FC**.
- (4) Orient all switching positions and labeling to the room orientation.
 - (a) **Controls at side walls** - control front lights with front most switch, operate middle lights with middle control, back lights with back switch;
 - (b) **Controls at front walls** – control front lights with left switch, operate middle lights with middle switch, run rear lights with right one;
 - (c) **Controls at vertically stacked locations** – control front lights with top switch and rear lights with bottom one. Mount switches in one row. Mount other controls for podiums, chalkboards, screens, etc. in a separate row below or next to the room lights, again considering positions that best relate to the room location of each piece of equipment.

c. **GENERAL ROOM LIGHTING ZONES:**

- (1) Plan for at least 3 light zones in each room at the ceiling.
- (2) Plan each zone to run parallel to the front wall. Tie fixtures between the projector and screen to this front zone.

- (3) Plan middle (if any) and rear zones using three tube light fixtures.
 - (a) The outer tubes are to be tied to the front zone and manually controlled on/off by switches at all entry/exit doors, podium and rear projection or booth area.
 - (b) The center tubes are to be manually controlled to dim or turn off lights with switches only at podium and at rear projection or booth area.
- (4) Plan for the instructor to adjust all the lighting levels for his needs from near the teaching position.
- (5) LIGHTS/SWITCH LAYOUT: relate as noted for **SWITCH CONTROL LABELING AND . . .**
- (6) DO NOT place any ceiling light fixtures within 7' in front of any projection screens.
- d. **CHALKBOARD LIGHTING ZONE:**
 - (1) Use a separate on/off, circuited and wall mounted light strip above the instructor's chalkboard.
 - (2) Restrict light pattern to the chalkboard, so that none spills onto the back of the extended projection screen or toward the students. This means two switches for the chalkboards.
 - (3) Provide proper clearances to the fully extended screen.
 - (4) Mount switch with built-in pilot light on or near the instructional station.
 - (5) Properly label through 3/16" high engraving on the plate.
 - (6) 30 FC (50 FC design minimum) of lighting is to be provided on only the instructional chalkboard surfaces.
 - (a) Use light meters with the sensing element oriented toward the student seating area, NOT TOWARD THE CEILING.
 - (b) Determine by averaging 9 points of a three row and three column matrix.
- e. **INSTRUCTIONAL PODIUM AND SIGNER LIGHTING ZONES:**
 - (1) The ceiling mounted podium light is not needed if a light is built into the podium.
 - (2) Otherwise, provide.
 - (a) A very directional and adjustable fixture over the position - with no spill or wash on screens.
 - (b) Individual control, with rheostat having a pilot light, near the instructional station.
 - (c) Locate fixture on room center side of the podium, at about "11 o'clock" or "1 o'clock", and a few feet on the student seating side of the position, to minimize instructor head shadows on reference materials.
 - (d) Engrave switch plate with 3/16" high lettering.
- f. **INSTRUCTIONAL TABLE ZONE:**
 - (1) Place a dimming directional light fixture over the instructor table (when included) with no spill or wash on the screens. Individually switch from near instructional station. Position in ceiling system at 3' on student side of table.

16.52. CLASSROOM EMERGENCY LIGHTS:

1. Where codes require; such lights are NOT to be on when the class is in session, unless all building power goes off.
2. Classrooms / lecture halls need the ability to be made totally dark.
3. Fire alarm strobes are NOT to be placed behind projection screens, which when extended block the light from the strobes.

16.53. CLASSROOM EMERGENCY EXIT LIGHT SIGNS:

1. Use energy efficient LED type light signs where codes require emergency exit light signs.
2. Orient exit sign lighting so that light rays do not shine onto the screen areas, causing image "color shift".

16.54. CORRIDOR LIGHTING:

1. Provide code minimums for the general traffic areas where bench seating is also located.
2. Locate lights above bench/alcove areas that provide 50 FC of light for reading and writing.
3. If no benches provide 50 FC lighting in the corridors.

16.70. TELEPHONES:

1. Include in each technology classroom / lecture hall.
2. Provide necessary outlet and conduit.
3. Used as an intercom with a central computer/MTSS technician's office, shop, or network room.
4. **Locations in Classrooms:**
 - a. In instructional technology classrooms – locate on wall closest to podium or as designated by PSU.
 - b. In conventional classrooms – locate right beside the chalkboard at the instructional end of the room.
5. Coordinate early in project cycle and identify installation time frame with ITS-TNS and ITS-TLT to allow proper and timely installation during construction, not after finishes are installed.

16.80. SOUND SYSTEM:

1. Question need in each classroom for an instructor microphone and room speakers.
2. Consider technology and power needs as well as use of ADA hearing assisted devices for the audio impaired.
3. Use speakers tied via switcher/routers to the computers, CD Roms, DVDs and VCR's, in all cases.
4. Refer to above comments under the **CONVENTIONAL AV POWER / CONDUIT NEEDS** heading.
5. Coordinate with MTSS services.
6. Plan for speaker locations - in podium, at/in ceilings and/or on the walls (least desired). No conduits or wires on room finish surfaces.

16.90. AUDIO-VISUAL and TECHNOLOGY:

1. **TECHNOLOGY EQUIPMENT "CLOSET":**
 - a. If needed, place close to the instructional space for today's electronic computer and teaching systems.
 - b. Provide for a securable, well-ventilated "closet" / cabinet with extending shelves for server equipment.
 - c. Closely coordinate with the **ITS-TLT** and **MTSS** representatives.
 - d. Locate space so that access is possible from the front AND the back.
 - e. See door and push-button combination lock requirements noted above under item **8.00**.
2. **POWER AND CONTROLS:**
 - a. Provide power for tech projectors at the ceiling and computers at the podium/instructional area on the same circuit.
 - b. Locate such outlets in each classroom space.
 - c. Provide same feed with a common, same phase, same ground and neutral power circuits that are clean of ambient and stray signals for the podium/tech projector circuit(s).
 - d. Include cabling, 2" conduit, and boxes for controls between the podium and the projector positions.
 - e. No other powered items are to be tied into these circuits supporting instructional technology.
3. **CEILING HUNG PROJECTOR:**
 - a. Provide rigid structural support for the ceiling hung projectors for the current or future equipment.
 - b. Coordinate EXACT location with **MTSS**, if **MTSS** is involved with the project - or as specified by the projector manufacturer, based on screen size and projector model.
 - c. ROUGH PRELIMINARY PLANNING RULE to aid preliminary conduit placement - the projector is centered about 1-1/2 to 2-1/2 x screen width from the screen.

- d. **Construction documents must indicate to check with MTSS just prior to installing the projector infrastructure for exact location dictated by the purchased projector model.**
 - e. Identify in writing the exact projector model and distance factor prior to placing related components.
 - f. Models change so close coordination is necessary with **MTSS** until the actual projector is installed.
 - g. Mount screen top & projector as high as possible to maintain the greatest possible distance between projector bottom and floor – in no case less than 9' AFF.
 - h. Projector mount to structure:
 - (1) Use 4 unistrut rails, 1 set perpendicular, 6' long and spaced 3' apart and 1 set 4' long parallel to the screen for mounting the pipe hanger support to the projector.
 - (2) Obtain needed info from **MTSS** for particular projector "pipe" hanger to be used.
4. **CONVENTIONAL AV POWER / CONDUIT NEEDS:**
- a. **Slide or film projector controls** - provide all junction boxes, conduits, wiring.
 - b. **Sound jacks** – when requested, provide one sound jack at each box centered as follows:
 - (1) At front wall near the instructional position
 - (2) At back of the room
 - (3) At a central riser face, if any, about 1/2 way back; similarly connect near the instructional station.
 - (4) Place these jacks independent of technology podiums in all classrooms.
 - c. **At Technology Podiums:**
 - (1) Place (4) four-plex outlets (or more as defined by **ITS-TLT** and/or **MTSS**) inside each for projectors, amplifiers, etc. & one duplex outlet on the dashboard.
 - (2) Provide external power and cover plate arrangements for laptop use - coordinate with **MTSS**.
 - d. Engrave all plates in 3/16" high letters for "**SOUND**", "**PROJ-1**", and "**PROJ-2**", etc.
5. **TECHNOLOGY OUTLETS / POWER / CONDUIT NEEDS:**
- a. **General:**
 - (1) Include, place boxes and conduits for fiber and other cabling needed for technology classrooms.
 - (2) Place such power and cable boxes in/adjacent to the instructional podium, within the student area, if required and above ceilings for WIFI, if required.
 - (3) Mount convenience and tech outlets next to all computer and other technology equipment.
 - b. **Coordination** – work closely on technology outlet, locations and conduit home run needs with **ITS-TLT, ITS-TNS, MTSS** and **Police Services**.
 - (1) Generally locate such outlets for network and fiber close to or into the instructional tech podium.
 - (2) Place convenience outlets close to such "technology" outlet boxes.
 - (3) Engrave the labels on these outlet cover plates.
 - (4) Cable-TV access is to be included unless otherwise told.
 - c. **Telecommunications:**
 - (1) Into or within the room & at corridor benches, involve **ITS-TLT, ITS-TNS, MTSS, Police Services, UCIF - FC** & Design Team members.
 - (2) **Technology Classrooms:**
 - (a) Provide minimum (5) high-performance UTP cables and one RG-6 coaxial cable into the instructional technology podium.
 - (b) Provide minimum (1) high-performance UTP cable centered in the front wire way or if no wire way centered on the front wall beneath the chalkboard used by the instructor.
 - (3) **Conventional Classrooms:**
 - (a) Provide minimum (5) high-performance UTP cables centered in the wire way or if no wire way centered on the front wall beneath the instructional writing surface.
 - (b) Provide minimum (1) RG-6 coaxial cable at the instructional end of the room in the wire way or if no wire way then beside and below the writing surface that best accommodates a cart mounted television.
 - d. **Instructional Tech Podium** – four (4) of the four-plex outlets are to be placed inside and one duplex outlet is to be placed on the "dash board".
 - e. **At Corridor Benches:**
 - (1) Place conduits and outlet boxes for technology outlets beside each duplex outlet above benches.
 - (2) Coordinate closely needs with **ITS-TNS** for boxes and conduit runs to these outlet boxes.
6. **INSTRUCTIONAL PODIUM:**
- a. PSU design by **ITS-TLT** is to be used, as it is standard on campus. Who provides:

- (1) On projects funded by **UCIF** or **ITS-TLT**, podium is generally provided by PSU.
- (2) On building projects that are new, major renovations or additions, it and all technology is fully funded by the project **F F & E Budgets**.
- b. Is to be coordinated with **ITS-TLT** for location, type, and scheduling/delivery needs.
- c. Provide about 4' minimum between podium and the front wall projections (chalkboard rails, chase corners, etc) and 30" minimum from a side wall.

7. SECURITY LINES:

- a. Provide conduit from the room to the telecommunications closet for running the fiber optic security line from the permanently located computer equipment.
- b. Close coordinate with **Police Services** and their vendor is essential since they will be taking care of system.
- c. Costing of work:
 - (1) On projects funded by **UCIF** or **ITS-TLT**, security cost is generally by these PSU entities.
 - (2) On building projects that are new, major renovations or additions, the project **F F & E Budgets** cover the costs.

8. AMX, CRESTRON OR OTHER SPECIAL MEDIA & TECHNOLOGY CONTROL SYSTEMS:

- a. Such systems will most likely be used in large spaces requiring many technology components.
- b. Such control systems are usually subcontracted to AV integrators who write intensive software programs that permit the control system to properly and functionally operate the various devices (room lights, DVDs, VCRs, computers, data projectors, sound systems, document cameras, laptop computers, other plug-in devices, etc).
- c. Such intensive software programs most often involve compiled and un-compiled data or source code.
- d. Such compiled and un-compiled data or source codes shall be provided to PSU, with the complete code system turned over to PSU and MTSS upon complete installation of the system - to allow modifications by PSU when system components are modified or added thereafter.
 - (1) Provide the actual and complete code to PSU.
 - (2) The developer/vendor shall allow PSU to have ALL components of the software, in essence licensing the complete code in perpetuity to PSU, thus allowing PSU to use the code to modify the system and become the exclusive Owner of the software code for the unique location to which the code is developed.
 - (3) The developer/vendor shall fully warrant and document any code changes during the one (1) year warrantee period after the FULLY functional code and system is accepted by PSU. The developer/vendor shall be responsible for all required diagnosis, repairs, code and documentation updates.
 - (4) Once system and code is considered FULLY functional, it shall be used for a period of at least 10 days to be proven error free and perform accurately. If not error free and if not performing accurately in this 10-days, the developer/vendor will be required to make the proper code and function changes, at which point the 10-day error free period will once again commence. This cycle shall continue until all systems and code operate properly and without error for the particular installation.
 - (5) The detailed documentation of all code shall be provided to PSU in the care of **MTSS** by paper copy as well as in electronic form on CD in the latest version of Microsoft Word.

9. WIRELESS COMPUTER SYSTEMS:

- a. Evaluate possible use for each building project in the classrooms and immediate areas outside classrooms.
- b. Coordinate closely with the **UCIF-Sub-Committee** that includes representatives from **ITS-TNS** and **ITS-TLT** since their groups will be taking care of the systems.

END