



CLASSROOM & TECHNOLOGY DESIGN & CONSTRUCTION MINIMUM REQUIREMENTS

PREPARED
IN
COLLABORATION
WITH

THE SUB-COMMITTEE OF THE
UNIVERSITY COMMITTEE OF
INSTRUCTIONAL FACILITIES

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00.00. INTRODUCTION / GENERAL INFORMATION:

Below are minimal considerations for the design and construction of all PSU **classrooms, seminar rooms and lecture halls** being designed or planned for new or in remodeled work.

General Purpose Classrooms (GPCs) are defined as those classrooms, seminar rooms and lecture halls that are scheduled via the Registrar's Office for use by PSU faculty, staff, colleges, departments or PSU organizations. To allow easy use across the campus by all instructors, all **GPCs** by necessity require common elements.

GPCs are monitored and maintained by representatives from the Office of Physical Plant (janitors, area services, maintenance personnel, etc) and the **University Committee on Instructional Facilities (UCIF) Sub-Committee**, composed of members from various disciplines. The **GPCs** are up-graded by OPP and the disciplines representing the above Committee.

Additional considerations are often addressed and included in the **GPCs** that may be specific to the localized needs of a college or department, while including these **Classroom and Technology Design and Construction Minimum Requirements** hereafter referred to as **GPC Minimum Requirements**. Such additional considerations in **GPCs** are the responsibility of the college or department to maintain and upgrade.

Priority vs. No Priority Scheduling - **GPCs** where departments or colleges are given a lead time before the University wide scheduling of the classrooms are said to have priority scheduling. All other **GPCs** have no priority scheduling. Priority scheduling occurs when a department or college fully or partially funds a classroom and then contributes it to the **GPC** pool fully scheduled by the Registrar's Office. All classrooms that can be used by the University wide population are to be **GPCs**. Some graduate level and very special classrooms, such as art or music rooms, may not be easily adaptable to general classrooms usable by the University wide population. These classrooms would remain departmental or college classrooms.

College and/or departmental classrooms, seminar rooms and lecture halls (CDCs) - The recommendation is that **ALL CDCs** comply with these **GPC Minimum Requirements**. At the very least, do not design and build classrooms, seminar rooms and lecture halls that inhibit the later upgrade of the **CDCs** to **GPCs**. Additional components may be added to **CDCs** that address the specific needs of the college or department as qualified above.

CDCs are defined as those instructional spaces generally maintained and upgraded at the expense of the college or department. During late design, construction or shortly after a project is completed, many colleges or departments decide to have rooms originally defined as **CDCs** converted to **GPCs** – usually due to financial issues. Conversion from **CDCs** to **GPCs** is relatively simple when constructed according to the **GPC Minimum Requirements**. The proper infrastructure and components would be in place. Thus, the college or department would not have to pay to upgrade the **CDCs** to the minimum requirements of the **GPCs**.

TRENDS:

The trend is for 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://www.libraries.psu.edu/mtss/equipment/purchase.html>

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

http://www.registrar.psu.edu/staff/instructional_facilities/inst_facilities_index.html

The **University Committee on Instructional Facilities (UCIF)** is a group of 16 individuals that take responsibility of the instructional spaces at Penn State. The chair is from the Office of the Vice-President and Dean for Undergraduate Education at Penn State. The UCIF has members that represent professors, students, the Registrar's Office, Media Tech and Support Services, OPP, the Commonwealth Campuses, Information Technology Services, Teaching & Learning Technology, Educational Equity for Underrepresented Groups and the Schreyer Center.

The UCIF-Sub-committee is a working and detail committee that reports to the **UCIF**. The University Committee on Instructional Facilities Operations & Technology Sub-committee members are:

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The individuals indicated in **Bold Lettering** above comprise the **Instructional Support Group (ISG)** from this Committee. These seven individuals are **CLOSELY** involved with all design, construction and operational aspects of the general-purpose classrooms. They 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 and CDCs. The **UCIF** Facilities Coordinator is the primary contact and CLIENT for new and renovation project meetings that require the Penn State expertise related to GPCs. The UCIF Facilities Coordinator in turn involves the various specialists that are also CLIENTS on any classroom project, while also being a part of the ISG.

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 conflicts from new innovations 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 problem areas 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
CDC(s)	College and department classroom(s), seminar room(s) and lecture hall(s)
CD	Compact Disk
DVD	Digital Video Disk
FC	Facilities Coordinator
FR&P	Facilities Resources & Planning
GPC(s)	General Purpose Classroom(s), seminar rooms(s) and lecture hall(s)
>	greater than
HER	Head end room (for technology that routes data to different rooms in a building)
HVAC	Heating, ventilating and air conditioning
IIC	Impact Isolation Class
ISG	Instructional Support Group
ITS	Information & Technology Services
<	less than
MTSS	Media Technology and Support Services
NRC	Noise Reduction Coefficient
OPP	Office of Physical Plant
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, sound strips 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. Locations for GPCs (new construction and if possible in renovations):
 - (1) Preferably on ground entry level and as close to main traffic



- entry doors as possible due to high traffic volume.
- (2) Near major stairs and elevators on levels immediately above ground level to isolate class change noise and high traffic functions from office and lab functions.
- (3) Keep away from noise generating sources as restrooms, building system rooms, labs and hazardous material rooms.
- 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:**

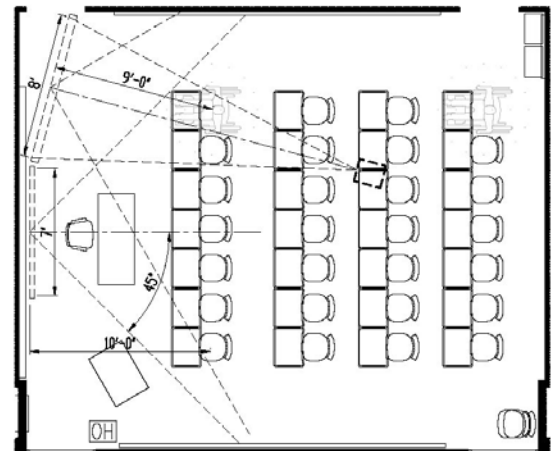
- (1). Corridors to be sized for double the loads identified in codes due to the heavy number of students leaving classrooms competing with those trying to get in classrooms.
- (2). In any case corridors to not be less than 10' wide.
- (3). Bench type seating is to be provided outside classrooms. The 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. Integrate waste receptacles into bench seating areas.



- (4). Consider cleaning, maintenance and comfort requirements when detailing bench seating.
- (5). **Student Waiting/Meeting Alcoves/Commons:**
 - (a) Encouraged along circulation paths serving classrooms, to allow groups to meet and have discussions while waiting for class changes.
 - (b) Such spaces can be equipped with chalkboards to facilitate student discussions and interactions.
 - (c) Such spaces 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) Adequate instructional area can be included:
 - (a) To have all areas and writing surfaces easily visible from all student seating.
 - (b) To have 24" x 60" instructor table w/ modesty panel, with chair(s) at table(s).
 - (c) To have minimum 8' space with 10' preferable (as further restricted by screen viewing needs identified later) from board wall to first row of student seats.
 - (d) To have all lighting, screen, tech controls and telephones easily accessible from a defined wall area near any instructional technology lectern (podium).
 - (e) To be totally accessible.
 - (f) To have space for parking cart-mounted overhead projectors.
- (5) Machinery and other noises need to 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 extends 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 (on chalkboards, projection surfaces, or whiteboards):**
 - (1) Glare from overhead lighting 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 (closet type alcove) 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 – no strike mullions on double doors.
3. **Hardware:**
 - a. To comply with PSU and code requirements with "CR" key lock cores.
 - b. To have totally quiet operational and closing characteristics.
 - c. To have only key lock and unlock **CLASSROOM FUNCTION** assemblies – no pushbuttons in edge plate, no dogging buttons or knobs on panic hardware, must always be able to egress from the classroom side.
 - 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; no power required in or to units) with "MTSS" key lock core.

08.50. WINDOWS:

- 1. **Interior** – NO glass beside doors (unless translucent glass block is used) where only narrow mullions separate the glass and door areas – separation must be at least 24"; or glass must be black – no covers.
- 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 and designed to not cast beams of sun or daylight 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 sides of rooms, as chalkboards are to be on front and side walls (no windows on front wall or within 15' of front walls).
 - f. Not recommended in lecture halls and interactive video conferencing classrooms used for distance education.
- 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 wall areas subject to abuse, such as below chair rails.
 - c. Apply chair rails on all non-masonry back and side walls in GPCs with movable student furniture - make of 1 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.



- e. Accent colors on walls are desirable – do not place on front wall or walls that might reflect onto screens.

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 small rooms (less than 20 students) 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 – units need to be dropped for servicing and replacing worn parts – screens to be placed in recessed box.
- b. **Sight lines** – between screens and any student seating to not be obstructed.
- c. **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.
- d. **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 tegular tiles & 24 x 24 or 24 x 48 sizes and normal grid members (not narrow designs or metal edged tiles).



09.60. CLASSROOM FLOORS:

- 1. **Multiple floor levels in a GPC** – no longer desired for instructional stages or seating tiers accessed by steps – ADA access needs must be addressed. 100 seat or greater lecture halls are the exception.
 - a. If used at student seating, all aisle riser nosings must be of contrasting color to the remaining flooring colors.
 - b. Aisle riser nosings to be metal only – plastic and vinyl do not last in high traffic areas like GPCs.
- 2. **Sloping floors** – under auditorium seating and/or at sloped aisles with flat tiers under seating are acceptable.
- 3. **Ergonomics – sight lines** – 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 6'-8" or as short 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. Use carpet tiles in classrooms, >10 stitches per inch; Antron 6.6 fiber nylon, yarn weight of 20 to 30 ounces; multi-dark colors to not show spills; stain, moisture & wear resistant; impervious and thick Unibond backing material not affected by moisture; edge curl resistant with no edge ravel; glue resistant to wet cleaning, anti-static, UL Class A; Lee's carpet squares are the recommended product.
 - b. Use only carpet squares pre-glued (preferred) w/ temporary backing to protect glue until carpet in place, where possible.
 - c. Other special flooring usage requires ISG acceptances, examples vinyl tile or sheet goods – if okayed, use the thickest materials.



- d. To complement acoustical needs for room for meeting acoustical requirements defined under **Room Acoustics** and **Noise** above.
- 6. **Wall Bases** – generally 4” vinyl or rubber to match existing materials in room. If a vinyl or rubber base, use pre-molded corner pieces.

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.
 - c. Provide with aluminum trim and tray, concealed spline connections.
 - d. Furnish with 50-year warranty against surface defects, shadowing after erasing, etc.



- 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 chalkboard from student seating positions.
 - c. Set chalk trays at 36” AFF.

3. **Add-ons:**

- a. Tack-boards:
 - (1) ONLY IN STUDENT TECH LABS – include tack surfaces on each side wall and back wall to allow special postings, with minimum of 4’ x 10’ behind printing stations.
 - (2). In other classrooms – only place 4’ h x 4’ to 6’ wide tack boards near rear entry doors.
- b. Chalkboards: Include top tack strip and map hook rail with movable map hooks, 1 for each 24” of chalkboard length plus one to have even number, unless otherwise accepted by the **Instructional Support Group**.
- c. Erasers: provide one per every 4’ (or fraction thereof) of chalkboard. Use Finney 12” erasures. More information is available at: 1-800-846-7027, <http://www.finney-hobar.com/erasers.html>.



- 4. **Definition in construction documents** – include board(s) sizes, mounting information, hidden fasteners, top cork tack strip and hook rail, hooks, chalk tray and specifications on construction documents.
- 5. **Recommended manufacturer:** Aywon, 100 E. Diamond Ave., Hazleton, PA 18201; 800-523-6671
- 6. **Whiteboards:**
 - a. Not supported in general-purpose classrooms at University Park Campus.
 - 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.

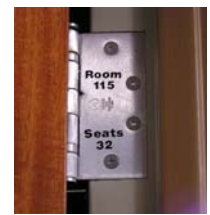
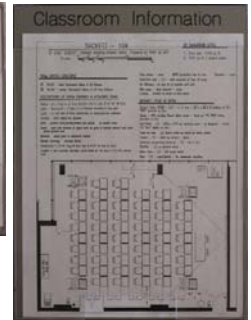
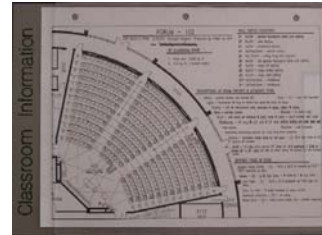
10.42. ROOM SIGNS:

- 1. **Required:**
 - a. Room numbers and “**Classroom**” is to occur at all classroom doors - see Sign Standard at OPP and example below.
 - b. OPP Sign Standard defines signage system and type.



2. **Added signs:**

- a. At each entry door from corridor place “**No Food, Drinks, Tobacco-use Allowed in Room**” and “**Doors Locked? Call Classroom Hotline 863-6000**”. An example is above.
- b. Beside each main door exiting a classroom place a sign reading “**Do Not Remove Tables, Chairs or Tech Items – These Are Classroom Materials**”. An example is above.
- c. Above or beside each help phone near the podium, a special sign with “**Room Number and BUILDING NAME**”, “**Tech Helpline 8-777-0035 – dates and times**”, “**Environment/Room Hotline 863-6000**”, “**University Police 863-1111**” and “**Security Escort Services 863-WALK**” is to be provided. An example is above for 129 Waring – verify Tech Helpline number as it can be different in different buildings.
- d. Include horizontal or vertical 9” x 12-1/4” slip-in sheet “**Classroom Information**” sign frame and transparent cover to be mounted as follows:
 - (1) At classroom/computer labs – two “ad-hoc” information frames at each door, 1 above and 1 below each room sign or as otherwise noted;
 - (2) At front of all classrooms above help phone – horizontal or vertical depending on room layout chart that will be placed in frames.
- e. **Room seat count identification** - Apply vinyl number for janitorial and maintenance purposes.
 - (1) **Numbers** – to be 1/8” to 1/4” high.
 - (2) **Location at door** – on top hinge plate fastened to frame, so that when door is closed the number does not show.
 - (3) **Which door** – put at east and/or south most door if codes require room to have more than one exit door. If two or more doors are necessary for room, place numbers at southeast most door.
 - (4) **Codes** – include “**Room ###**”; are for all and only loose furniture to go in classroom – “**IC = #**” Instructor Chair, “**IT = #**” Instructor Table, “**SC = ###**” Student Chairs, “**ST = ###**” stacking student tables, “**LTAC = ###**” loose tablet arm chairs.
- f. **GPC Directory** – locate at each building entrance a graphic building plan directory showing viewer location 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. See below. Dalglight screens with heavy black backing are recommended. Avoid side-tab tensioned screens.
2. **Quantities** – a minimum of 2 screens should be provided in classroom, 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 main screen width to most distant viewer - use a ratio of 1 to 4 for 4 x 3 format (1 to 3 for 16 x 9 format). Example - 32' to most remote viewer gives an 8' wide screen (gives 11' – rounded up – for 16 x 9 format).
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 screen unit can be dropped out for maintenance or replacement without destroying ceiling, soffits or other surrounding finish materials.
8. **Motorized Main Screen:**
 - a. Fully recess into ceilings at ALL locations unless identified otherwise in writing w/ ISG.
 - b. Mount so that in the down position it will clear wall-mounted lights at chalkboards or other protrusions.
 - c. Use engraved **SCREEN - UP, STOP, DOWN** control switch to operate screen movement.
 - d. **MOMENTARY SCREEN CONTROL SWITCHES ARE NOT ACCEPTABLE. THERE MUST BE A CENTER OFF POSITION AND SUSTAINED CONTACT WHEN SWITCHED TO "UP" OR "DOWN".** Screen units have limit switches that stop operation.
 - e. Screens 8' wide and wider to be motorized, unless defined otherwise by the ISG.
 - 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;
 - anchor wood box securely to building structure, not ceiling grid system.
 - g. In rooms 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 when extended no less than 36" AFF.
 - c. Do not hang screens from T-bars as hangers pull down – ceiling edge angles may be fasted to such boxes.
 - d. Hang screen housing inside 5-sided box recessed into ceiling as pictured and noted above.
 - f. Provide pull **chain** with knob on end for pulling down screen. Pull knob to be at 6' above floor for rolled screen.
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 at top toward GPC to minimize keystone effect from cart-mounted overhead projectors – work with **MTSS** for projector location for particular screens.



**RECESSED
MANUAL SCREEN**

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 used in operating mechanisms fail badly - do not use.
 - c. Provide these dual layer 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.
 - g. Mount such window coverings to clear any projections on the windows being covered and provide enough space to ceiling system to allow proper placement of the dual layer shade system.



2. Add combination locks to operable windows at spaces with air conditioning.
 - a. Building staff can open windows until non-functioning HVAC systems are operational.
3. Provide vertical mullion light shields to prevent exterior sun light from passing between adjacent shade units. Sun light to not hit screens.
4. If venetian blinds are necessary, they are to have non-plastic components and heavy duty operating components (photo example – NO plastic wands or wand connectors).



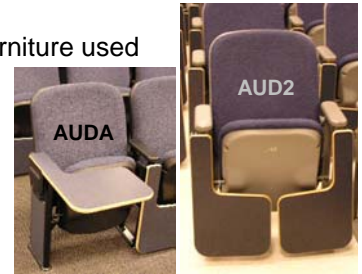
12.60. FURNISHINGS – SPECIAL EQUIPMENT:

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 of this minimum distance to the front of the classrooms.
- (2) Fixed seating attached to rows of tables not accepted unless demonstration unit is accepted and noted in writing by the **UCIF-ISG**. Such attached seats do not accommodate large or tall users.
- (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 used 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** – Classroom Lecture Hall with Auditorium seating having single movable writing surface – 10 to 16 square feet;

- (b) **AUD2** – Classroom Lecture Hall with Auditorium seating having dual movable writing surfaces – 15 to 20 square feet.



- (c) **AUD3** – Classroom Lecture Hall in Auditoriums type 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** – (**SSTs**) 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** – Classroom Lecture Hall - maintain no less than 39” from seat back to seat back, and preferably 44”.

- (b) **AUD2** – Classroom Lecture Hall - keep all seating at no less than 44” seat back to seat back, to allow passage of students when writing tablet surfaces are being used.

- (c) **AUD3** – Classroom Lecture Hall - 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 36” 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 28” 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 **ISG**.
- (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:**
- 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.
 - Squeezing the required seat count into too small spaces will not be accepted.
 - Reduced front instructional area or aisles will not be accepted to achieve the required seat count.
 - 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) **Classroom Lecture Hall Auditorium Seating:**
- AUDA & AUD2**
 - 22” and wider seat pans are to be used. If wider sizes become available these should be considered.
 - 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.
 - 15% at least, of the auditorium seats, if AUDA, 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.
 - Power is to be run to all seat rows for use with laptops – coordinate with ISG for exact details.
 - AUD3**
 - Critical to have distances defined above to allow movement when exams underway.
 - Table to be minimum 16” front to back and to have full-length front modesty panel, except at wheelchair positions, where the front panel would not allow the wheelchair user to get close enough to the writing surfaces.
 - Outlets may be required between pairs of seats for power and data – power only in wireless environments.
 - Heavy T-spline edges to be used on all tables at student positions and the T-molded spline edge is to be additionally glued in place. Do not use laminated plastic edges.
 - Chair type – to be capable of swiveling, have casters appropriate for the type floor surface the chair is to be located upon and is to have only a lever to raise or lower seat. No arms, knobs or back leaning or back height adjustments. Chairs to have durable fabric and construction with minimum of 10-year warranty on all parts and fabric.
Departments or colleges wishing to have more than this basic seat configuration will be responsible for replacing such seats in GPCs.
- (2) **Seating with tablet arms**, when used (mostly for large classroom lecture hall auditorium seating):
- Tablet surfaces to be largest model available (for laptops and paper) and not less than 212 square inches (280 square inches preferred) at the writing area.
 - >15% in a room are to be for left handed users.
 - Tablet surfaces are to have reinforced supports to prevent breaking of tablet arm when sat on by 350-pound individual.
- (3) **SSTs** - student stacking tables
- 24” wide x 19” deep x 30” high by CORT** Special Projects Group

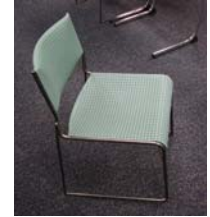


11250 Waples Mill Road, Suite 500, Fairfax VA 22030 - 800-565-2678 - Dan Huber

- (b) **26" wide x 20" deep x 30" high by KI** - their Intellect unit modified for PSU

3457 Babcock Blvd, Pittsburgh, PA 15237 - 412-921-2611, ext 12 - Dave Whiting

- (c) All SSTs to have "C" support frames, and "PSU blue" tops
- (4) **Student and instructor chairs** - stackable with perforated seat/back
 - (a) Example: **Thonet – Wafer Side Chair #5290** – can use any color other than Sand at SSTs
 - 1) McCartney's, PO Box 1714, Altoona, PA 16603 – 800-548-4138 – Mary Beth Schmidhamer
 - 2) Educational Furniture Solutions, 305 Woodcrest Circle, Limerick, PA 19468 – 610-630-3995 – Kevin Christman or Kathy Crilly
 - (b) See 1 b (1) (b) 5) above for another allowed seat type defined at AUDA 3.



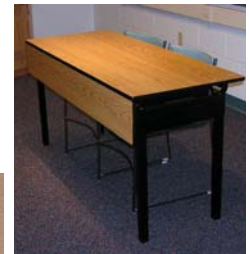
- (5) **For instructional and student laboratory technology seating stations** – tables, chairs, etc.
 - (a) All such seating, tables, podiums, cabinets, etc. are to have full size samples submitted to the **UCIF-ISG** for review and approval before placing such products out to bid. See 1 b (1) (b) 5) above for seat type noted under AUDA 3 heading.
 - (b) **Technology tables** - to have hidden-from-view and integrated wire management systems that are continuous from one table to the next and to the point of connection with the building infrastructure.



c. CLEARANCES:

- (1) Where possible, keep 5' between the last row of any seating type 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 (and in some cases student tables):** folding w/ modesty panel by Maywood - Training Table 24 x 60 x 30 H, LMO top, BL edge – Educational Furniture Solutions, 305 Woodcrest Circle, Limerick, PA 19468 – 610-630-3995 – Kevin Christman or Kathy Crilly.



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 outside classrooms near drinking fountains, vending machines, newspaper dispensers and other such waste generating sources.
- f. Include space in design next to printing stations in computer lab- classrooms for recycling waste containers.
- g. Coordinate functional considerations closely with the **UCIF-FC** and **Al Matyasovsky**, Supervisor of Labor and Equipment, at 863-4719 and cell 777-2954.



5. **Cart Mounted Overhead Projectors:**

- a. Used in nearly all GPCs, so plan for their use as well as storage when not used in a class.

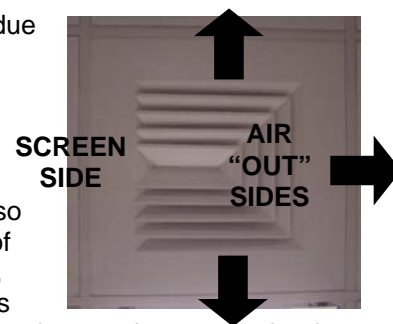
- b. Generally will be used on secondary screen in rooms having instructional technology, though they can also be used on the main screen.
- c. Distance from screen can vary from 9' in small GPCs to 16' in lecture halls – do not plan rooms to have these set in the student seating areas.

13.20. ASBESTOS:

1. Asbestos may be encountered in renovation projects.
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 discharge diffusers.***
 - (2) Design and install systems that isolate machine and other air noises.
 - (3) Size ducts, diffusers and air returns 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 in general and NC = 20 at grills or registers.
 - (5) ANSI/ASA S12.60-2002 sets 35 decibels for maximum background noise for unoccupied school classrooms – this is too high and needs to be 30 decibels or lower.
 - b. **Transfer grills**
 - (1) Not allowed in doors or corridor walls.
 - (2) To be used to equalize air pressure of auditorium classroom spaces on both sides of large-attached-fixed projection screens.
 - 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 any projection screens, as shown by three way diffuser to right.
 - e. **HVAC system for classrooms** – zone independent of rest of building so zone 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. Maintain proper room air exchanges at all class occupied times, during both the cooling and heating seasons and size for the people loads, any heat generating and technology equipment loads, as well as loads from adjacent side, below and above spaces.
3. **Building and machinery noises & vibrations**
 - a. Isolate from Classrooms, be the noise or vibrations from elevator, HVAC equipment, other kinds of motors or other noise generators (including light fixtures).



- b. Building equipment vibrations transferred into building structure not desired as such vibrations can cause classroom ceiling hung technology projectors to bounce around. Do not allow this to happen.
4. **Thermostats** – place locking clear covers over all room thermostats or temperature sensors 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 NEAR PODIUMS:

1. Close to Instructional Technology Podium/Desk/Instructor Areas:

- a. Concentrate the multiple controls for lights, screens, ceiling mounted tech projectors and other components within 4 to 5 feet of the instructional tech podium in each room. Engrave each device plate for functional area – see below.
- b. Locate “**Help**” telephones near these controls, too.
- c. Provide in construction documents scaled elevation layout showing positions for all controllers, telephones, and other devices.



2. At Other Areas:

- a. Light switches are required at all classroom vestibule doors and classroom doors, except one way emergency exit doors (no hardware on door outside room). 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 lighting control happens in booth, the device plates are to be engraved with the same wording used near the podium.

16.05. CONVENIENCE & DUPLEX OUTLETS:

1. In Classrooms:

- a. Front walls – run two-channel wire management system across front of each classroom and evenly space 3 duplex outlets in the wire management system (Wiremold).
- b. Side walls – in addition to above requirement:
 - (1) Place at least two duplex outlets on each sidewall and space no greater than 16’ apart in classrooms **without** student technology.
 - (2) Place two-channel wire management system the length of the sidewalls in classrooms **with** student technology.
- c. Rear wall:
 - (1) Place two-channel wire management system the length of the back wall in classrooms and evenly space 3 duplex outlets in the wire management system.
- d. Wire management systems – to be mounted with tops just below chalkboard trays – same for other walls.
- e. Above Lay-in Ceiling:
 - (1) Special outlets may need to be in special fire rated enclosures.
 - (2) Locate for ceiling mounted tech projectors.
- f. At printer stations in computer-lab classrooms - Four-plex outlets to be provided above cabinet or above table top.
- g. Special needs will be further defined for computer lab/classrooms and computer driven informational signs.



2. At Benches & Alcoves at Classroom Corridors:

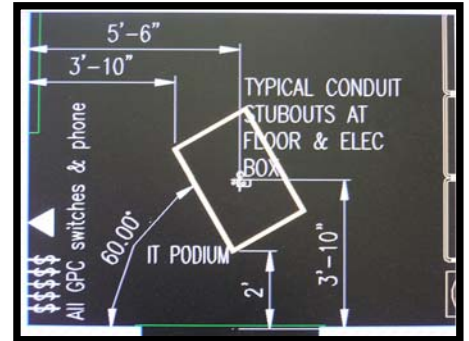
- a. For laptop computer use, space duplex outlets at 5’ intervals above benches.
- b. For laptop computer use, provide boxes adjacent to duplex outlets.
- c. Use non-removable screws for the cover plates.

3. At Flat Panel Information Screens outside Computer Lab / Classrooms:

- a. Provide clock outlet in wall beside doors to such rooms for power to the flat panel monitors.

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 early in the design/construction process with the Classroom **FC** in which case they 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.
4. Conduits between projector and instructional technology podium:
 - a. 2" metal electrical conduit (no substitute sizes or plastic) to be used for control and signal cable from tech podium to tech projector for cables with molded ends (example: **NO BNC CABLES TO BE USED**) and to equipment racks in some rooms requiring more equipment than will fit in the instructional tech podium.
 - b. Two 1" conduits required for power and security wires between tech podium & tech projector:
 - (1) Power to be same phase, ground, neutral, etc. at a GPCs tech projectors, podium and equipment rack (where needed).
 - (2) Security conduits to be separated from power conduits by a minimum of 6" due to power interference with signal and security cables.
 - (3) Security conduits to be separated from lights and their circuits by at least 24" due to electrical emissions that interference with signal and security cables.
 - c. Two 2" conduits (no substitute sizes or plastic) required for signal cables with 3 tech projectors used in a room.
5. Conduits for Flat Panel Information Screens outside Computer Lab / Classrooms:
 - a. Provide conduits to data outlets and security box in wall beside doors to such rooms to operate and secure the flat panel monitors.
 - b. Conduits can terminate above accessible ceiling systems. Otherwise run to telecommunication closet.



16.51. CLASSROOM LIGHTS AND LIGHTING CONTROL:

1. **GENERAL:**
 - a. Use energy efficient lights, with tight light ray directional control, 3000-to 3500 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)
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 (or other easy access methods) 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 essential 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 and entry vestibules into classrooms.
- 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, BACK, BACK DIM, PODIUM DIM, TABLE, CHALKBOARD, AISLES**, etc.
- (3) Lettering to be minimum 1/8” 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 2 main room light zones in each room at the ceiling.
- (2) Plan each zone to run parallel to the front wall. Tie fixtures between the ceiling tech projector and screen to this front zone. Large **GPCs** may require special consideration and discussion with the **ISG**.



- (3) Plan middle (if any) and rear zones using multi-tube light fixtures.
 - (a) Half or greater than half of each fixture 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 remaining tubes are to be manually controlled to dim or turn off lights with switches only at podium and at rear projection or booth area.
 - (c) Alternatives:
 - (1) All lights of fixtures come fully on with the front fixtures when activated at the door plus allowing independent control at the instructor station of the front fixtures and the back fixtures. These back fixtures would then be entirely dimming at the instructional area.
 - (2) All lights go on when the motion-sound sensor turns on lights upon entering a dark room.
- (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' 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 chalkboard lights.



- (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 1/8" high engraving on the plate.
- (6) 30 FC (50 FC design minimum) lighting average 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.
- (7) Suggested product: Alkco surface mounted wall washer 7500 series, phone 847-451-0700.

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 1/8" 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. Use relay system to turn on these fixtures in case of power outage.
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" or interlock via relay to light only when emergency power is activated.

**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. Locate light switches adjacent to benches for bench/alcove area lights.
4. If no benches provide 50 FC lighting in the corridors serving instructional rooms.
5. Use occupancy-motion sensors to also turn on-off these lights, in addition to light switches adjacent to benches and at the each end of a corridor/hall served by the lights.

16.70. TELEPHONES:

1. Include in each technology classroom / lecture hall.
2. Provide necessary outlet, wiring 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 instructional podium or as designated by PSU – **ISG** members.
 - 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.
6. See section 16.90, paragraph 5 - C for more specifics.



16.80. SOUND SYSTEM:

1. Question need in each classroom for an instructor wireless and/or fixed microphone and room speakers.
2. Consider technology and power needs as well as use of ADA hearing assisted devices for the audio and/or visual 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** leadership.
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 of a rack.
 - e. See door and 5-push-button combination lock requirements noted above under paragraph **8.00**.
 - f. Proper conduits identified elsewhere in this document to run into this room from the instructional tech podium(s) and the ceiling projector(s) and speakers.
 - g. Provide at least one quadruplex outlet 36" above floor. Add more outlets as needed to meet tech equipment load requirements. If more are needed, locate horizontally every 4' along the walls around these technology equipment rooms, same phase, ground, and neutral as that of the instructional tech components used in the GPC.
 - h. Provide cooling capacity that will adequately maintain a maximum room temperature of 70° F 24 hours a day year around.
2. **POWER AND CONTROLS:**
 - a. Provide power for tech projectors at the ceiling and computers at the podium/instructional duplex outlet 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 (no substitute sizes or plastic)**, 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.
 - f. Provide a keyed switch for the power circuit(s) to the ceiling mounted tech projectors in each GPC.
 - (1) Locate keyed switch(es) next to other ganged switches on the wall near the instructional tech podium.
 - (2) Key switch to match that for the Forum GPCs, with a common keyway requiring only one key for all switches.
 - (3) Keyed switch is to be used to totally shut off power to projectors to allow proper resets to occur as needed with the newer projectors.
3. **CEILING HUNG PROJECTOR:**
 - a. Provide rigid structural support for each ceiling hung projector for the current or future equipment.
 - (1) Use 4 unistrut rails, 2 set perpendicular, 6' long and spaced 3' apart and 2 set parallel to the screen, 4' long for mounting the pipe hanger support to the projector.
 - (2) Obtain needed info from **MTSS** for particular projector "pipe" hanger to be used.

- (3) Provide threaded pipe needed between unistrut mounting plate and tech projector mounting plate.
 - (4) Isolate from all building and mechanical and system vibrations to prevent image from jumping around screen.
 - 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, except when placed in a rear booth, or with special lenses fabricated for a special need.
 - 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.
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) Install one duplex side outlet pedestal (no higher than 3-1/2") on the floor under the podium for the podium power plugs.
 - d. Engrave all outlet plates in 1/8" high letters for "**SOUND**", "**PROJ-1**", and "**PROJ-2**", etc.
 - e. See 16.90 paragraph "1" above for other power requirements for AV equipment.
5. **TECHNOLOGY OUTLETS / POWER / CONDUIT NEEDS:**
- a. **In General:**
 - (1) Include, place boxes and conduits for fiber and other cabling needed for technology classrooms – see paragraph **16.10**.
 - (2) Place such power and cable boxes under/adjacent to the instructional podium, within the student area, if required and above ceilings for instructional tech projectors.
 - (3) Mount convenience and tech outlets next to all computers and other technology equipment.
 - (4) See other items in this 16.90 section for other needs related to instructional technology component needs as well as Section 16.05.
 - b. **Coordination** – work closely on technology outlet, locations and conduit home run needs with **ISG**.
 - (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. **For Telecommunications:**
 - (1) Into or within the room & at corridor benches, involve **ISG** & 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 in the location that best accommodates a cart mounted television.

- d. **At Instructional Tech Podium** – power strips provided by ITS-TLT will be plugged into the floor duplex outlet pedestal under the podium.
- e. **At Printer Tables or Counters in Computer Lab-Classrooms** – provide for four-plex outlet above table or counter height.
- f. **At Ceiling Mounted Tech Projectors** – provide duplex outlet at projector location. Also include key lock on/off switch for this projector. Locate key lock next to other controls on wall near instructional tech podium.
- g. **At Corridor Benches:**
 - (1) Space at 48" o.c. duplex outlet above benches for power use of wireless laptop computers.
 - (2) Coordinate closely needs with ITS-TNS for boxes and conduit runs to these outlet boxes.
- h. **At Flat Panel Information Screens outside Computer Lab / Classrooms:**
 - (1). Provide blocking in wall to support monitor mounting bracket and the junction boxes for the power, data and security wiring.

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 **3'-6" minimum** between podium and the front wall projections (chalkboard rails, chase corners, etc) and **24" minimum** from a sidewall. See plan graphic under paragraph 16.10.



7. COMPUTER LAB – CLASSROOM:

- a. Such rooms have power, network connections and security cabling run in several manners to the technology on the student computer tables. Generally, one to two computer stations are located on a table, depending on table length.
 - (1) Table ends or sides butted to walls – utilities feed from wall mounted multi-channel wire-ways. In such cases, all utilities are to be fed from these wire-ways.
 - (2) Free standing tables in rows or groups – utilities feed from **EACH** floor box serving **EACH** table. Each floor box is to have power outlets, network connections and a place for the security hard wire to rise to fasten to the black box often mounted on the bottom of a table in that row or group.
 - (3) Utilities to computer lab tables are:
 - (a) Network wires – individual cables to each computer station from the central telecommunications room – necessary in floor boxes or at the wire-ways.
 - (b) Security fiber optics – this is looped through a series of computer stations, usually in a row or group of tables that ties to a “black box” mounted to a table and hardwired back to the telecommunications room via the wire-way or the floor boxes (usually at only one floor box per group or row).
 - (c) Power:
 - 1) Via floor boxes – each computer station needs two plug outlets for power or junction boxes for pigtailed or whips.
 - 2) Via wall mounted wire ways – two possibilities exist, depending on furniture supplier:
 - a) Twist lock connectors - female power connectors are desired at the wire-ways used to feed power to each of the table rows or groups of tables. A twist lock male plug is to be mounted to a 4' cord of a 6 plug power strip.
 - b) Pigtailed or whips - for wiring into wire ways or junction boxes.

- 3) Some furniture suppliers use pigtails or power whips that require wiring into independent power circuits. Provide junction boxes and space needed for the minimum number of power circuits (often 4 independent circuits) used by such furniture systems.
 - (d) Tables – are to be provided with under-table continuous enclosed and covered wire management enclosures fabricated with removable covers that secure firmly and positively into place.
 - b. Instructional technology podiums are to be installed in these rooms as noted previously and hereafter.
 - c. Printer tables and stations are to be included in each computer lab–classroom with capability for at least two printers (four-plex outlet and 4 data jacks).
 - d. Who does what:
 - (1) The Contractor:
 - (a) For Network wires – pathways, conduits, labeled pull-strings, wire-ways are to be provided from the telecommunications rooms to each station via the wall mounted wire-ways or floor boxes with appropriate termination components for the boxes.
 - (b) For Security – pathways, conduits, labeled pull-strings, wire-ways from telecommunications room to “black boxes” at each row or group of tables, whether at wall or at floor box.
Exception: security contractor is sub to the contract work, then wire is pulled and terminated at each end – (1) the telecommunications closet at one end and the black box at the wall wire-ways, and/or (2) the telecommunications room at one end and the black boxes to be fastened to each group or row of free standing tables with continuous wires via the floor boxes.
 - (c) For Power – wire-ways, conduits, wires from electrical panels (1) to the twist-locks and the wiring of the mating twist lock to the power strip for feeds from wall mounted wire ways; (2) to floor boxes (no plastic parts exposed to wearing floor surfaces or sliding tables), with the 4-plex outlets in each floor box, and (3) to pigtails or whips to be fastened at the junction boxes to the necessary number of circuits.
 - (2) PSU:
 - (a) Network wires or cables between device boxes in classroom and furniture are pulled and terminated by PSU unless noted otherwise.
 - (b) Security – wiring and black boxes furnished and installed unless part of contracted work with contractor.
 - (c) Power – daisy chaining power strips from the twist lock unit, the convenience outlets, the pigtails or whips for the power to the other tables butting against walls; plugging power into floor boxes for technology on free standing rows or groups of tables.
 - e. Floor box locations:
 - (1) No less than one for every two computer stations (with room for four-plex outlet, 4 data cables and security cables).
 - (2) Locate toward the front edge of the tables and close to a leg.
 - (3) Do not place in aisles or in seating areas where rolling chairs can damage connectors or wires.
 - (4) **Furniture products and plan layouts required identification early in design to allow proper definition and location of floor boxes.**
 - f. Wire-way locations:
 - (1) Tops just below tables where table ends butt against walls.
 - (2) Bottoms just above tables where table backs butt against walls.
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 in written and electronic form via the subcontracted AV integrator, with the complete code system turned over to **PSU and MTSS** upon complete and functional installation of the system - to allow maintenance and modifications by **PSU** when system components are changed or added thereafter.

- (1) Provide the actual and complete operational 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 the Audio/Visual System furnished to be free from defects in workmanship or failure for a period of one (1) year from the date of acceptance or first beneficial use, whichever occurs first. Warranty service for such defects will be handled in a reasonable and timely manner from the time of notification to winning bidder by the Owner or their agent. Warranty covers on-site service for equipment, installation materials, installation labor and control system programming. The developer/vendor shall also document and include in the final electronic format any code changes during the one (1) year warranty period after the FULLY functional code and system is accepted by PSU. The developer/vendor shall be responsible for all required diagnosis, labors, costs, repairs, code and documentation updates during that time.
 - (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. No Trojans or codes are to be built into the software that create problems tied to dates or times. If the operating code is 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 at the cost of the vendor until all systems and codes operate properly and without error for the particular installation. The one-year warranty period for the software starts upon evidence that the code is correctly written and properly operating the technology. This warranty is NOT tied to the building or hardware substantial completion date. The system and code is to be noted in writing as accepted by MTSS and ITS-TLT representatives.
 - (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.
- e. **NO BNC CABLES TO BE USED – ONLY CABLES WITH ENDS SPECIFIED BY MTSS – thus the need for 2” electrical metal conduits (no substitute sizes or plastic allowed) defined in Section 16.10 in this document.**

9. **HEAD END (BUILDING TECHNOLOGY CONTROL) ROOMS (HER):**

- a. Audio visual systems installed in GPCs to be stand alone systems for each GPC or GPC auditorium.
- b. Separate such GPC and HER rooms and equipment so that HER components are not affiliated with operations of the GPC's instructional technology components.
- c. There can be some interconnections of the GPC instructional technology equipment to the HER components to allow data and audio to be received from or transmitted into the GPC from the HER, thus allowing information to be routed to other rooms from or into the GPCs. Understand that GPC technology functions are NOT to be routed through such HER equipment for operation of the GPC tech functions, though.
- c. Reasoning:
 - (1) Equipment, software and routing equipment and systems in HERs greatly complicate the operational functions of the individual GPCs.
 - (2) These HER components greatly affect the ability to upgrade / replace GPC technology required for class instructional needs.
 - (3) Such HERs house highly sophisticated systems that create additional maintenance and repair issues which in turn delay or prevent timely resolution of operational problems related to GPC audio visual systems.
 - (4) The HERs are the responsibility of the department/college to maintain and upgrade, including the interface components allowing the tie to the GPC technology.

10. **WIRELESS COMPUTER SYSTEMS:**

- a. Evaluate possible use for each building project in the classrooms and immediate areas outside classrooms.
- b. Coordinate closely with the **ISG** since their groups will be taking care of the systems.

11. INTERACTIVE VIDEO CONFERENCING SYSTEMS:

- a. Evaluate possible use in the classrooms for each building project.
- b. Coordinate closely with the **ISG** representatives since their groups will be taking care of the systems.

12. SECURITY LINES:

- a. Provide wiring pathway from main telecommunications room to podium, projector and any permanently located classroom computer equipment.
- b. Where conduit is required, a minimum diameter of one (1) inch is required for the podium, the projector and the common raceway for permanently located classroom computer equipment.
- c. Close coordination with **Police Services** and their vendor is essential since they will be taking care of system.
- d. 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.
- e. Refer to section 16.95 for more detail related to GPC and GPC-Computer Lab security information.

16.95. SECURITY SYSTEMS:

1. **BUILDING SECURITY (DOORS):** generally not applicable to general- purpose classrooms as they remain unlocked from 7 am to 11 pm, Monday through Friday, during each semester, unless technology maintenance requires a lock-down. Rooms may be locked between semesters and during semester breaks after janitorial staff has cleaned rooms.
2. **CLASSROOM TECHNOLOGY EQUIPMENT SECURITY (COMPUTERS, TECH PROJECTORS, PRINTERS, PLOTTERS, MONITORS, SCANNERS, ETC.):**
 - a. General:
 - (1) All GPC and GPC-Computer Lab technology equipment is to be protected with a theft security system that will report to University Police.
 - (2) Consulting Design Team is to work early with the **ISG** for general equipment requirements that may
 - (a) help establish termination points for such security equipment and
 - (b) set the project security design parameters for the GPC-Computer Labs.
 - (3) Consulting Design Team is to continue coordinating details with the **ISG** representatives and major users of the rooms during project design and at each subsequent design refinement meeting
 - (a) to further define the required details in the developing construction documents, and
 - (b) to further refine information about the intended technology for each GPC and GPC - Computer Lab.
 - b. Contract Documents must define the following for the GPC and GPC - Computer Labs:
 - (1) Wiring pathways from the main telecommunications rooms to the points in the classrooms (examples are: podium technology, ceiling tech projectors, document cameras, student computer stations, etc.)
 - (2) Locations for pathways (such as conduits) where easy access cannot be obtained (as example – above drywall ceilings) to run low voltage security wiring.
 - (3) Sizes of conduits for such pathways from each classroom to the main telecommunications rooms.
 - (4) Specific security layout for the system that will be developed in conjunction with the University Police representatives to the **ISG**, based on defined furniture plans for each GPC – GPC Computer Lab.
 - (5) Termination points for each end of each security device necessary for properly monitoring all GPC and GPC - Computer Lab technology equipment.
 - (6) Wiring for the security systems from the termination points in each of the GPC and GPC - Computer Lab rooms.
 - (7) Duplex outlets for powering security equipment at positions needed for the security equipment components to function properly.

- c. Termination devices to be noted and locations defined for each particular GPC and GPC - Computer Lab room applications (black box for fiber optic loops through student equipment and at instructional tech podiums, resistors at ceiling hung tech projectors, the main security panel in the telecommunications rooms, etc.).
- d. Who provides and does what:
 - (1) Wiring and conduit to be run and placed as a part of the construction contract work as defined in the construction documents - done in close coordination with the selected security vendor that will be doing the installation;
 - (2) Such individual sets of wiring to have each end labeled with unique identifier particular to each set of wires running from the classroom termination point into the telecommunications room.
 - testing of the wires to be done by installing electrical (sub)-contractor in presence of security personnel and vendor (sub)-contractor to assure that all wires properly terminate as labeled.
 - any wiring not testing correctly to be replaced by electrical installer and tested until it is passed and accepted by the security personnel and vendor (sub)-contractor.
 - after successful testing of the installed wiring, and acceptance by the security vendor (sub)-contractor, the security vendor (sub)-contractor will be responsible for the wire and its terminations.
 - (3) Security main control panels, keypads, black boxes (fiber-optic security devices), etc. to be provided and installed by the security vendor (sub)-contractor and wired together via the wires provided in the general or electrical (sub)-contract work;
 - (4) Fiber optic cables will be furnished and installed by **PSU** ITS-TLT and MTSS technicians, who are to run the fiber-optic cables through the tech equipment and make connections to the black boxes as well as connect the wires to the tech projector resistors.

3. CORRIDOR SECURITY CAMERAS

- a. Required at corridors serving GPCs and GPC-Computer Labs. Exceptions to this requirement are to be documented in writing to the designers by the ISG.
- b. Comply with above notations under heading 2 in 16.95 relative to meetings, detailing construction documents, defining points, working with Police Services, running pathways from the cameras to the telecommunication rooms, installation, testing wires, providing power sources where needed, etc.

4. REFERENCES:

- a. PSU – Department of University Safety – Security Access Controls Specifications, including the following documents at the following web site:
http://www.opp.psu.edu/construction/standards/design_standards.cfm
 - (1) Access Controls Document
 - (2) Alarm System Specification
 - (3) CCTV Security Systems Specification

END