

USD CLASSROOM & TECHNOLOGY DESIGN & CONSTRUCTION CONSIDERATIONS

**Prepared
In
Collaboration
With**

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CLASSROOM & TECHNOLOGY DESIGN & CONSTRUCTION CONSIDERATIONS

1.0 Introduction / General Information:

Below are minimal considerations for the design, construction and remodeling of all USD classrooms, seminar rooms, conference rooms, lecture halls and other learning spaces.

General Purpose Classrooms (GPCs) are defined as those classrooms, seminar rooms, conference rooms and lecture halls that are scheduled via the xxxxx Office for use by USD faculty, staff, colleges, departments or USD organizations.

College and/or Departmental Classrooms, seminar rooms, conference rooms and lecture halls (CDCs). It is recommended that **ALL CDCs** comply with the **GPC Minimum Requirements**. Additional components may be added to **CDCs** that address the specific needs of the college or department and funded by requesting college or department.

2.0 Abbreviations Used:

ADA	Americans with Disabilities Act
AFF	above finished floor
ASHRAE	American Society of Heating, Refrigeration and Air-Conditioning Engineers
ATS	Academic Technology Services
CDC's	College ore department classroom(s), seminar room(s), conference room(s) and lecture hall(s)
CD	Compact Disk
DVD	Digital Video Disk
FM	Facilities Management
GPC's	General Purpose Classroom(s), seminar rooms(s), conferences room(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
IMS	Instructional Media Services
ITS	Information Technology Services
<	less than
NRC	Noise Reduction Coefficient
STC	Sound Transmission Coefficient
TV	Television
VCR	Video cassette player
VTC	Video Teleconferencing Classroom

3.0 Generalized Classroom Design considerations:

3.1 Preferably on ground entry level and as close to main traffic entry doors as possible due to high traffic volume.

- 3.2 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.
- 3.3 Keep away from noise generating sources as restrooms, building system rooms, labs and hazardous material rooms.
- 3.4 For new facilities consideration should be given during the site planning process for access and parking of vehicles which deliver and maintain presentation media equipment. Considerations include ramps, level vehicle access points, and other provisions for the ease of movement of heavy, bulky or fragile equipment.
- 3.5 Corridors and Seating Outside Classrooms:
 - 3.5.1 Corridors to be sized for double the loads identified in codes due to the heavy number of students leaving classrooms completing with those trying to get into classrooms.
 - 3.5.2 In any case corridors to not be less than 10' wide.
 - 3.5.3 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. Integrate convenience and duplex outlets into bench seating areas.
 - 3.5.4 Consider cleaning, maintenance and comfort requirements when detailing bench seating.
- 3.6 Student Waiting/Meeting alcoves/Commons:
 - 3.6.1 Encouraged along circulation paths serving classrooms, to allow groups to meet and have discussions while waiting for class changes.
 - 3.6.2 Such spaces can/should be equipped with dry erase whiteboards to facilitate student discussions and interactions.
 - 3.6.3 Such spaces should be well designed to contain noise that may be generated in such settings.
- 3.7 Classroom design:
 - 3.7.1 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.
 - 3.7.2 A minimum of 20 square feet per student should be used for preliminary planning purposes.
 - 3.7.3 Better sight lines can be achieved.
 - 3.7.4 Better seating arrangements can be situated.
 - 3.7.5 Better technology needs can be addressed.
 - 3.7.6 Adequate instructional areas can be included.
 - 3.7.7 Machinery and other noises need to be located remote from the classrooms---etc.
- 3.8 Codes, ADA, accepted standards, controlling authority and agency requirements:
 - 3.8.1 Comply with or exceed on all new and renovation work.
 - 3.8.2 USD requirements in some cases exceed these minimums, thus enhancing the code, ADA, accepted standards, authority and agency requirements. Comply with the USD enhancements when more stringent.

3.8.3 All classrooms must be designed to comply with the American with Disabilities Act Accessibility Guidelines, and Title 24 of the California Code of Regulations.

3.9 Visual:

3.9.1 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.

3.9.2 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.

3.9.3 No visual obstructions, like columns, podiums, lighting fixtures, between student seating areas and whiteboards and screens at instructional end of room.

3.9.4 Glare from overhead lighting causes distractions to learning. The contrast ratio for the student viewing area of the front of the room shall not exceed 3 to 1. A light meter is to be used to check this in new and renovated construction.

3.10 Classroom Equipment Storage:

3.10.1 Space (closet type alcove) to be provided in each classroom for storage of classroom media equipment.

3.10.2 In classroom 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.

4.0 Ceilings:

4.1 Heights:

4.1.1 Renovation and 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.

4.1.2 New Construction---clear height at instructional end of room:

4.1.2.1 Up to 75 students---11' minimum clear height AFF between tech projector and screens.

4.1.2.2 75 to 150 students---greater than 13' AFF.

4.1.2.3 150 and over students---greater than 15' AFF.

4.2 Special Requirements:

4.2.1 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.

4.2.2 Sight lines---between screens and any student seating should not be obstructed.

4.2.3 Obstructions---keep any ducts, piping or lighting fixtures along side-walls to avoid recessed screen housings and so area between screens and ceiling mounted projectors is as high as possible.

4.2.4 Ceiling Materials---

- 4.2.4.1 Use non-sagging (humidity resistant) lay-in acoustical tile for most classroom ceiling areas.
- 4.2.4.2 Use 24" x 24" sizes and normal grid members.
- 4.2.5 Acoustics-Ceilings and Walls should be designed to evenly distribute sound throughout the classroom. The acoustic design must control the sounds and voices in the room so that they are heard easily and accurately and must prevent unwanted background or outside noise from intruding (noise from HVAC systems).

5.0 Classroom Floors:

- 5.1 Multiple floor levels in a GPC:
 - 5.1.1 Currently 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.
 - 5.1.2 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.
 - 5.1.3 Noise---floor and other elements surrounding classrooms to have an Impact Isolation Class (IIC) that prevents sound transmission into room from floors and equipment surrounding the classrooms.
 - 5.1.4 Flooring---as identified in the project scope or program. To complement acoustical needs for room for meeting acoustical requirements as defined.

6.0 Windows:

- 6.1 Interior:
 - 6.1.1 Glass may be permitted beside doors---
- 6.2 Exterior:
 - 6.2.1 Are to be operable and have key locks mastered alike for a building, to allow staff to open in case of HVAC failure.
 - 6.2.2 Are to have STC capabilities of >50.
 - 6.2.3 Are to be located and designed to not cast beams of sun or day-light onto projected surfaces or whiteboards at the front instructional area.
 - 6.2.4 Are to be thermo double or triple glazed units with e-glass to minimize heat loss and gain.
 - 6.2.5 Limit locations to rear sides of rooms, as whiteboards are to be on front and side walls (no windows on front wall or within 15' of front walls.
 - 6.2.6 Not recommended in lecture halls and interactive video teleconferencing classrooms used for distance education.

7.0 Window Coverings:

- 7.1 Combination Opaque and Translucent window Coverings
 - 7.1.1 Windows to have two coverings if possible. One layer is to allow some light entry into room. Second layer is to totally cut all light entry into room.
 - 7.1.2 Window covering with plastic parts used in operation mechanisms FAIL BADLY---DO NOT USE.
 - 7.1.3 If possible, provide these dual layer shades at any classroom/seminar/lecture rooms having exterior windows.

- 7.1.4 May be dual roller blinds if available.
- 7.1.5 Mount tightly to window frames to prevent light spill around ends.
- 7.1.6 Mount such window coverings to clear any projections on the windows being covered.
- 7.1.7 Add combination locks to operable windows at spaces with air conditioning so that building staff can open windows until non-functioning HVAC systems are operational.
- 7.1.8 If Venetian blinds are necessary, they are to have non-plastic components and heavy duty operation components (NO plastic wands or wand connectors).

8.0 Walls:

- 8.1 STC = or > 50
- 8.2 All openings, cracks, joints to be caulked to minimize sound transmission.
- 8.3 Inside:
 - 8.3.1 All walls surrounding rooms to run tight to structure above ceilings.
 - 8.3.2 Corridor walls to have double studs staggered to isolate inside and outside wall elements.
 - 8.3.3 All to have non-cellulose sound blankets.
- 8.4 Exterior walls common with classroom:
 - 8.4.1 All penetrations and wall elements to be sealed and designed to minimize noise entry into room.
- 8.5 Finishes:
 - 8.5.1 Apply paint on most surfaces...
 - 8.5.2 Use epoxy like paints for low wall areas subject to abuse.
 - 8.5.3 Apply chair rails on all non-masonry back and side walls in GPCs with movable student furniture-made of...
 - 8.5.4 Outside wall corners (such as entry recesses to classrooms)- provide corner guards to 4' AFF applied so that students cannot work them loose.
 - 8.5.5 Accent colors on walls are desirable-do not place on front wall or walls that might reflect onto screens.
 - 8.5.6 Acoustics-Ceilings and Walls should be designed to evenly distribute sound throughout the classroom. The acoustic design must control the sounds and voices in the room so that they are heard easily and accurately and must prevent unwanted background or outside noise from intruding (noise from HVAC systems).
 - 8.5.7

9.0 White Dry-Erase Boards and/or Tack Boards:

- 9.1 White Dry-Erase Boards:
 - 9.1.1 Supported and encouraged in all GPCs at USD.
 - 9.1.2 Special circumstances may require other styles-only after committee approval.
 - 9.1.3 The right markers that do not damage the surface are to be furnished by the users.
 - 9.1.4 Size:
 - 9.1.4.1 4'high w/ absolutely flat _____ on _____ surfaces.
 - 9.1.4.2 All GPCs except large auditoriums are to have white dry-erase boards.
 - 9.1.4.3 Provide with aluminum trim and tray, concealed spline connections.

9.1.4.4 Furnish with ___-year warranty against surface defects, shadowing after erasing, etc.

9.2 Location:

9.2.1 Provide white dry-erase board WRITING surface at the instruction end and at sidewalls (if available and requested). White dry-erase boards may also be required at rear wall.

9.2.2 DO NOT place behind technology console areas where console will block view of white dry-erase boards from student seating positions.

9.2.2.1 Set tray at 36" AFF.

9.3.1 Add-ons:

9.3.1.1 Tack-boards: ONLY in Tech Labs---include tack surfaces on each side wall and back wall to allow special postings, with a minimum of 4' x 10' behind printing stations.

9.3.1.2 White dry-erase boards: Include top tack strip and map hooks, 1 for each 24" of whiteboard length plus one to have even number.

9.3.1.3 Erasers: Provide one per every 4' (or fraction thereof) of whiteboard.

9.4.1 Definition in construction documents:

9.4.1.1 Include board(s) sizes, mounting information, hidden fasteners, top cork tack strip and hook rail, tray and specifications on construction documents.

9.5.1 Recommended manufacturer:

9.5.1.1 _____

10.0 **Projection Screens:**

10.1 Image Area-provide motorized and/or manual with seamless, matte white finish, as large as possible, depending on room size. See Below. Da-Light screens with heavy black backing are recommended. Motorized Screen 8'/10' and larger shall be side-tab tensioned type screens.

10.2 Quantities-If possible a minimum of 2 screens should be provided in classroom, lecture and seminar rooms.

10.3 Viewing:

10.3.1 Align screen so that 45-degree sight lines left and right of the perpendicular centerline cover all student seats within the 90-degree cone.

10.3.2 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.

10.4 Construction Documents-Note angle and dimensions on plan to allow exact placement in field.

10.5 Screen Size-size main screen width to most distant viewer-use a ratio of 1 to 4 for 4x3 format (1 to 3 for 16x9 format). *Example-32' to most remote viewer gives an 8' wide screen (gives 11'-rounded up- for 16x9 format).*

10.6 Screen Mounting Height-Set high and fully recess the housing to keep bottoms of viewing area 36" or greater above floor.

10.7 Recessed Screen Housing and 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.

10.8 Motorized Main Screen:

- 10.8.1 Fully recess into ceiling at ALL locations unless identified otherwise in writing.
- 10.8.2 Mount so that in the down position it will clear wall-mounted lights at white dry-erase boards or other protrusions.
- 10.8.3 Use engraved SCREEN-UP, STOP, DOWN control switch to operate screen movement.
- 10.8.4 **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 must have limit switches that stop operation.
- 10.8.5 Screens 8' wide and wider to be motorized, unless defined otherwise.
- 10.8.6 Recess fully into the ceiling all main screens used in conjunction with ceiling mounted data 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.
- 10.8.7 In rooms with over 70 student seats, two main screens may be provided if space is available.
- 10.9 Manual Second Screen if requested:
 - 10.9.1 Size width to room, but no less than 5' wide or 1 to 6 ratio screen width to most remote seating position.
 - 10.9.2 Identify exact height from bottom of screen housing to floor, again as high as possible and when extended, no less than 36" AFF.
 - 10.9.3 Do not hang screens from T-bars as hangers pull down-ceiling edge angles may be fasted to such boxes.
 - 10.9.4 Hang screen housing inside 5-sided box recessed into ceiling as pictured...
 - 10.9.5 Provide pull string/chain with know on end for pulling down screen. Pull know to be at 6' above floor for rolled screen.
- 10.10 Fixed Screens:
 - 10.10.1 May be used where bottom is over 7' AFF and wall space from this level if the ceiling is sufficient-exception-in auditorium where all viewers can see a lower bottom (generally in tiered spaces).
 - 10.10.2 Mostly restricted to auditorium type classroom environments.

11.0 Asbestos:

- 11.1 Asbestos may be encountered in renovation projects.
 - 11.1.1 Identify early in design process in the room and at other external locations critical to the project area.
 - 11.1.2 Identify piping and conduit routes early in design outside the space being built or remodeled to complement planning, design and construction needs.
 - 11.1.3 Contact _____

12.0 Plumbing, Heating, Ventilation & Building Noises at or near Classrooms:

- 12.1 Pipes:
 - 12.1.1 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.
- 12.1.2 All pipe penetrations through walls, floors or overhead slabs to be isolated and caulked at the penetrations to prevent sound transfer.
- 12.1.3 If baseboards used, ALL pipes to be hidden by the covering-none below the shroud.
- 12.1.4 HVAC Room Air:
- 12.1.4.1 Use air-handling systems with **low velocity discharge diffusers.**
- 12.1.4.2 Design and install systems that isolate machine and other air noises.
- 12.1.4.3 Size ducts, diffusers and air returns large enough **to achieve a noise free "library quiet" environment. ASHRAE minimum requirements are not enough for classrooms.**
- 12.1.4.4 Noise level is to be no higher than NC=30 in general and NC=20 at grills or registers.
- 12.1.4.5 ANSI/ASA S12.60-2002 sets 35 decibels for maximum background noise for unoccupied classrooms- this is too high and needs to be 30 decibels or lower.
- 12.1.4.6 Transfer Grills:
- 12.1.4.6.1 Not allowed in doors or corridor walls.
- 12.1.4.6.2 To be used to equalize air pressure of auditorium spaces on both sides of attached-fixed projection screens.
- 12.1.4.7 No open return air plenum space between ceiling and structure-due to need for electrical components for ceiling mounted data projectors and document cameras and wireless computer system receivers/transmitters.
- 12.1.4.8 Diffuser throw-orient so that air from diffusers does not hit any projection screens, if needed use three way diffusers.
- 12.1.4.9 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.
- 12.1.5 Building and machinery noises and vibrations:
- 12.1.5.1 Isolate from Classrooms, the noise or vibrations from elevator, HVAC equipment, and other kinds of motors or other noise generators (including light fixtures).
- 12.1.5.2 Building equipment vibrations transferred into building structure not desired as such vibrations can cause classroom ceiling hung data projectors to bounce around. Do not allow this to happen.
- 12.1.6 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.

13.0 Switch & Device Plate Layouts on Walls Near Consoles:

- 13.1 Close to Instructional Technology Console/Desk/Instructor Areas:
 - 13.1.1 Concentrate the multiple controls for lights, screens, ceiling mounted data projectors and other components within 4 to 5 feet of the instructional console in each room. Engrave each device plate for functional areas.
 - 13.1.2 Locate “**Help**” analog/IP telephones near these controls or locate in instructional console. Phone should be “restricted-access” but with plan ahead scheduling of off-campus-access.
 - 13.1.3 Provide in construction documents scaled elevation layouts showing positions for all controllers, telephones and other devices.
- 13.2 At Other Areas;
 - 13.2.1 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.
 - 13.2.2 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 console.

14.0 Convenience & Duplex Outlets:

- 14.1 In Classroom:
 - 14.1.1 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).
 - 14.1.2 Side walls-in addition to above requirement:
 - 14.1.2.1 Place at least two duplex outlets on each sidewall and space no greater than 16’ apart in classrooms **without** student technology.
 - 14.1.2.2 Place two-channel wire management system the length of the sidewalls in classrooms **with** student technology.
 - 14.1.3 Rear wall:
 - 14.1.3.1 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.
 - 14.1.4 Wire management system- to be mounted with tops just below white-board trays-same for other walls.
 - 14.1.5 Above Lay-in Ceiling:
 - 14.1.5.1 Special outlets may need to be in special fire rated enclosures.
 - 14.1.5.2 Locate a duplex 120V outlet for **EACH** ceiling mounted data projectors and network wireless devices.
 - 14.1.6 At printer stations in computer-lab classrooms – Four-plex outlets to be provided above cabinet or above table top.
 - 14.1.7 In-floor mounted four-plex outlets on 10’ centers to be provided in every classroom or learning space for laptop computer charging.
 - 14.1.8 Special needs will be further defined for computer lab/classrooms and computer driven informational signs.

- 14.2 At Benches and Alcoves at Classroom Corridors:
 - 14.2.1 For laptop computer use, space duplex outlets at 5' intervals above benches.
 - 14.2.2 For laptop computer use, provide boxes adjacent to duplex outlets for data access.
 - 14.2.3 Use non-removable screws for the cover plates.
- 14.3 At Flat Panel Digital Signage Information Screens:
 - 14.3.1 Provide clock-type outlet in wall for power and data to the flat panel monitors.

15.0 Conduits, Wireways, Low Voltage Wires, Other Wires, Wiremold and other Utility Lines:

- 15.1 Note that all such utility products are to be run behind the wall, ceiling and floor finishes.
- 15.2 If exceptions are needed, identify them early in the design/construction process in which case they are to be limited to "special" surface applications absolutely necessary due to structural issues.
- 15.3 Special wire management systems may be allowed on surfaces where they can be well integrated into the intended function and needs of the rooms. These signal cable and power Wireways are to be identified early in the design process.
- 15.4 Conduits between data projector and instructional technology console:
 - 15.4.1 2" metal electrical conduit (no substitute sizes or plastic) to be used for control and signal cables from tech console to data 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 console.
 - 15.4.2 Two 1" conduits required for power and data wires between tech console and data projector.
 - 15.4.2.1 Power to be same phase, ground, neutral, etc at the GPCs data projector, console and equipment rack (where needed).
 - 15.4.2.2 All audio, video, data and control electrical circuits should be fed from "clean" legs from the transformer free of high inductive loads. There should be NO elevator motors, compressor motors, blower motors, etc. on the side of the power transformer that feeds the media equipment.
- 15.5 Conduits for digital signage flat panels:
 - 15.5.1 Provide conduits to data and AC Power outlets flat panel monitors.
 - 15.5.2 Conduits can terminate above accessible ceiling systems or may run to telecommunication closet.

16.0 Classroom signal Cabling, Analog/Digital Cable Television, Telephone and Data Network Outlets:

- 16.1 Signal Cable and Wiring for Media-The following are general guidelines. Individual project specifications will be specified precisely.
 - 16.1.1 Audio cable-All microphone and line level signals lines should be paired, 100% or better shielded, low-loss, stranded, tinned copper, audio quality wire of no smaller than 22 SWG, with a drain wire, and have PVC, polyethylene, rubber or similar insulation. Nominal capacitance between conductors should be approximately 50

- pF/ft. or less. The minimum number of pairs should be chosen according to the number of signal paths necessary for the project.
- 16.1.2 Speaker cable-Speaker cable should be 100% shielded, stranded, tinned copper wire 14 SWG or larger. Example: Belden_____.
 - 16.1.3 Video cable-Video cable should be Belden_____. Verify exact requirements and final cable selection with USD Project Manager.
 - 16.1.4 Control cable-Control cable should be 7 or 8 conductor (minimum), 100% shielded, stranded, tinned copper wire 24 SWG or larger. Capacitance between conductors should not exceed 11 pF/ft. and cable should be data grade. Example: Belden_____. Verify exact requirements and final cable selection with USD Project Manager.
- 16.2 Cable Television Analog/Digital (CATV)-General requirements:
- 16.2.1 Design of the cable television Analog/Digital (CATV) distribution system, including signal levels at the inputs and outputs of each device in the system, must be approved by the USD Project Manager and ITS Telecommunications.
 - 16.2.2 *USD uses a two-way, sub-split analog/digital CATV system to allow programming originating in classrooms and other locations to be fed back to the headend. The cable television system must be designed and constructed with this capability in mind.*
 - 16.2.3 All F-connectors are to be tightened to 15 foot-pounds.
 - 16.2.4 CATV signal level is to be between +5 dB and +15 dB at all outlets.
 - 16.2.5 The maximum leakage allowed anywhere in the system is 20uV/m at 10 feet.
 - 16.2.6 Active and passive devices shall be bandpass rated at 750 MHz or greater.
 - 16.2.7 Inter-building underground cables are to have flooding compound.
 - 16.2.8 Long runs may require amplifiers with slope adjustment to provide a balanced signal.
 - 16.2.9 Outlets should be self-terminating.
 - 16.2.10 One outlet is required at the location of each media equipment console.
 - 16.2.11 In rooms with projections booths, one outlet is required in the booth as well. Coordinate location of this outlet with the USD Project Manager and IMS Staff.
- 16.3 Cable requirements
- 16.3.1 Runs under 100 feet indoors should be: Quad Shielded RG-6. Example_____.
 - 16.3.2 Runs between 100 and 300 feet should be: Quad Shielded RG-11. Example_____.
 - 16.3.3 Runs over 300 feet should be: aluminum-jacketed, flooded hardline coaxial cable, either 0.565 or 0.840 inch diameter.
- 16.4 *Outlet locations for Data, Analog/Digital Cable Television and Telephone Service.*
- 16.4.1 *Small and Mid-sized GPCs (up to 75 seats).*
 - 16.4.1.1 *Dual duplex data outlets should be located at each of the following locations:*

- 16.4.1.1.1 *The front of the classroom*
- 16.4.1.1.2 *The data projector*
- 16.4.1.1.3 *All wireless network access points*
- 16.4.1.1.4 *The media equipment rack or console*
- 16.4.1.2 *One campus cable television outlet should be provided at the media equipment rack or console*
- 16.4.2 *Large GPCs (over 75 seats).*
 - 16.4.2.1 *Data outlets should be located at each of the following locations:*
 - 16.4.2.1.1 *Dual outlets at each of at least two locations at the front of the classroom*
 - 16.4.2.1.2 *Dual outlets at each data projector*
 - 16.4.2.1.3 *One outlet at each wireless network access point*
 - 16.4.2.1.4 *Four outlets in the projection booth*
 - 16.4.2.1.5 *Four outlets at the media equipment rack*
 - 16.4.2.1.6 *Six outlets at the Instructional Tech Console*
 - 16.4.2.2 *Cable television outlets should be located at each of the following locations:*
 - 16.4.2.2.1 *The media equipment rack*
 - 16.4.2.2.2 *The projection booth*
 - 16.4.2.2.3 *the Instructional Tech Console*
 - 16.4.2.3 *Campus telephones (analog or IP) should be located in the following locations:*
 - 16.4.2.3.1 *In the projection booth*
 - 16.4.2.3.2 *The front of the room near the lighting and media equipment controls or in the Instructional Tech Console*

17.0 Classroom Lights and Lighting Control:

- 17.1 *Use energy efficient lights, with tight light ray directional control, 3000-to-3500 degree K bulbs.*
- 17.2 *Fluorescent fixtures with parabolic louvers to have reduced grid size to minimize horizontal light spill and glare.*
- 17.3 *Do not hang any pendant direct/indirect fixtures between existing / new/future ceiling-mounted projectors and screens, nor use any within the front 2/3rds of the rooms.*
- 17.4 *Foot candles*
 - 17.4.1 *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.*
 - 17.4.2 *Final lighting (with all lights fully on and none dimmed) FC measurement to be in 12 spots from front to back, left to center to right.*
 - 17.4.3 *These 12 measurements will be averaged to check the 50FC 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.*
- 17.5 *Lamp replacement Serviceability and Maintenance*
 - 17.5.1 *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.
- 17.5.2 High ceilings are those that cannot be accessed in all locations with a 10' ladder and require scaffolding to replace burned out bulbs.
- 17.5.3 Auditoriums are considered to be any tiered or sloped space with seating for 140 or more students.
- 17.5.4 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 to removing burned-out bulbs and installing new ones.
- 17.6 Scene Control Switches
 - 17.6.1 Do NOT use, unless integrated into the computer control system (usually in large rooms) and/or cleared in writing by the USD Project Manager.
 - 17.6.2 Low voltage lighting control systems can be used, though.
- 17.7 Motion and Sound Sensors
 - 17.7.1 Use in all instructional GPCs areas and entry vestibules into classrooms.
 - 17.7.2 Sensors are to automatically shut down all lights about (1 hour) after no room activity is sensed.
 - 17.7.3 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.
- 17.8 General room Lighting
 - 17.8.1 Place at the instructor's area.
 - 17.8.2 Place at each room door.
 - 17.8.3 Use only a single on-off switch at each entry/exit door position tied to main room lights.
 - 17.8.4 Locate lighting rheostat dimming controls only at the instructional tech console and rear projection booth (if any) positions.
 - 17.8.5 Use pilot lights or illuminated panels to help locate all light control switches in the dark at the console position.
 - 17.8.6 All light switches, if possible, should be in the UP position when the fixtures are ON and in the DOWN position when in the fixtures are OFF.
- 17.9 Switch control labeling and relative position
 - 17.9.1 Engrave all light control switch device plates only at instructional console position and rear projection booth (if any) position.
 - 17.9.2 Possible labels for the light operated-FRONT, MIDDLE, BACK, BACK DIM, CONSOLE DIM, TABLE/WHITEBOARD, AILES, etc.
 - 17.9.3 Lettering to be minimum 1/8" high.
- 17.10 General Room Lighting Zones
 - 17.10.1 Plan for at least 2 main room light zones in each room at the ceiling.
 - 17.10.2 Plan each zone to run parallel to the front wall. Tie fixtures between the ceiling data projector and screen to this front zone. Large GPCs may require special consideration and discussion with USD Project Manager.

- 17.10.3 Plan for the instructor to adjust all the lighting levels for their needs from near the teaching/console position.
- 17.10.4 DO NOT place any ceiling light fixtures within 7' of any projection screens.
- 17.11 Whiteboard Lighting Zone
 - 17.11.1 Use a separate on/off, circuited and wall mounted light strip above the instructor's whiteboard.
 - 17.11.2 Restrict light pattern to the whiteboard, so that none spills onto the back of the extended projection screen or toward the students.
 - 17.11.3 Provide proper clearances to the fully extended screen.
 - 17.11.4 Mount switch with built-in pilot light on or near the instructional tech console.
 - 17.11.5 30 FC (50 FC design minimum) lighting average is to be provided on only the instructional whiteboard surfaces.
- 17.12 Instructional Tech Console and Signer Lighting Zone
 - 17.12.1 A ceiling mounted console light is not needed if a light is built into the console.
 - 17.12.2 Otherwise, provide:
 - 17.12.2.1 A very directional and adjustable fixture over the console-with no spill or wash on screens.
 - 17.12.2.2 Individual control, with rheostat having a pilot light, near the instructional tech console.
 - 17.12.2.3 Locate fixture on room center side of the console, at about "11 o'clock" or "1 o'clock", and a few feet on the student seating side of the console, to minimize instructor head shadows on reference materials.
 - 17.12.2.4 Engrave switch plate.
- 17.13 Instructional Table Zone
 - 17.13.1 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 console.

18.0 Telephones:

- 18.1 Include a digital/IP telephone/intercom in each technology enhanced GPCs/Lecture hall.
- 18.2 Provide necessary outlet, wiring and conduit.
- 18.3 Used as an intercom with central computer help desk/IMS technician's office, shop, network room and or security.
- 18.4 Location in Classrooms:
 - 18.4.1 In instructional technology enhanced GPCs-locate on wall closest to instructional console or as designated by USD Project Manager.
 - 18.4.2 In conventional classrooms-locate right beside the whiteboard at the instructional end of the room.
 - 18.4.3 Limit on-campus/off-campus accessibility.

19.0 Sound Systems:

- 19.1 Question need in each classroom/GPC's for an instructor wireless and/or fixed microphone and room speakers.
- 19.2 Consider technology and power needs as well as use of ADA hearing assisted devices for the audio and/or visual impaired.

- 19.3 Use speakers tied via switcher/routers to the computers, DVDs and VCR's in all cases.
- 19.4 Coordinate with USD Project Manager.
- 19.5 Plan for speaker locations-in consoles, at/in ceilings and/or on the walls (LEAST DESIRED). No conduits or wires on room finish surfaces.

20.0 Audio-Visual and Technology:

- 20.1 On building projects that are new, major renovations or additions, IT and ALL Technology including computers, printers, network, servers, etc. are fully funded by the Project Budget.
- 20.2 Technology Equipment "Closet" if needed:
 - 20.2.1 If needed, place close to the instructional space for today's electronic computer and teaching systems.
 - 20.2.2 Provide for a securable, **well-ventilated "closet"/cabinet** with extending shelves for server equipment.
 - 20.2.3 Closely coordinate with the ITS/IMS and Telecom representatives.
 - 20.2.4 Locate space so that access is possible from the front AND the back of any rack(s).
 - 20.2.5 Proper conduits identified elsewhere in this document to run into this room from the instructional tech console(s), ceiling projector(s) and speakers.
 - 20.2.6 Provide at least one quadraplex 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 GRC.
 - 20.2.7 PROVIDE COOLING CAPACITY THAT WILL ADEQUATELY MAINTAIN A MAZIMUM ROOM TEMPERATURE OF 70° f 24 HOURS A DAY YEAR ROUND.
- 20.3 Power and Controls:
 - 20.3.1 Provide power for data projectors at the ceiling and computers at the instructional tech console-duplex outlet on the same circuit.
 - 20.3.2 Locate such outlets in each GPCs space.
 - 20.3.3 Provide same feed with a common, same phase, same ground and neutral power circuits that are clean of ambient and stray signals for the console/data projector(s) circuit(s).
 - 20.3.4 Include cabling, 2" conduit (no substitute sizes or plastic), and boxes for controls between the console and the projector positions.
 - 20.3.5 No other powered items are to be tied into these circuits supporting instructional technology.
 - 20.3.6 *Provide a keyed switch for the power circuit(s) to the ceiling mounted data projectors in each GPC.*
 - 20.3.6.1 *Keyed (common keyway) switch is to be used to totally shut off power to projectors to allow proper resets to occur as needed with the newer projectors.*
- 20.4 Ceiling Hung Data Projector(s):
 - 20.4.1 All Data Projector(s) should have HDTV compatibility, feature wide-aspect LCD panels which allow native reproduction of WXGA (1,280 x 800) images from a computer. This will provide a visually powerful display of wide-screen (16/9) images from DVD

- sources, as well as wide-screen images from wide-aspect computers, etc.
- 20.4.2 All Data Projector(s) should feature lamp replacement access from the rear and if possible built in closed captioning capabilities.
 - 20.4.3 Provide rigid structural support for each ceiling hung data projector for the current or future equipment.
 - 20.4.3.1 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.
 - 20.4.3.2 Obtain needed information from IMS Project Manager for particular projector "pipe" hanger to be used.
 - 20.4.3.3 Provide threaded pipe needed between unistrut mounting plate and data projector mounting plate.
 - 20.4.3.4 **Isolate from all building and mechanical and system vibrations to prevent image from jumping around screen.**
 - 20.4.4 Coordinate EXACT location with IMS Project Manager, if IMS is involved with the project-or as specified by the projector manufacturer, based on screen size and projector model.
 - 20.4.5 ROUGH PRELIMINARY PLANNING RULE to aid preliminary conduit placement-the data projector is centered about 1-1/2 to 2 x screen width from the screen, except when placed in a rear projection booth, or with special lenses fabricated for a special need.
 - 20.4.6 Construction documents must indicate to check with IMS just prior to installing the data projector infrastructure for exact location dictated by the purchased projector model.
 - 20.4.7 Identify in writing the exact projector model and distance factor prior to placing related components.
 - 20.4.8 Models change so close coordination is necessary with IMS until the actual projector is installed.
 - 20.4.9 Mount screen top and projector as high as possible to maintain the greatest possible distance between data projector bottom and floor-in no case less than 9' AFF.
 - 20.5 Conventional AV Power/Conduit Needs;
 - 20.5.1 At technology console install one quadraplex outlet box on the floor under the tech console for the console power plugs.
 - 20.6 Technology Outlets/Power/Conduit needs in general:
 - 20.6.1 Include, place boxes and conduits under/adjacent to the instructional tech console, within the student area if required and about ceilings for instructional data projectors.
 - 20.6.2 Mount convenience and tech outlets next to all computers and other technology equipment.
 - 20.6.3 Floor mount convenience and tech outlet(s) in student area on a 10' center grid layout.
 - 20.6.4 If casework is used in student area pull convenience and data outlets to pop-up AC Power and data connection points in casework.
 - 20.6.5 Coordination-work closely on technology outlet, locations and conduit home run needs with IMS/ITS/Telecom.

- 20.6.5.1 Generally locate such outlets for network and fiber close to or into the instructional tech console.
- 20.6.5.2 Place convenience outlets close to such “technology” outlet boxes.
- 20.6.5.3 Cable-TV (analog/digital) access is to be included unless otherwise told.
- 20.6.6 For Telecommunications:
 - 20.6.6.1 Into or within the room and at corridor benches, involve ITS/Telecom Design Team members.
 - 20.6.6.2 Technology Classrooms:
 - 20.6.6.2.1 Provide minimum (5) high-performance UTP cables and one RG-6 coaxial cable into the instructional tech console **OR** provide an 8 port switch such as: Catalyst 3560 8 10/100 PoE + 1 T/SFP + IPB Image unit with power cord.
 - 20.6.6.3 Conventional Classrooms:
 - 20.6.6.3.1 In anticipation of technology being added, provide minimum (5) high-performance UTP cables and one RG-6 coaxial cable into classroom space (above ceiling storage until upgrade is completed).
 - 20.6.6.3.2 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.
- 20.6.7 At Instructional Tech Console-power strips provided by IMS/ITS will be plugged into the floor quadraplex outlet under the console.
- 20.6.8 At Printer Tables or Counters in Computer Lab-Classrooms-provide for quadraplex outlet above table or counter height.
- 20.6.9 At Ceiling Mounted Data Projectors-provide duplex outlet at projector location.
- 20.6.10 At Ceiling Mounted Wireless Network Devices-provide duplex outlet at each wireless device location.
- 20.6.11 At Corridor Benches-space at 48” o.c. duplex outlet above benches for power use of wireless laptop computers.
- 20.6.12 At Flat Panel Digital Information Screens-provide blocking in wall to support monitor mounting bracket and the junction boxes for the power, data and security wiring.
- 20.7 Instructional Console:
 - 20.7.1 USD design by IMS/Select Cabinets is to be used, as it is standard on campus. Who Provides:
 - 20.7.1.1 On projects funded by USD or IMS/ATS, console is generally provided by IMS/ATS unless MCO funds will cover.
 - 20.7.1.2 On building projects that are new, major renovations or additions, IT and ALL Technology including computers, printers, network and servers are fully funded by the Project Budget.
 - 20.7.2 Is to be coordinated with IMS/ITS for location, type and scheduling/delivery needs.

- 20.7.3 Provide 3'-6" minimum between console and the front wall projections (whiteboard rails, chase corners, etc.) and 12" minimum from a sidewall. Locate console so that access is ALSO possible from the back of console, 12"-18" service space needed to front of first student desk/casework.
- 20.7.4 Standard/Additional Audio/Visual Equipment, model or type may change, that MAY be included:
 - 20.7.4.1 Computer for Console*
 - 20.7.4.2 Flat-Panel Monitor
 - 20.7.4.3 OR-SMART Sympodium w/arm* (upgrade)
 - 20.7.4.4 Wolfvision Doc Cam (VZ-8+ or VZ-9) (upgrade)
 - 20.7.4.5 Altinex Cablenook
 - 20.7.4.6 SmartPanel (A->V) SP3-AFVP+
 - 20.7.4.7 SmartPanel SP2-SMCHAS Black
 - 20.7.4.8 SmartPanel CatLinc
 - 20.7.4.9 Catalyst 3560 8 10/100 PoE+1 T/SFP+IPB Image
 - 20.7.4.10 Kramer Switcher KRM-VP32XL
 - 20.7.4.11 Mixer Amp
 - 20.7.4.12 DVD/VCR (HD-DVD or Sony Blue-Ray)
 - 20.7.4.13 Barix Instreamer 100/WebCasting
 - 20.7.4.14 AVLEX Gooseneck Mic
- 20.8 Computer Lab-Classroom:
 - 20.8.1 On building projects that are new, major renovations or additions, IT and ALL Technology including computers, printers, network and servers are fully funded by the Project Budget.
 - 20.8.2 Such rooms have power, network connections and security cabling run in several manners to the technology on the student computer tables/casework. Generally, one to two computer stations are located on a table, depending on table length.
 - 20.8.3 Table/casework ends or sides butted to walls-utilities feed from wall mounted multi-channel wire-way management system (Wiremold). In such cases, all utilities are to be fed from these wire-ways.
 - 20.8.4 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 "security black box" often mounted on the bottom of a table in that row or group.
 - 20.8.5 Utilities to computer lab tables are:
 - 20.8.5.1 Network wires-individual cables to each computer station from the central telecommunications room-necessary in floor boxes or at the wire-ways.
 - 20.8.5.2 Security fiber optics or other security cables-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).
 - 20.8.5.3 Power

- 20.8.5.3.1 Via floor boxes-each computer station needs two plug outlets for power or junction boxes for pigtails or whips.
- 20.8.5.3.2 Via wall mounted wire-ways – two possibilities exist, depending on furniture supplier:
 - 20.8.5.3.2.1 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.
 - 20.8.5.3.2.2 Pigtails or whips-for wiring into wire ways or junction boxes.
- 20.8.5.3.3 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.
- 20.8.5.3.4 Tables/casework-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.
- 20.8.5.4 Instructional technology consoles are to be installed in these rooms as noted previously and hereafter.
- 20.8.5.5 Printer tables and stations are to be included in each computer lab-classroom with capability for at least two printers (quadraplex outlet and 4 data jacks).
- 20.8.5.6 Who does what:
 - 20.8.5.6.1 The Contractor:
 - 20.8.5.6.1.1 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.
 - 20.8.5.6.1.2 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.
 - 20.8.5.6.1.3 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.

20.8.5.6.2 USD:

20.8.5.6.2.1 Network wires or cables between device boxes in classroom and furniture are pulled and terminated by USD unless noted otherwise.

20.8.5.6.2.2 Security-wiring and “black boxes” furnished and installed unless part of contracted work with contractor.

20.8.5.6.2.3 Power-daisy chaining daisy chaining power strips (if approved) from the twist lock unity, 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.

20.8.5.7 Floor box locations:

20.8.5.7.1 No less than one for every two computer stations (with room for quadraplex outlet, 4 data cables and security cables).

20.8.5.7.2 Locate toward the front edge of the tables/casework and close to a leg.

20.8.5.7.3 May also need to place on a 10’ grid if table locations can not be identified.

20.8.5.7.4 Do not place in aisles or in seating areas, if possible, where rolling chairs can damage connectors or wires.

20.8.5.7.5 **Furniture products and plan layouts required identification early in design to allow proper definition and location of floor boxes.**

20.8.5.8 Wire-way locations:

20.8.5.8.1 Tops just below tables where table ends butt against walls.

20.8.5.8.2 Bottoms just above tables where table backs butt against walls.

20.9 AMX, Extron, Crestron or other Special Media and Technology Control Systems:

20.9.1 Such systems will most likely be used in large spaces requiring many technology components.

20.9.2 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, VCR, computers, data projectors, sound systems, audio/rich-media streaming devices, document cameras, desktop/laptop computers, video/audio teleconferencing systems, other plug-in devices, etc.).

- 20.9.3 Such intensive software programs most often involve compiled and un-compiled data or source code.
- 20.9.4 Such compiled and un-compiled data or source codes shall be provided to USD in written and electronic form via the subcontracted AV integrator, with the complete code system turned over to USD and IMS upon complete and functional installation of the system-to allow maintenance and modifications by USD when system components are changed or added thereafter.
- 20.9.4.1 Provide the actual and complete code to USD.
- 20.9.4.2 The developer/vendor shall allow USD to have ALL components of the software, in essence licensing the complete code in perpetuity to USD, thus allowing USD 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.
- 20.9.4.3 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 warrantee period after the FULLY functional code and system is accepted by "USD. The developer/vendor shall be responsible for all required diagnosis, labor costs, repairs, code and documentation updates during that time.
- 20.9.4.4 Once system and code is considered FULLY functional, it shall be used for a period of at least 10 working 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 these 10-days, the developer/vendor will be required to make the proper code and function changes, at which time 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 IMS and ITS/ATS representatives.

- 20.9.4.5 A yearly maintenance agreement provided by vendor beyond the one-year warranty period is highly encouraged.
- 20.9.4.6 The detailed documentation of all code shall be provided to USD in the care of IMS by paper copy as well as in electronic form on CD/DVD in the latest version of Microsoft Word.
- 20.9.5 **NO BNC CABLES TO BE USED-ONLY CABLES WITH ENDS SPECIFIED BY IMS/ITS-thus the need for 2" electrical metal conduits (no substitute sizes or plastic allowed).**
- 20.10 Head End (Building Technology Control) Rooms (HER):
 - 20.10.1 Audio visual systems installed in GPCs to be stand alone systems for each GPC or GPC auditorium.
 - 20.10.2 Separate such GPC and HEP rooms and equipment so that HER components are not affiliated with operations of the GPC's instructional technology components.
 - 20.10.3 There can be some interconnections of the GPC instructional 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 GPC's. Understand that GPC technology functions are NOT to be routed through such HER equipment for operation of the GPC tech functions, though.
 - 20.10.4 Reasoning:
 - 20.10.4.1 Equipment, software and routing equipment and systems in HERs greatly complicate the operational functions of the individual GPCs.
 - 20.10.4.2 These HER components greatly affect the ability to upgrade/replace GPC technology required for class instructional needs.
 - 20.10.4.3 Such HERs house highly sophisticated systems that create additional maintenance and repair issues which in turn may delay or prevent timely resolution of operational problems related to GPC audio visual systems.
 - 20.10.4.4 The HERs are the responsibility of the ITS/Telecom Department to maintain and upgrade, including the interface components allowing the tie to the GPC technology.
- 20.11 Wireless Computer Systems:
 - 20.11.1 Evaluate use for each building project in the classrooms and ALL areas outside classrooms.
 - 20.11.2 Coordinate closely with the ITS/Telecom Department who will be taking care of the wireless systems.
- 20.12 Interactive Video Teleconferencing Systems (VTC):
 - 20.12.1 Evaluate possible use in classrooms for each building project.
 - 20.12.2 Coordinate closely with the ITS/ATS/IMS Department who will be taking care of the Video Teleconferencing Systems.
 - 20.12.3 **THE INSTRUCTOR MUST BE CLEARLY VISIBLE, NOT ONLY FROM ALL SEATS, BUT FROM ALL CAMERA POSITIONS, SINCE THE PRIMARY FUNCTION OF THIS TYPE**

OF CLASSROOM IS TO FACILITATE THE TRANSMISSION AND RECEPTION OF INSTRUCTION WITH MINIMAL INTERFERENCE.

20.12.4 Special consideration must be given to the acoustic characteristics and soundproofing of a Video Teleconferencing Classroom. Noise from HVAC systems, adjacent halls or exteriors must not intrude into the classroom or control room areas. Acoustic treatment of walls, floors and ceilings to reduce unwanted reflections is critical for clear sound transmission. The acoustic design must control the sounds and voices in the room so that they are heard easily and accurately and must prevent unwanted background or outside noise.

20.12.5

20.12.6 Special consideration should also be given to extra lighting on the "stage" area of the Video Teleconferencing Classroom to ensure the best possible video image.

21.0 **Security Systems:**

21.1 Classroom Technology Equipment Security (Computers, Data Projectors, Printers, Plotters, Monitors, Scanners, etc.) GENERAL:

21.1.1 All GPC and GPC-Computer Lab technology equipment is to be protected with a theft security system that will report to Public Safety.

21.1.2 All Security Systems for new, major renovations or additions are to be fully funded by the Project Budget.

21.1.3 Consulting Design Team is to work with ITS for general equipment requirements that will set the project security design parameters for the GPC-Computer Labs.

21.1.4 Specific security layout for the system that will be developed in conjunction with Public Safety.

21.1.5 Duplex outlets for powering security equipment at positions needed for the security equipment components to function properly.

21.1.6 Security main control panels, keypads, (black box fiber-optic security devices-if used), 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.

22.0 **SEATING/FURNISHINGS-SPECIAL EQUIPMENT:**

22.1 Student Seating GENERAL:

22.1.1 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.

22.1.2 Locate front row so that access is possible from the back of the instructional console, suggest minimum 12"-18" service space needed to front of first student desk/casework.

22.1.3 Fixed seating attached to rows of tables NOT ACCEPTED unless demonstration unit is accepted and noted in writing by ITS/ATS. Such attached seats do not accommodate large or tall users.

22.1.4 Fixed and continuous tables/casework is acceptable in auditorium and large classrooms with movable chairs (*on casters-?*).

22.1.5 Other requirements:

23.0 Accessibility:

23.1 Considerations must be made during the planning and design of classrooms for the special requirements of students and faculty with disabilities. The construction or alteration of any building must comply with the American with Disabilities Act (ADA).

Special Consideration should be given for people with disabilities that who use wheelchairs, crutches or guide dogs. In addition, consideration should be given for people with other disabilities such as limited vision, hearing loss, energy limiting conditions (such as cardiopulmonary disorders), environmental sensitivities and mental disabilities.

Below are listed some considerations for the design of classrooms. This list must not be considered exhaustive and all current guidelines and codes for accessibility must be followed:

- 23.1.1 Doorways and aisles should have a minimum width of 36" to allow for easy passage of wheelchairs.
- 23.1.2 It is required that all classrooms have an accessible route. The use of thresholds, stairs or other barriers should be minimized.
- 23.1.3 For persons with disabilities, wheelchair stations must be provided with a choice of sight lines that is comparable to those provided for persons without disabilities.
- 23.1.4 To reduce conditions that can cause environmental sensitivities, whenever possible, the use of materials, such as chalk-boards (chalk-dust) or with chemical aromas, including carpet glue, paint and roof tar should be minimized.
- 23.1.5 Due to many medical conditions which are referred to collectively as cardiopulmonary medical problems, fresh air or clean re-circulated air must be provided for classrooms. Windows and fresh air intakes for classrooms should be located away from loading docks, mechanical areas, exhaust vents, roadways and other sources of potential irritants.