

# **A Guide for Architects and Engineers**

## **Multimedia Classrooms and other High-Tech Space**



**At the University of North Carolina, Chapel Hill**

**Information Technology Services**

**[www.unc.edu/its](http://www.unc.edu/its)**

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Latest version can be found at <http://multimedia.unc.edu/guide>

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# Forward

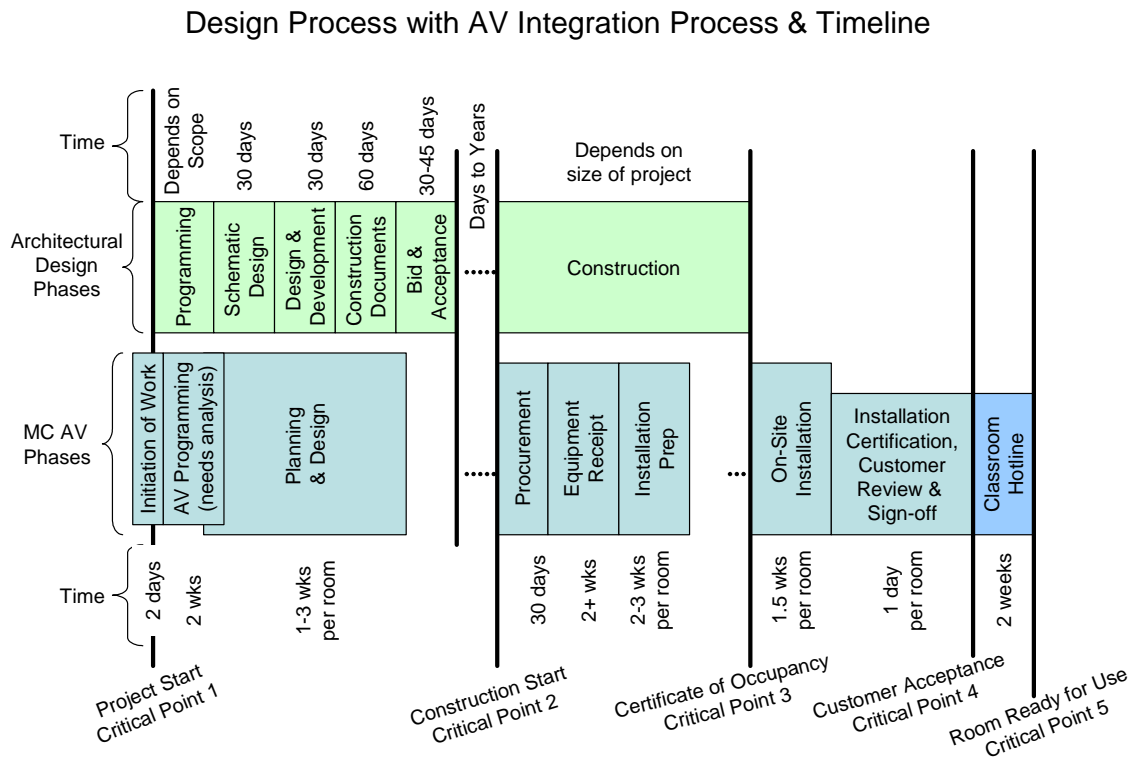
This document, Guide for Architects & Engineers, provides a framework for architects and engineers engaged in the design of high-tech presentation facilities at the University of North Carolina at Chapel Hill. This guide highlights the most common points of convergence at which architectural and audio-visual designs must interact. The goal, therefore, is to identify and establish a foundation of core systems and interdependencies early in the design process to free the A&E and AV Designer to pursue (and, therefore to resolve creatively) the more challenging design elements unique to a particular project.

The forms that support the communications for this process can be found in the accompanying document [A Guide for Architects and Engineers Process Documents](http://www.unc.edu/multimedia/guide2) ([www.unc.edu/multimedia/guide2](http://www.unc.edu/multimedia/guide2)).

## Overview

### Integrated Process Overview

It is important for the AV Design and Implementation process to be integrated with the Architectural Design and Development process. Critical points in the process impact integration and cost of the project. The integration of these processes should flow as depicted in Figure 1.



**Figure 1. Integrated Architectural and AV Process**

There are a number of documents, activities, and approvals associated with each of the phases in the integrated process. Another view of this integrated process along with the list of action items and deliverables is shown in the [Design Process with AV Integration](#) diagram (see [www.unc.edu/multimedia/guide2](http://www.unc.edu/multimedia/guide2)).

## ***Process Integration Critical Points***

Figure 1 identifies where in the process critical integration points occur. Each of these points impacts the project as follows.

### **Project Start Critical Point 1**

It is critical that at the start of the Architectural Programming phase that the AV group(s) are involved. The AV programming activities generate the AV requirements for the room(s). This information should be input to the overall Architectural Programming and Design activities. If the AV programming activities aren't started until later in the Architectural process, the Architectural diagrams and specifications must be changed. These changes result in additional costs to the project. If the AV programming and design activities do not start until construction timeframe the cost impact is higher as actual room construction features may need to be reconstructed.

### **Construction Start Critical Point 2**

Procurement for the AV equipment cannot start until Construction begins and funding is released. Any funding that expires less than 45 days from the release of funds is at risk. It is unlikely that the procurement process will be completed and equipment and invoices will be received from vendors in less than 45 days.

### **Certificate of Occupancy Critical Point 3**

The Certificate of Occupancy is granted based on a successful inspection and how the room meets specifications. The AV cabling and equipment is not generally reflected on this documentation. A Certificate of Occupancy inspection is likely to fail if the additional AV equipment and cabling is installed in the room prior to the inspection. If this occurs, the AV equipment and cabling must be removed before the Certificate of Occupancy will be granted. This situation has occurred in past projects when the AV equipment and cabling were installed prior to the inspection to meet tight schedules. The Multimedia Classroom team will do early installation of equipment only with a signed [Entry Authorization form](#) (see [www.unc.edu/multimedia/guide2](http://www.unc.edu/multimedia/guide2)) from Facilities or the room owner.

### **Customer Acceptance Critical Point 4**

At this point the AV equipment has been installed and certified to be working by the installation vendor and the AV team. A customer walk-through and review occurs. If the room is to be maintained by the Classroom Hotline group, the customer walk-through is performed with the Classroom Hotline group. If the Classroom Hotline group is not supporting the room, the customer walk-through is performed with the room owner. Upon successful completion of the walk-through and acceptance of the room by the customer/Classroom Hotline the [Final Sign-off Sheet](#) (see [www.unc.edu/multimedia/guide2](http://www.unc.edu/multimedia/guide2)) is signed. The room is turned over to the customer.

## **Room Scheduled for Use**

The Classroom Hotline requires two weeks from customer acceptance to Room Available for Use. This time is used to make sure Hotline personnel are trained on new equipment and become familiar with any new programming aspects. User (faculty) training on how to run the rooms also occurs during this timeframe.

## ***Types of Facilities***

In this document, the term 'classroom' is used to generically reference any space in which some form of presentation occurs. To improve clarity, a project may use the following terms (see [Room Type Matrix \(www.unc.edu/multimedia/guide2\)](http://www.unc.edu/multimedia/guide2) for more details):

- **Seminar Room.** A smaller classroom that seats from ten (10) to thirty (30) students. Typically, a Seminar Room uses modular tables with sled-base chairs in a circular or U-shaped arrangement.
- **Conference Room.** Even smaller than a Seminar Room, a Conference Room may seat from eight (8) to sixteen (16) people around a single, heavy conference table. Often the décor is more formal to accommodate departmental or administrative meetings.
- **Lecture Hall or Auditorium.** A large room with one-hundred (100) to four-hundred and fifty (450) fixed seats.
- **Computer Lab.** A room with many computer workstations or laptop connections in which students work independently on dissimilar projects. Typically there is no presentation system in this type of room.
- **Computer Classroom.** A room with many computer workstations or laptop connections in which an instructor leads students through software training or coordinated group computing activity.
- **Teleconference Room or Teleclass.** This can be any size room in which the instructor is able to conduct a two-way audio-video teleconference via the Internet (H.323). Smaller rooms with fixed tables offer greater opportunity for interactivity with all participants because microphones can be placed at seating positions.
- **Smart Zone.** A round table that seats up to six students with laptops. Each student can plug in to the table for network, power and VGA video. When one wishes to share their work with the group, he/she presses the red button in front of them to send their laptop's image to a large flat-panel display on the nearest wall. A white board or SmartBoard can be added for brainstorming.
- **Kiosk.** A public, walk-up terminal or touch screen designed for general information retrieval.
- **Café.** A food-service setting in which video displays and sound provide background entertainment. Controls may be available at each table.

## ***Types of Multimedia Classrooms***

Unless otherwise specified, all high-tech presentation space should provide the following general characteristics:

- **Unsecured user-equipment.** The user can activate and operate the system without the use of a key or pass-code and without opening a cabinet door.
- **Equipment within arm's reach.** The user-accessible equipment should be placed in close proximity to the location from which the user should present, teach or facilitate.
- **Features and Costs** associated with high-tech presentation space can be found in the [Technology Level Matrix \(www.unc.edu/multimedia/guide2\)](http://www.unc.edu/multimedia/guide2).

## ***General Purpose Classrooms***

Any public classroom scheduled by the Registrar's Office is categorized as a GPC. A Multimedia Classroom designated to be a GPC must conform to guidelines set forth by the Provost's [Classroom Design and Advisory Committee](#) (CDAC) found at . . .

<http://cdac.unc.edu/classroominformation>

- **CDAC Representative.** Because a GPC may be used by any teacher in any regularly scheduled class, the Program must take into account the needs and expectations of those users not brought to the table. CDAC represents the collective needs of the greater Carolina teaching community and provides a forum for participation in all design meetings.

## ***ITS Classroom Hotline Support***

The Classroom Hotline provides support via two models:

- **General Purpose Classroom Support.**  
The primary mission of the Classroom Hotline is to support users of General Purpose Classrooms. All GPCs, regardless of the level of technology, are automatically supported by the Classroom Hotline at no added cost to individual academic departments.
- **Contract (SLA) Support.**  
The Classroom Hotline offers contract-based support for departmentally-owned space with presentation systems. Departments that may choose to contract with the Classroom Hotline for support services should provision departmental facilities with non-proprietary equipment supported by the Classroom Hotline.

Often, clients with self-owned space do not recognize the amount of manpower needed to support users of presentation facilities until after the space is in service; at which point, the Classroom Hotline receives a request for a Service Level Agreement (SLA) for Classroom Hotline support services.

The higher cost of maintaining 'one-off' designs that use incompatible cables, equipment without reserves, and proprietary control system programs yields a



significantly lower return on investment (ROI) than identically-functioning rooms built to Classroom Hotline specifications.

## ***Submittals***

Unless otherwise specified, submittals should be ANSI-C subsets that provide the following items associated with all rooms within the scope of the AV Program. One subset copy should be delivered to MC office at **05A Swain Hall, CB#3420, Chapel Hill, NC 27599-3420**. When projects utilize an off-campus AV Consultant, a second subset must be forwarded to their place of business. A minimum of two (2) weeks from date of receipt should be given for comment deadlines.

- Floor plan
- Furniture layout
- Reflected Ceiling Plan
- Interior elevations
- Cross Sections
- Other details
- Electrical Plan
- Conduit
- Telecommunications
- HVAC
- Plumbing
- Finishes
- Lighting Fixture Schedule
- Millwork
- Sightlines
- Doors and windows
- Window treatment
- Screen Detail
- Screen Schedule
- Project Specification Book

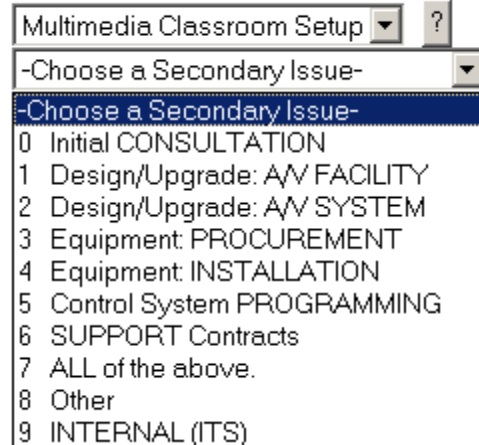
# Initiation of Work

## Project Request

Upon request, Multimedia Classrooms at UNC will provide one complimentary, initial consultation without obligations to fees or deliverables. If project work is to commence, the client will provide a departmental account number on the [Request for Service form \(www.unc.edu/multimedia/guide2\)](http://www.unc.edu/multimedia/guide2) which will be used to generate a Service Level Agreement (SLA) and [Scope of Work \(www.unc.edu/multimedia/guide2\)](http://www.unc.edu/multimedia/guide2). Follow these steps to initiate work:

1. Browse to the [Remedy web submit form](http://multimedia.unc.edu/help) at <http://multimedia.unc.edu/help> to initiate consultative services from Multimedia Classrooms at UNC.
2. Select the Multimedia Classroom Setup option from the first drop-down menu.
3. From the second drop-down menu, select the type of service you wish to obtain...

Type of help needed:



Multimedia Classroom Setup ?

-Choose a Secondary Issue-

0 Initial CONSULTATION

1 Design/Upgrade: AV FACILITY

2 Design/Upgrade: AV SYSTEM

3 Equipment: PROCUREMENT

4 Equipment: INSTALLATION

5 Control System PROGRAMMING

6 SUPPORT Contracts

7 ALL of the above.

8 Other

9 INTERNAL (ITS)

4. Enter as much relevant information as you can in the *Problem Description* text area...

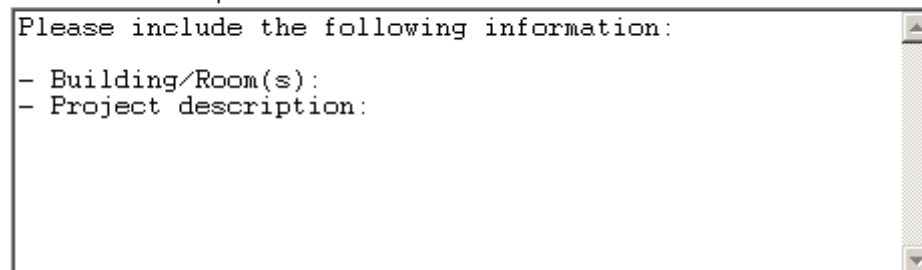
Type of help needed:



Multimedia Classroom Setup ?

0 Initial CONSULTATION

### Problem Description\*



Please include the following information:

- Building/Room(s):

- Project description:

5. Fill in your contact information and click *Submit*.

## ***Project Communications***

Upon approval of the *Service Level Agreement*, Multimedia Classrooms at UNC will set up an email distribution listserv to ensure good communications. Participants address all project correspondence to the listserv address to have all messages stamped with a prominent project tag in the email subject field (i.e. *[UNC.SciPlex] screen sizes*) and propagated to key project team members. Upon request, additional project team members can be added to the list. The following project members are added by default to the Project Contact List (see the [Project Contact List](http://www.unc.edu/multimedia/guide2) at [www.unc.edu/multimedia/guide2](http://www.unc.edu/multimedia/guide2)).

- Facilities Project Manager
- Multimedia Classrooms Project Lead
- Architect
- Electrical Engineer
- Lighting Designer
- Client Representative
- AV Designer (if different from MC Project Lead)
- Construction Manager

Multimedia Classrooms at UNC uses Remedy Project Tracking System to log all activities and project statistics. Access to this campus-wide tool is available upon request.

## ***Project Team Members***

Facilitated by UNC FPD Project Manager

- Design Team
  - Architect
  - Electrical Engineer
  - AV Designer
- Client Team
  - Client Rep
  - User Group
  - Hotline Rep
  - CDAC Rep

## Programming

It is essential to establish programmatic requirements for AV/Communications systems early in the design process using an ICIA-certified AV Design Consultant (CTS-Design certification). Within the context of this Guide, a user group's needs must be considered as part of a campus-wide classroom strategy when a *General Purpose Classroom* (GPC) is being built or the Classroom Hotline will be supporting the room(s).

User surveys and User Encounter meetings are held by the Multimedia Classroom team to determine the programmatic requirements from the users. The [Classroom Equipment Checklist](#) or the [CDAC Equipment Checklist \(www.unc.edu/multimedia/guide2\)](http://www.unc.edu/multimedia/guide2) is used during these sessions to assist the users in understanding standard equipment options. Other equipment needs are taken into consideration as a result of the programmatic requirements.

The results of the programming phase are documented in a Program Document which is delivered to the Project Manager for inclusion and consideration in the Architectural design of the room(s). Once the Program Document is accepted by the Project Manager or Customer the [Programmatic Sign-Off Sheet \(www.unc.edu/multimedia/guide2\)](#) is completed and returned to the Multimedia Classroom team.

## Schematic Design

For projects in which the design team must first define the boundaries of assignable space, it is essential to understand the relationship between the maximum depth of a room (we think of this as *maximum viewing distance*) and *minimum ceiling height*. *Maximum viewing distance* determines *minimum screen height*, and *minimum screen height* determines *minimum ceiling height*. If these dimensions are not coordinated early in the design process, nothing else will work.

### ***Readability of Projected Images***

In order to ensure readability of projected images, the following three criteria must be satisfied:

- Words projected on the screen must be **large enough** to read from the back of the room. To ensure that projected images are large enough to be read from the back of the room, divide the maximum viewing distance by five (5) to obtain minimum image height. Multiply image height by 1.33 to obtain dimensions of 4:3 image. (See [Screen Size Matrix](#) at [www.unc.edu/multimedia/guide2](http://www.unc.edu/multimedia/guide2) to quickly calculate image dimensions.)

**Formulas:**

$$\text{Min. Image Height (Ih)} = \frac{\text{Max. View Distance (VDmax)}}{5}$$

$$\text{Aspect Ratio 4:3 Image Width (Iw)} = \text{Ih} \times (4/3)$$

$$\text{Aspect Ratio 16:9 Image Width (Iw)} = \text{Ih} \times (16/9)$$

- The view of the complete projected image is **unobscured** by heads, bodies or furniture. To avoid viewing obstacles, the bottom of the projected image should be at least 4-ft AFF (to clear seated obstacles) and at least 6-ft AFF (to clear standing obstacles). (See [Screen Size Matrix](#) at [www.unc.edu/multimedia/guide2](http://www.unc.edu/multimedia/guide2) to quickly calculate image dimensions).
- **Sufficient contrast** between the projected letters (usually black) and the background (usually white) makes it easy to read. Since a data-video projector can only project light and not black, it is imperative to keep light away from the screen, yet on the works-surfaces, when projecting an image. This means that, while we may have 20-35 foot candles of task lighting on the students' and instructor's work surfaces, we should have less than two (2) foot candles of ambient light on the screen during projection. (See the [Lighting](#) section for more details.)

## Minimum Ceiling Height

Minimum ceiling height is determined by the size (image height) of the screen *plus* the height of the obstacles in front of it. As a rule of thumb, we want at least 4-ft AFF to the bottom of the projected image where no obstacles (ie. Furniture or standing presenter) regularly obscure the image from view. In the event that a standing presenter's lectern is regularly positioned in front of the screen, the bottom of the projected image should be no less than 6-ft AFF. This is shown in the Figure 2.

### Formulas:

$$\text{Min. Ceiling Height (Ch) at screen}^* = 4 + \frac{\text{Max. View Distance (VDmax)}}{5}$$

\*This formula assumes screen housing recessed in ceiling.

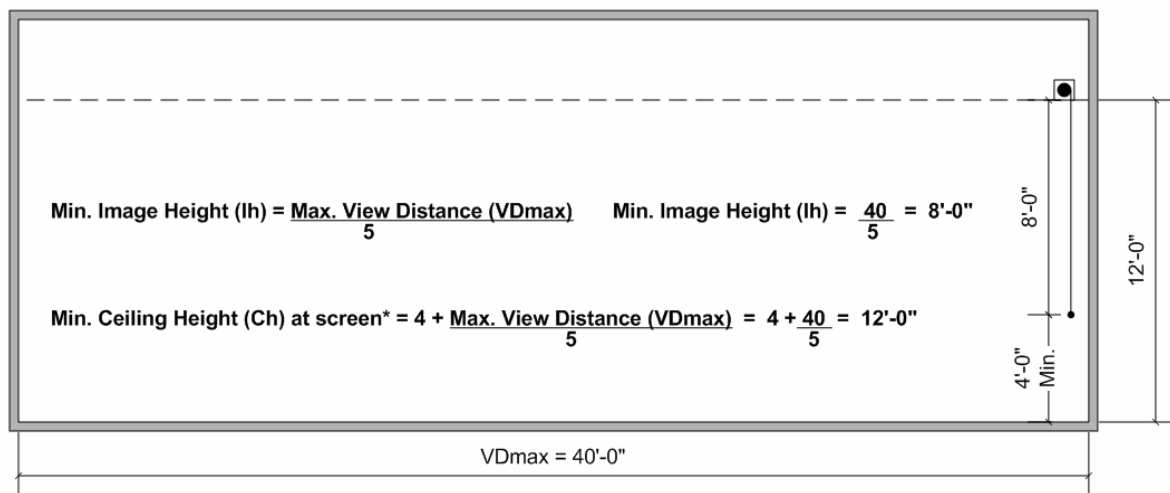


Figure 2. Minimum Ceiling Height Calculations

## Architect's Schematic Design Submittal

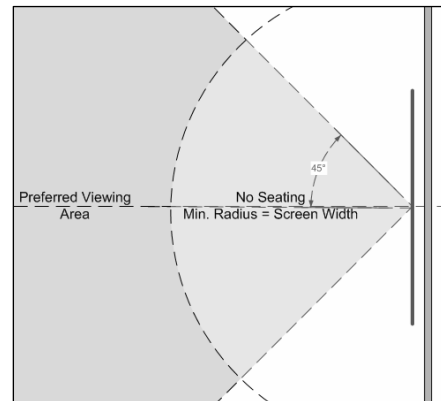
Upon completion of Schematic Design Phase, Architect should submit a schedule documenting current details on all potential presentation space. The [Schematic Design Submittal: Architect's Room Summary](#) document can be found at [www.unc.edu/multimedia/guide2](http://www.unc.edu/multimedia/guide2). See the [Submittals](#) section for information on where to submit this document.

## Design and Development (D&D)

During Design and Development, the AV Designer and A&E (Architecture and Engineering), apply programmatic elements of the AV design to the empty classroom. Central to the early part of this process is *display screen placement* and the usable amount of seating area defined by a screen's *viewing angles*.

### Viewing Angles

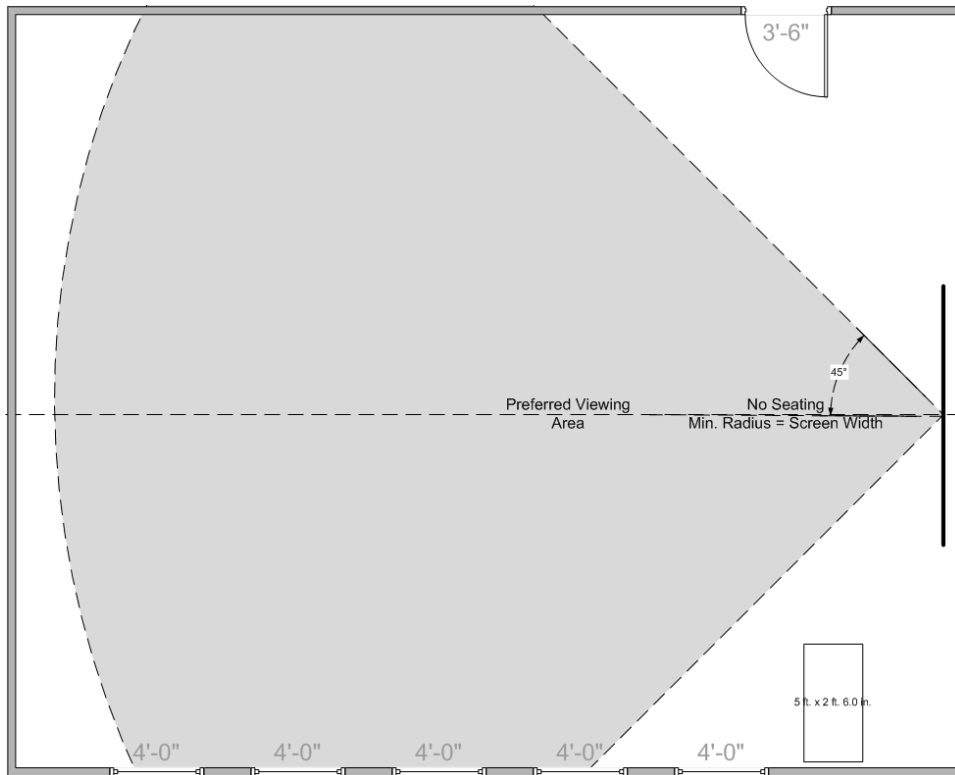
- Preferred Viewing Angles or *Viewing Cone* should be considered to be 45° to either side of the screen's center axis.
- Preferred Seating Positions should be no closer than one screen width to the screen. A minimum of 1.5x screen widths is preferred for large venues.



### Screen Placement

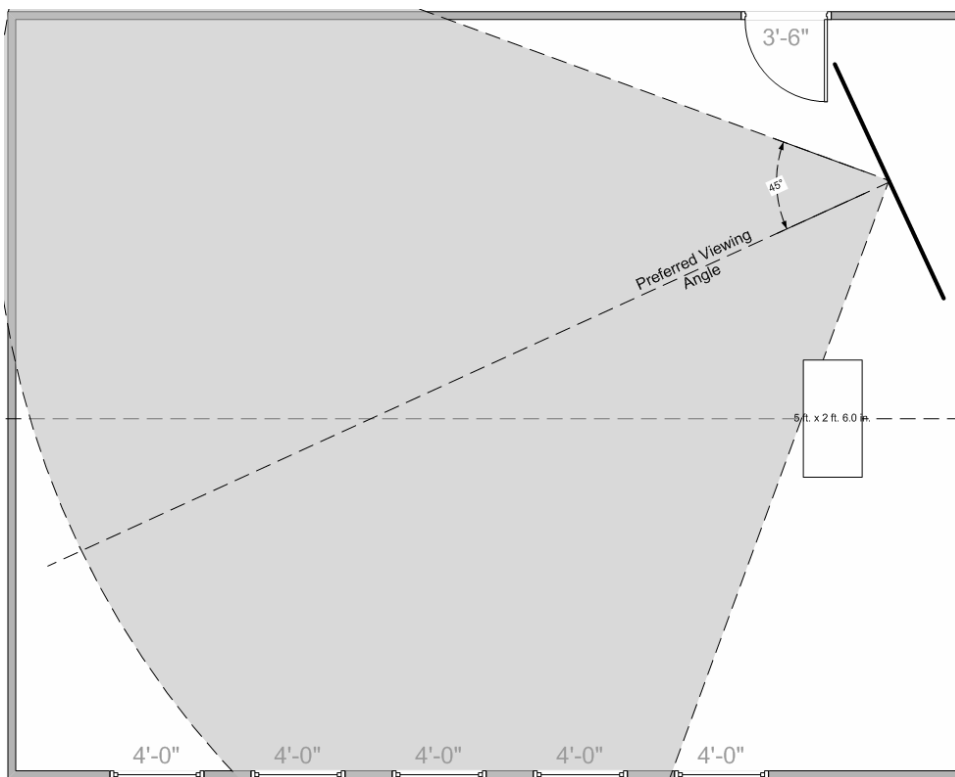
The following considerations should be applied to the placement of projection screens.

- Evidence suggests that most instructors prefer to teach from the center of the room.
- Most instructors utilize projected images to augment material written on the board. Therefore, it is advantageous to maximize the amount of usable board space that remains available while projection screen is in use.
- Presenters tend to be more effective when positioned in the left margin of projected text material. Think of the presenter/instructor as an animated bullet in a PowerPoint presentation.
- Avoid positioning a projection screen to face uncontrolled light sources such as windows, skylights, exit signs, transoms.



**Figure 3. Screen placement: Centered**

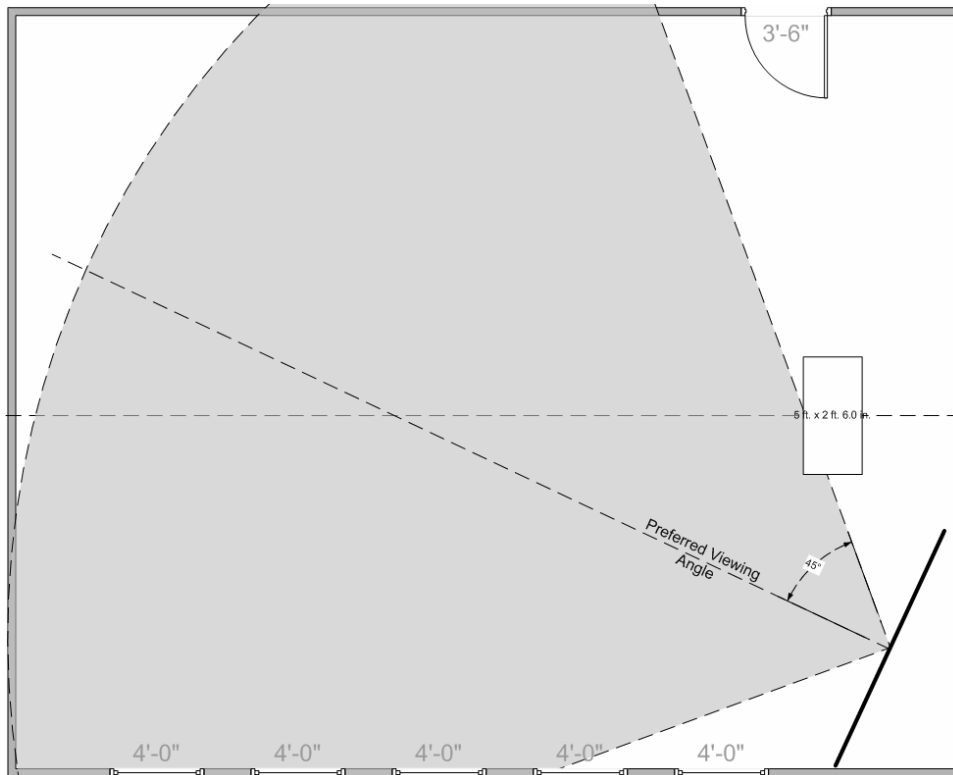
The screen on the center axis of the room places the instructor in the far corner and provides little usable board space.



**Figure 4. Screen Placement: Screen at Entry**



The screen at the entry puts the instructor in the middle (good) and affords much board space (very good), but is angled toward windows (potential light source).



**Figure 5. Screen Placement: Exterior Wall**

The screen to the exterior wall puts the instructor in the middle (good), to left of the screen (good), affords much board space (very good), and is protected from light from the windows (good).

## **Screen Specification**

- Projection screens up to 7-ft wide may be the manual pull-down type.
- Projection screens should be recessed in the ceiling.
- Projection screens should be positioned as close as possible to the wall to avoid creating an obstacle to egress.
- Electric projection screens should have a low voltage control with AV control system interface (typical: dry contact closure).
  - Projection screens should be purchased and installed within the General Contract.

### **Screen Specification (specimen: Stewart Visionary):**

- Screen case should be self-trimming to pre-cut opening in various ceiling configurations.
- Screen case can be shipped separately from the screen roller/motor assembly to help speed up the construction installation process.
- Screen must disappear into the case when not in use.
- To reduce mechanical points of failure, the screen case should have a removable, slotted opening through which the screen descends rather than a mechanical door.
- Screen case and batten should be available in white.
- Screen must be seamless, solid vinyl with tab-tensioning.
- The AV Designer is to specify the screen optical characteristics on a per project basis.

## ***Architect's Design & Development Submittal***

Upon completion of the Design and Development Phase, the Architect should submit a schedule documenting current details on all potential presentation space. The [Design & Development Submittal: Architect's Room Summary](#) can be found at ([www.unc.edu/multimedia/guide2](http://www.unc.edu/multimedia/guide2)). See the [Submittals](#) section for information on where to submit this document.

## Construction Documents (CD)

Once the screens and floor plan have been finalized and accepted, the Design Team can begin to detail the space with the requisite window *treatment*, *lighting* and *infrastructure*.

### ***Window Treatment***

Window treatment provides an aesthetic improvement to the interior design by diffusing or limiting the amount of exterior light (both direct and indirect) passing through exterior windows while maintaining a sense of space, light and movement beyond the room perimeter for its occupants.

- **Blinds.** Blinds, such as Venetian mini-blinds, deliver high aesthetic improvements at a low initial installation cost. This window treatment can provide years of trouble-free service in low-dust installations where their angle and trim can be set once by a technician and left untouched.  
A mini-blind is *not* a durable solution for applications in which it is regularly
  - Trimmed to compensate for extreme changes in sunlight.
  - Trimmed to address changing needs in interior light control.
  - Subject to a dusty or pollen-filled environment.
  - Subject to a regularly opened and closed window.
- **Shades.** Though generally regarded as an element of interior design, window shades are integral to a successful presentation system design because they reduce the amount of unattenuated outdoor light that would otherwise spill into the classroom and add foot candles at the screen, thereby diminishing the readability of the projected image.

**Shade Specification.** Unless specified for a unique application, *blackout shades or track-shades may not be used*. Shade selection should conform to the following criteria:

- Shades should utilize silent, low-voltage (DC) motors. (Example: [Sivoia QED by Vimco](http://www.vimco.com/QED) at <http://www.vimco.com/QED>).
- Shades should provide a low-voltage control that is integrated into the lighting control system *and* the AV system in tandem.
- Shade control should be configured to raise and lower all shades in room simultaneously.
- Installers should complete all travel/limit adjustments and demonstrate proper operation during final electrical inspection.
- Unless otherwise specified, fabric color should be dark (dark brown, gray, black). Desired effect: Dark-colored fabric tends to disappear in front of a window in daylight as if the window had tinted glass. Unlike light-colored fabric, dark materials resist flaring (which diminishes the shades effectiveness) in direct sunlight.
- Unless otherwise specified, shade material should provide an [openness factor of no more than 5%](http://www.vimco.com/fabrics/fiberglass1.asp) (reference <http://www.vimco.com/fabrics/fiberglass1.asp>).

## Mounting Points

- **Dolby speakers.** In-wall blocking should be provided to support JBL Control Series speakers: [Control 23](http://www.jblpro.com/pub/install/control/ctrl23.pdf) (reference <http://www.jblpro.com/pub/install/control/ctrl23.pdf>), [Control 25](http://www.jblpro.com/pub/install/control/ctrl25.pdf) (reference <http://www.jblpro.com/pub/install/control/ctrl25.pdf>). Speakers typically are surface-mounted close to the ceiling grid in the following configuration.

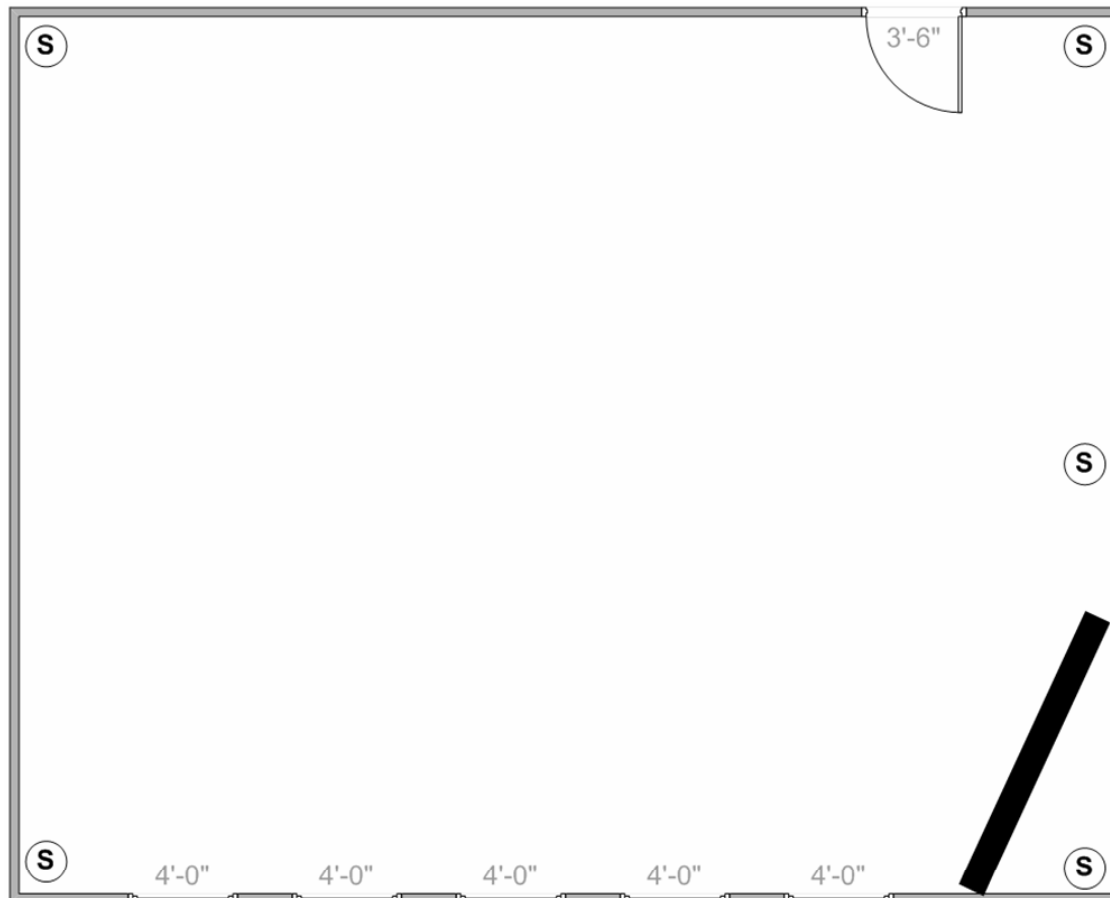
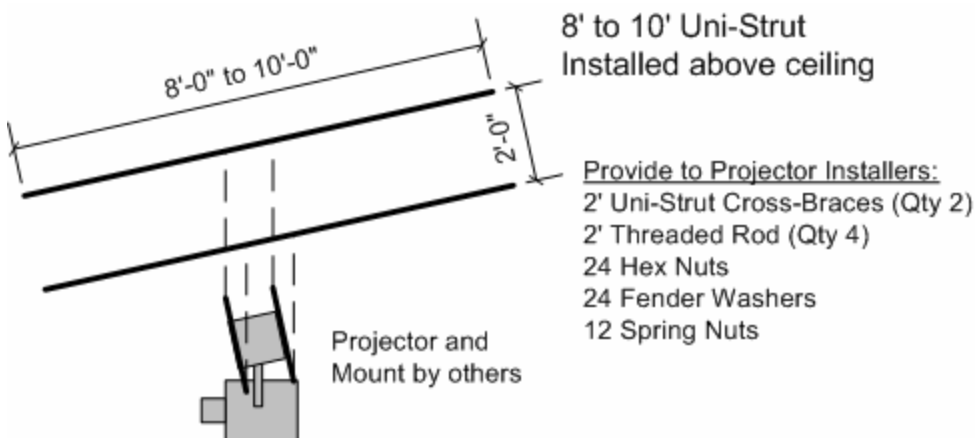


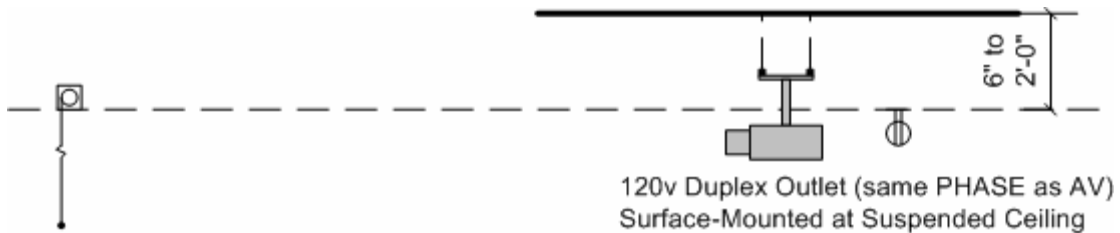
Figure 6. Dolby Speaker Layout (typical).

- **70v Speakers** are specified in facilities that require speech reinforcement (typically +70 seats). Speakers layout should be specified by the AV Designer. (See also Electro-Voice [EVID C8.2](http://www.electrovoice.com/electrovoice/EVfiles.nsf/lookup/EVIDC82-EDS/$File/C82_38110126.pdf) (reference [http://www.electrovoice.com/electrovoice/EVfiles.nsf/lookup/EVIDC82-EDS/\\$File/C82\\_38110126.pdf](http://www.electrovoice.com/electrovoice/EVfiles.nsf/lookup/EVIDC82-EDS/$File/C82_38110126.pdf)) and [EVID C8.2LP](http://www.electrovoice.com/electrovoice/EVfiles.nsf/lookup/EVID_C8.2LP_EDS/$File/C82LP_38110169.PDF) (reference [http://www.electrovoice.com/electrovoice/EVfiles.nsf/lookup/EVID\\_C8.2LP\\_EDS/\\$File/C82LP\\_38110169.PDF](http://www.electrovoice.com/electrovoice/EVfiles.nsf/lookup/EVID_C8.2LP_EDS/$File/C82LP_38110169.PDF) ).)

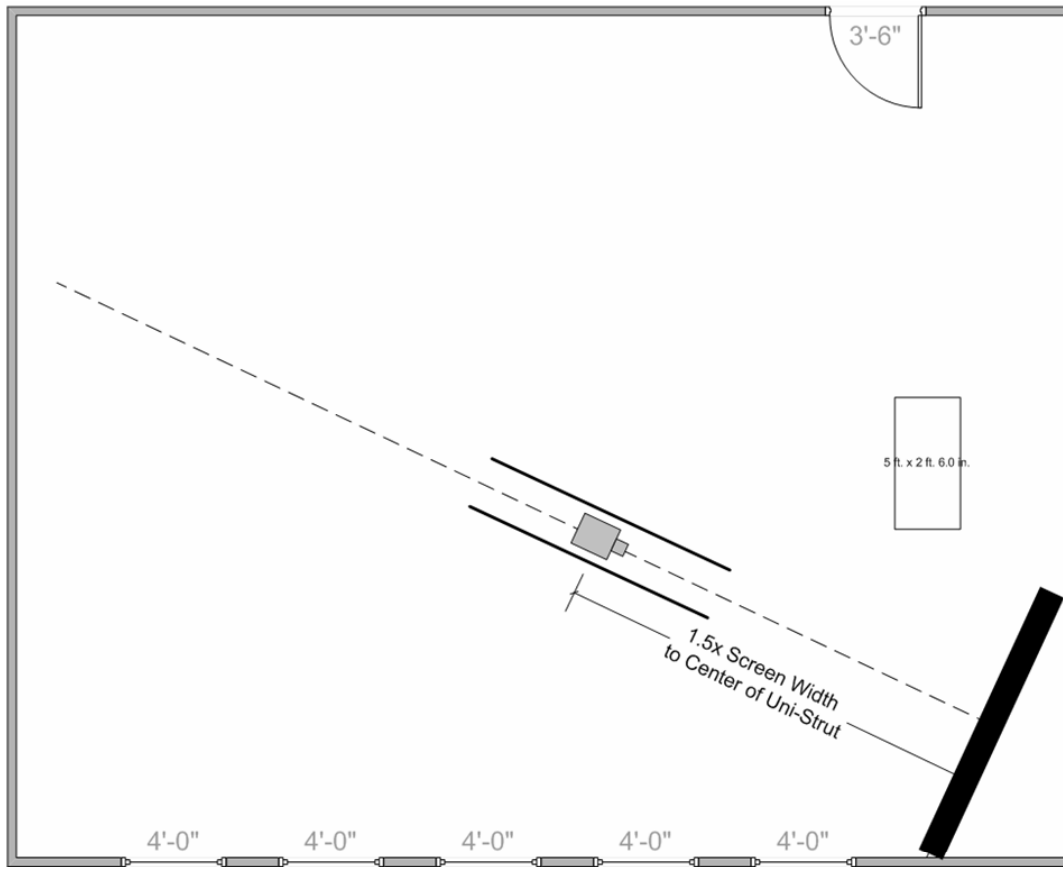
- **Specification: Mounting Point for Data Projector(s).** The Contractor is to install two (2) 10-ft lengths of Uni-strut 2'-0" O.C. on the center-axis of the projection screen. The center of the uni-strut is typically 1.5x screen width from the screen. Contractor should include:
  - 2-ft Uni-strut cross-braces (qty 2)
  - 2-ft threaded rod (qty 4)
  - 24 hex nuts
  - 24 fender washers
  - 12 spring nuts



**Figure 7. Projector Mount Above Ceiling**



**Figure 8. Projector Mount at Suspended Ceiling**



**Figure 9. Projector Mount in relation to Screen**

## ***Control interfaces***

The following room systems/components should be provisioned with both a wall-switch and a low-voltage control interface to be tied to AV control system (by owner). The Contractor is to provide dedicated conduit from low-voltage control interfaces to AV control system location.

- Lights (GRAFIK Eye or RadioTouch)
- Screens (UPC-20 or equiv.)
- Shades (UPC-20 or equiv.)

## ***Conduit Riser (low-voltage)***

Low-voltage conduit risers for other than MC1 rooms may be unique to the specific needs of the facility and program. (See [Appendix A: Sample Diagrams](#) for MC1 Riser Diagrams.)

- **Pull-string and Labels.** All empty low-voltage conduit should have polypropylene pull-string with a rigid tag attached at each end of sufficient size and rigidity to prevent it from being pulled into conduit. A permanent label indicating location of opposite conduit opening should be attached at readable position in close proximity to conduit opening.
- **Above-grade, low-voltage conduit.** All above-grade, low-voltage conduit should be rigid, electrical metallic tubing (EMT) with hot galvanized steel O.D. with an organic corrosion resistant I.D. coating and should be produced in accordance with U.L. Safety Standard #797 and ANSI C80.3 and should be listed by a nationally recognized testing laboratory with follow-up service.
- **Below-grade, low-voltage conduit.** All below-grade, low-voltage conduit should be galvanized rigid metal conduit (RMC) hot-dipped interior and exterior and conforms to U.L. Standard #UL-6, ANSI C80.1 and NEC 2002 Article 344.
- **Pull and Junction Boxes.** All junction boxes are galvanized metal, Nema 1, screw cover, unless otherwise stated.

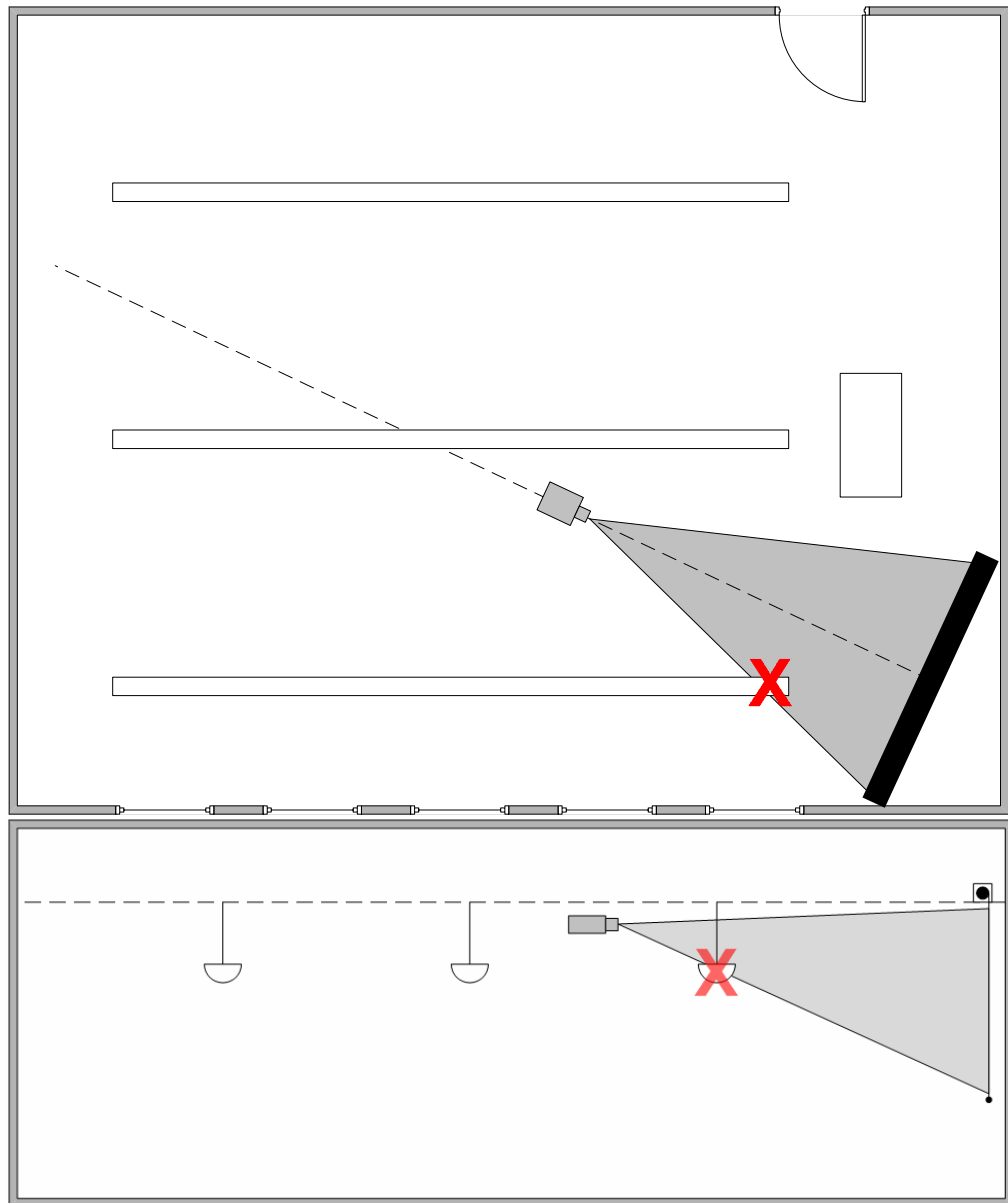
## ***Floorboxes***

Floorboxes are to be used wherever movable podium locations are assigned. [Floorbox selection](#) can be made at <http://www.fsrinc.com>.

## Lighting

The objective of a functional lighting plan is to provide sufficient illumination for instructors and students to read, write and interact without dozing off while keeping ambient light off the projection screen in order to create a high-contrast, readable image. During projection, the lighting plan should achieve the following performance criteria:

- 20-35 foot candles of task lighting at student seats, instructor's station and board.
- Less than 2 foot candles at the screen.
- Indirect Lighting. Care should be taken when placing pendant lighting fixtures to ensure that a) ambient light at the screen remains within spec; b) fixture does not invade light path of projected image (see Figure 10).



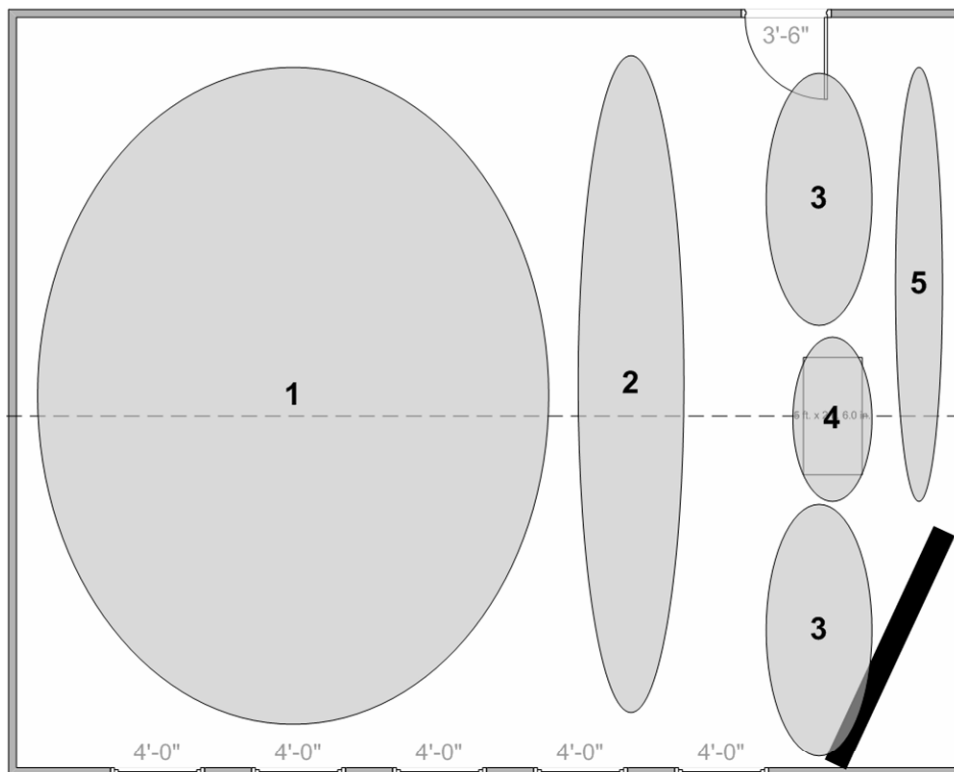
**Figure 10.** Pendant Luminaries obstruct image path.



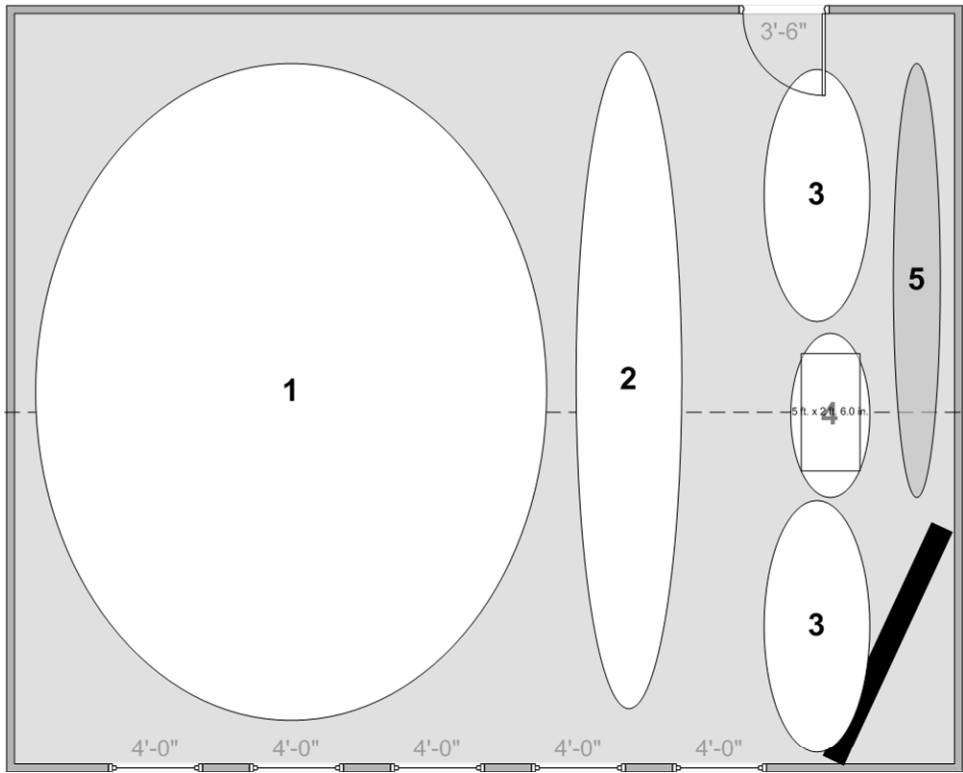
## Lighting Zones

Lighting zones tie together a bank of luminaries on a single (dimmer) circuit (typically) to illuminate a specific region or address a specific task. The following diagrams illustrate a typical five-zone lighting plan.

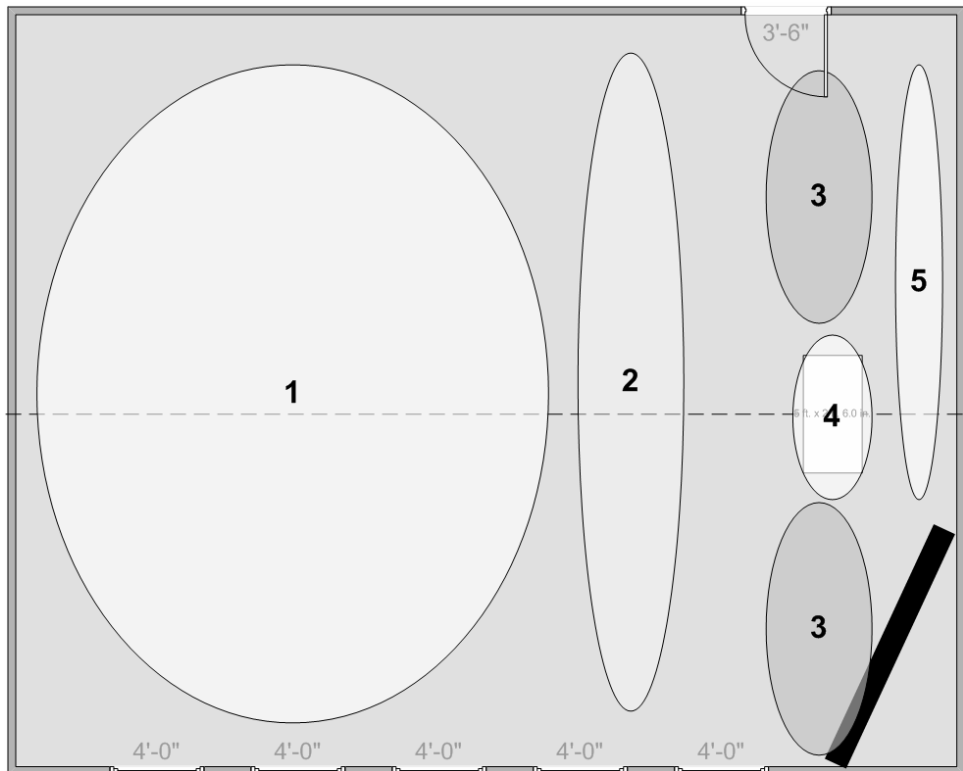
- **Zone 1.** Main audience/common area.
- **Zone 2.** Front-of -room buffer zone.
- **Zone 3.** Apron/instruction area.
- **Zone 4.** Podium special.
- **Zone 5.** Board warmer.



**Figure 11. Typical lighting zones in a Multimedia Classroom**

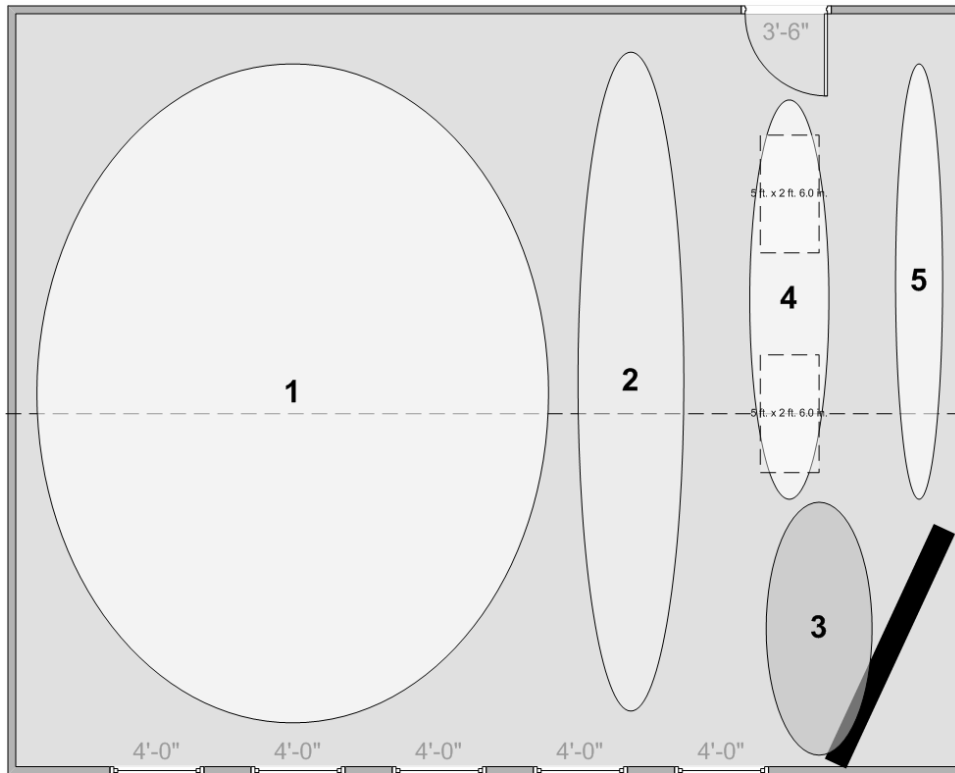


**Figure 12. Lighting for Lecture Mode**



**Figure 13. Presentation Mode**

Note in Figure 12 that Zone-3 accommodates a second screen if needed.



**Figure 14. Lighting Zones for a Moveable Podium**

Note that in Figure 13 that an additional 1-2 ft of board-to-podium clearance helps to isolate the screen from Zone-4 light spillage.

## Power, Data and Telecom

Specific power and data requirements will be matched to the unique programmatic requirements of each room. The following base specifications apply to most designs:

- AV equipment within a single room should draw power from dedicated circuits on the same phase.
- Whenever possible, a distribution sub-panel, controlling AV equipment circuits should be placed in each room.
- An equipment cabinet should be provisioned with one (1) video and three (3) network drops.
- Each podium location should be provisioned with one (1) telephone and two (2) data drops.

## Noise Criteria

One performance objective of an acceptable room design is to provide a quiet work environment hospitable to conversational speaking volume (approx. 60 dBA). Contributing noise sources such as mechanical systems, forced air turbulence, ballast noise, elevator machinery, plumbing surge and traffic can combine to elevate the (ambient) noise floor above acceptable levels for classroom activities.

The Architect should design all general presentation facilities not to exceed **NC-35 curve**. Video teleconferencing facilities should not exceed to **NC-30 curve**. The Architect should identify early in the design process any scheduled space for which these specifications may be costly to achieve. Care should be taken when designing HVAC system and lighting system components to ensure that system noise is not transmitted into the room. Acoustic testing as a condition of project sign-off should demonstrate success of design.

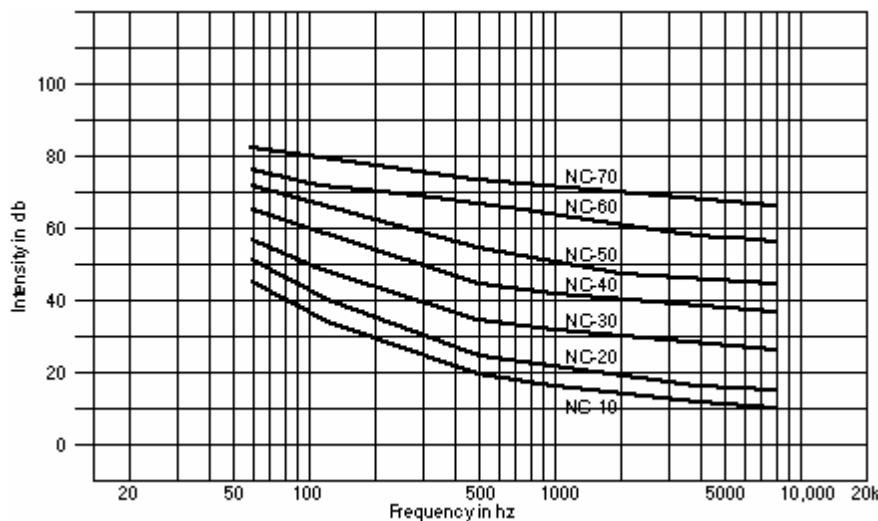


Figure 15. Noise Criteria Curves

## ***Projection Booth***

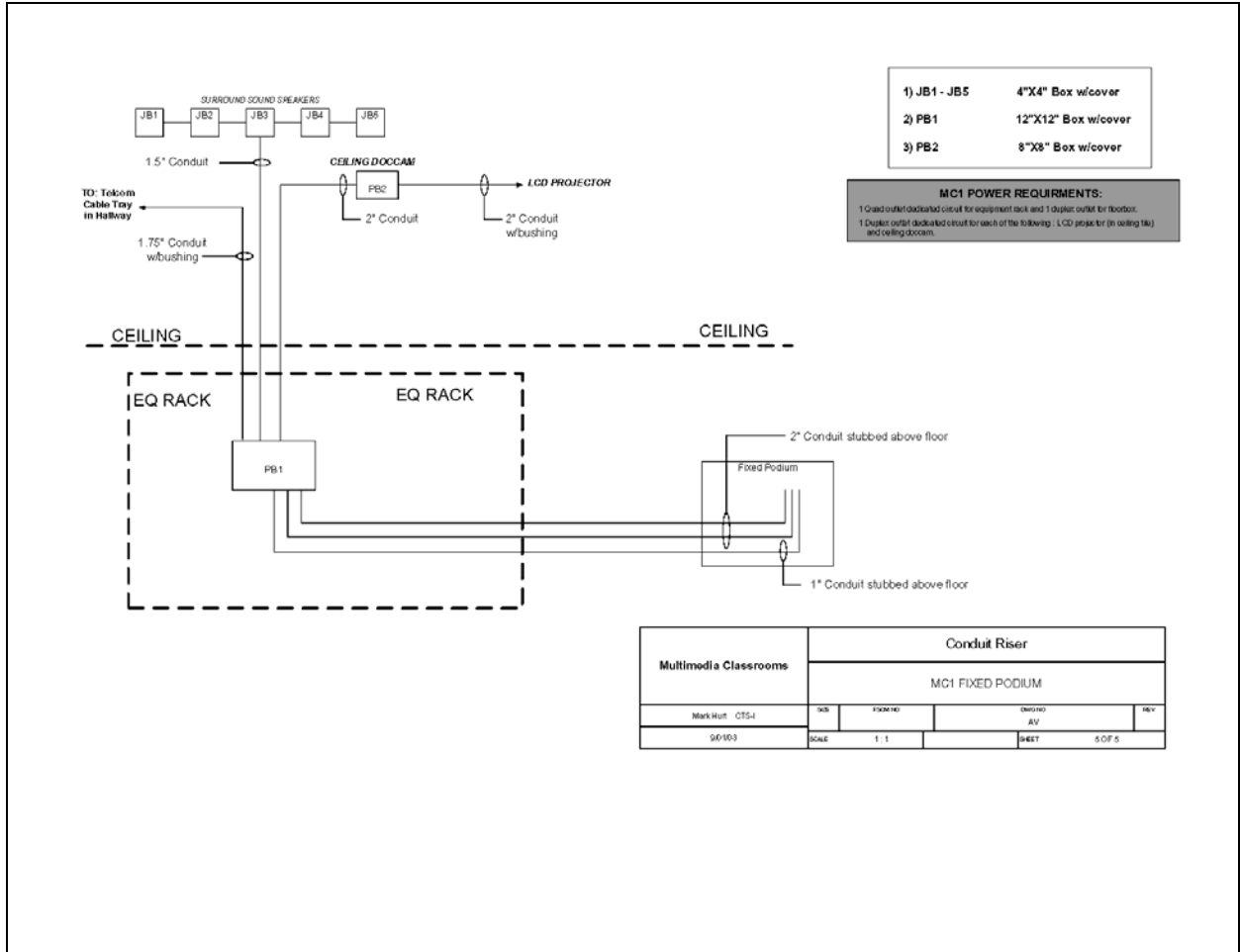
Projection booth glass should be cinema-grade, non-reflective glass with no more than 1% residual reflection with incident light perpendicular to the surface. Reference: [Schott AMIRAN® on standard clear float glass](#). See [http://www.schott.com/architecture/english/products/non\\_reflective\\_glass/amiran/technical\\_info.html](http://www.schott.com/architecture/english/products/non_reflective_glass/amiran/technical_info.html).

## ***Architect's Construction Document Submittal***

Upon completion of Construction Documents Phase, Architect should submit a schedule documenting current details on all potential presentation space. The [Construction Document Submittal: Architect's Room Summary](#) document can be found at ([www.unc.edu/multimedia/guide2](http://www.unc.edu/multimedia/guide2)). See the [Submittals](#) section for information on where to submit this document.

# Appendix A: Sample Diagrams

## Riser Diagram: MC1 Fixed Podium



# Riser Diagram: MC1 Moveable Podium

