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LECTURE HALL DESIGN STANDARDS
UNIVERSITY OF MARYLAND, BALTIMORE COUNTY

Revised August 29, 2000

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University of Maryland, Baltimore County
GENERAL LECTURE HALL DESIGN GUIDELINES
Revised Draft, August 25. 2000

1.0 INTRODUCTION

Special appreciation and acknowledgement is given to Mr. Victor Aulestia, Director of Instructional Technology for the time and effort he committed to develop the January 4, 2000 Lecture Hall Design Guidelines.

In addition, appreciation is extended to the following individuals including their respective staffs who have provided valuable input and assistance or participated in the revision/refinement of the Lecture Hall Design Guidelines.

- George Alinsod, Physical Plant
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- Eliot Shimoff, Psychology
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- Phil Sokolove, Biology
- Brooks Stephens, Computer Science/Engineering
- Jack Suess-Director, UCS
- Tom Taylor, Enrollment Management
- George Vitak, Director, Communication Services

The organization of this document is based on providing two sections of information:

- General Lecture Hall Design Guidelines.
- Specific Lecture Hall Design Guidelines.
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To assist in the design, the selected Consultant is required to comply with both the General Lecture Hall Design Guidelines and Specific Lecture Hall Design Guidelines respectively.

It should be further noted that excluding section and subsection titles, changes from the original standards are represented in bold type.

2.0 OVERVIEW

The University of Maryland, Baltimore County Lecture Hall Design Guidelines are intended to be used as the criteria for the design and construction of new and renovated lecture halls on the UMBC Campus. **These guidelines are meant to supplement UMBC's Design Standards, which can be obtained from the Office of Capital Planning. Any proposed design which deviates from these guidelines must be reviewed and approved by the Office of Capital Planning.**

Designing a space for teaching and learning requires careful planning and organization. It requires close collaboration between the architect, mechanical engineer, electrical engineer, lighting designer, audio-visual specialist, and instructor. A well designed space is the result of careful coordination of information gathered from architectural and engineering disciplines as well as established instructional technology principles.

3.0 GENERAL CHARACTERISTICS

3.1 Location

The learning environment must be: located within a building with easy access by students and equipment, isolated from noisy gathering places, and concentrated on the lower floors of buildings to provide an easy avenue for students, as well as provide convenient access for the disabled and support services. The uses of adjacent spaces must be carefully chosen to avoid distracting noises and sounds. They should not be adjacent to mailrooms, reception areas, dining facilities, rest rooms, bicycle parking, loading docks, mechanical equipment rooms, and other similar noise producing areas. Care must be taken in their location in relation to the exterior environments as well as to direct air paths between rooms.

Physical Access and Movement - The design shall take into account the flow of students both in and out of the space and within the space as well as the need for the instructor to move around in the front of the room.

The success with which a student receives information from an instructor or can effectively participate in class activities, is affected by factors of the room design, the shape as well as the its placement within a building. In spaces planned for extensive media use, the configuration can be one of the most significant factors contributing to the effectiveness of the display system, the student's comfort and ability to interact with the instructor and other students, and the strength and clarity with which the instructor's voice is heard.

For new facilities, consideration should be given during the site planning process for access and parking of vehicles which deliver and maintain audio-visual equipment. Items which need to be considered are ramps, level vehicle access points, and other provisions for the ease of movement of heavy or bulky equipment.

3.2 Entrances

The flow of students should be the major factor in determining the location of entrances. Entrances should be located to avoid student traffic passing through non-instructional areas. In addition, large numbers of students traveling in corridors and hallways can generate unwanted noise for still in use. In determining the size of entrances and exits, building codes should not be the only criteria. The flow of students in and out of rooms can have a major impact on size of entrances and exits. The design of entrances, exits, stairs, corridors, and exterior paths should take into account between-class student traffic. For example, it is not realistic to assume that a room will be completely vacant when students begin arriving for the next class.

Provide vision panels in entrance doors. They could be tinted.

Provide door stops to protect the wall surface (specifically gypsum wall board).

Grills shall not be allowed in room entrance doors.

3.3 **Seating,** Capacity, and Support Space

The size of the room should be designed to accommodate the programmed number of occupants as well as provide for additional support space. The support space must take into consideration both the set up and use of audio-visual equipment, access for the disabled, layout of the instructor's materials, circulation space and empty floor space needed to keep students from being seated too close to a chalkboard, projection screen, or video monitor.

In rooms with fixed theatre seating or tablet arm chairs, the seating should be secured to the riser for ease of floor cleaning.

There shall be no columns in any teaching space.

3.4 Floor, Walls, and Ceilings

Carpeting shall be provided in all rooms unless discipline specific related courses dictate otherwise.

Ceiling: If lay-in ceilings are used, 2' x 2' tiles should be specified and the Consultant shall comply with UMBC's Design Standards for tile standards and style.

Colors of finishes should be neutral on furniture and fixtures with accent color used where it can be easily maintained or changed (paint).

The ceiling height is another important consideration when designing the space. For example, because a projection screen must be large enough to display images of adequate size, it must be placed high enough from the floor to provide unobstructed sight lines. This usually requires a ceiling height higher than the standard eight feet.

3.5 Orientation

The orientation of a room's surfaces play a major role in how sound is reflected from the sending end of a room to the rear of a room. Careful consideration must be given to the configuration of each wall surface, ceiling plane, and floor finish. In rooms that require fixed seating or fixed tables, floors should be tiered to provide good sight lines. The ceiling section over the sending end should be inclined toward the students, angled upward from the sending end, to project the instructor's voice towards the rear of the classroom or lecture hall.

3.6 Writing Boards and Projection Screens

Seating - Selection of built-in seating shall also take into account durability and availability of spare parts.

The number of left handed tablet arm chairs should total approximately 10% of the room capacity.

Visible seat numbers shall be incorporated into all fixed seating.

Writing Boards – Whenever white boards are specified, secure storage for markers within the room is required.

Projection Screens – Dual projection screens are required; location to be determined during design to allow faculty the capability to project the same image on both screens or on one screen with the latter providing the capability to concurrently use the writing surface.

3.7 Accessibility

All rooms must be designed to comply with the Standards for Barrier-Free Access, available from the Office of Risk Management and Physical Plant.

Stations for wheelchair users shall be marked to prevent them from being pushed aside or used for stacking materials or otherwise be made unavailable for the intended user. In rooms with fixed seating, accessible tables should be fixed with stackable chairs so stations may be used as regular seating when not in use by individuals using wheelchairs.

3.8 Noise control

Other important factors must be considered in the design. To avoid the noise generated by their operation and use, vending machines must be located as far away as possible. Trash and recycling containers should be located near the vending machines. Restrooms and drinking fountains should be located nearby and should be designed to handle student use between classes, rather than minimum code requirements which are based solely on room occupant load. To prevent unwanted noise transmission, restrooms should not share common walls, floors, or ceilings with instructional spaces.

3.9 Data

For future flexibility/connectivity, all new rooms should be provided with infrastructure capability to accommodate both wireless and wired connectivity.

All rooms to be pre-wired to accommodate verbal interactive capability between the students and the instructor. The methodology (hard wired or wireless to be determined on a project basis).

3.10 Telecommunications

Phones – All rooms shall be provided with campus phone connectivity that will provide access to AV Services, Campus Police, Physical Plant, and all campus phone numbers. The campus will investigate the ability to use a light versus a bell to indicate incoming calls on these phones.

The telecommunication systems shall consist of pathways and spaces which only house cabling and equipment provided by the university. Coordinate telecommunication requirements with UMBC's Department of Communications Services. Reference UMBC's Design Standards for Pathway Specifications.

Regardless of the type of room, it is essential to provide the infrastructure connectivity for the desired delivery system and this should include: copper (either level 5, 6, or 7 depending on what is current on campus), optical fiber (both single and multi-mode), and coaxial. With media in place, the need for flexibility is essential.

Regarding wireless capability, the design should allow for its placement providing hardwire to the room with a transmitter(s) located in the room. It would be the Consultant's responsibility to deal with room configuration issues. In the near term, wherever there is laptop use, hardwire connections should be provided.

Provide an active telephone jack in all rooms that is conveniently located to the technology console.

The pathway to just outside of each room should use cable trays. Conduits should then be used for entering larger rooms. Within each room, there are 4 methods of providing service and they are presented below in order of highest to lowest flexibility capability.

- **Raised Floor**
- **Embedded channeling**
- **Hard conduit to specific locations**
- **Distribution to the walls**

3.11 Natural Lighting

Natural lighting is not desired in lecture halls.

3.12 Electrical and Lighting

Line voltage (120v) electric clocks (digital and centrally controlled at Physical Plant) should be located in each Classroom and Lecture Hall.

Use Low Voltage Electrical System since it provides more versatility/flexibility. This would also allow the use of motion detectors (automatic lights on and off) in each room. In rooms that have media control systems, the system should be programmed to automatically shut off the lights.

Fluorescent lighting voltage is 277. Lower light levels appropriate for projection in rooms is required and can be achieved with multi-tube fluorescent fixtures. First, zone the lighting so that fixtures in the instructor area are switched separately from those in the seating area.

Lighting fixture diffusers should be specified since different diffusers will greatly change the lighting pattern.

All fluorescent fixtures shall be have parabolic lenses and placed parallel to the writing surface at the front of the room.

Incandescent light fixtures shall be dimmable and banked for lighting control.

RETROFIT of Spaces - Split the switching of the tubes in the fixtures over the seating area. For example, in a 3 tube fixture, put all the center tubes on one switch and the two outboard tubes on another switch. This will provide a low (1 tube), medium (2 tubes) and high (3 tubes) lighting level.

Lighting Planning - When incorporating both incandescent and fluorescent, there is a need for consistency regarding spectrum and lighting levels. All presets (including room technology) should have a manual override.

Lighting Control – Lighting controls should be conveniently located to the instructor station, clearly labeled, and should provide instantaneous response when pressed. In addition, lighting control should have a minimum of four options: full-on, two projection settings (medium and low), and full-off.

Lighting: Dimmable directional tungsten filament downlights should be used in teaching spaces in lieu of fluorescent dimming fixtures. Fluorescent tubes should be specified as 41k Kelvin.

3.13 HVAC

In existing rooms, consideration should be given to installing ceiling fans to enhance proper air circulation in the room.

HVAC Controls: Climate Control - Temperature and air flow as well as the associated acoustical control of HVAC systems are critical to the room. There should be centrally monitored and controlled (Physical Plant) HVAC systems in all instructional spaces.

Mechanical Services, General Requirements: A number of air changes should be specified based on the heating and cooling load of the space. In addition, fancoils in classrooms generate noise and therefore are not desirable since they create a disturbance to the class and are more maintenance intensive. It is recommended that baseboard heating (fin tubes) be used in classrooms below window areas.

Fresh Air Supply – The space should conform to ASHRAE 1997 code standard or the most currently acceptable edition.

3.14 Sundry Issues

Trash cans are to be provided in all rooms.

Keylocks - Although not-in-place, it is UMBC's goal to use card keys in lieu of key locks on AV and electrical service and equipment access.

Stainless steel in lieu of plastic switch and outlet plates as well as data and voice plates are to be used.

Metal pencil sharpeners should be installed.

3.15 UMBC's Design Standards

The selected Consultant shall comply with all requirements and services as set forth in UMBC's Design Standards. As it relates to instructional spaces specifically, the design consultant shall comply/satisfy the criteria set forth below:

- **Part I-D, Codes**
- **Division 6, Wood and Plastics; E. Interior Architectural Woodwork**
- **Division 8, Doors and Windows, including Addenda**
- **Division 08460, Automatic Door Operators**
- **Division 08710, Finish Hardware**
- **Division 08800, Glazing**
- **Division 9, Finishes**
- **Division 10, Specialties, D. Interior Signage**
- **Division 12, Furnishings – Classroom Seating**
- **Division 15, Mechanical**
- **Division 16, Electrical**
- **Division 17, Fire Protection Engineering**
- **Part III, Request for Deviation from Design Standards.**

University of Maryland, Baltimore County
SPECIFIC LECTURE HALL DESIGN GUIDELINES
Revised Draft, August 25. 2000

1.0 INTRODUCTION

The purpose of this document is to provide guidelines for the design of lecture halls at UMBC. The document will be a useful reference for Departments and User Groups in planning new facilities or upgrading existing spaces.

The Lecture Hall Design Guidelines will be used by consultants commissioned for University projects.

The guidelines will be a controlled document and will be reviewed periodically.

It should be further noted that excluding section and subsection titles, changes from the original standards for lecture halls are represented in **bold type**.

2.0 SPACE PLANNING AND LAYOUT

2.1 Objectives

Lecture halls are places of social and personal interaction, where learning takes place and where creative thinking is encouraged.

The primary objective of the design team is to achieve the best possible arrangement of architectural elements and teaching facilities so that both teaching and learning is maximized.

Design of lecture theatres and teaching spaces requires a balanced relationship between architectural/construction skills and teaching/AV disciplines. The objective of the design team should be to optimize the 'function' of space, by clearly identifying all performance requirements and allowing for these needs in the design stage.

Each project should be supported by analysis of client requirements, interviews with users, and consideration of applicable standards.

Ancillary support spaces (i.e. lobbies off of lecture halls) should be serviced by the primary telecommunication distribution system/infrastructure in the building. Alternative use(s) of these spaces suggest that floor connections restrict its use and suggest that either the architectural elements of the building dictate locations or possibly, wireless capability would be most appropriate for these areas.

2.2 Lecture Halls - General

These Guidelines concentrate upon lecture halls, as these spaces require the greatest design input and in which is usually found the greatest complement of audiovisual facilities.

Lecture halls are generally single function spaces with fixed seating and writing furniture on a tiered or sloping floor surface. Each seat should have a clear unobstructed view to the lecturer and all boards and screens located on the presentation wall. These spaces are generally well equipped for visual communication.

Natural lighting is not desirable in lecture halls.

2.3 Information Transfer and Display

The success of the lecture hall as a teaching space could be measured by its ability to support and enhance teaching. It may be stated broadly that spaces, which are comfortable and pleasant, will provide a good environment for the acquisition of knowledge. More specifically, generous access, comfortable seating, clean sight lines, good lighting, articulate sound, appropriate scale, pleasant spatial forms, colors and textures, etc. all contribute to the success of a teaching space.

However we can quantify a range of individual characteristics, which are known to support communication, and we are able to optimize the performance of the various teaching tools provided in a lecture theatre. However no amount of investment in technology can correct for a badly prepared or designed teaching area. The technology and the architectural design must be complementary if the teaching requirements are to be met.

In cases where existing spaces are being renovated or upgraded it is usually difficult (and frequently impossible) to satisfy all requirements. The need for multiple imaging (display) areas often conflicts with the need for writing surfaces.

In some cases the width of the lecture hall at the front may preclude use of multiple screens and display surfaces.

Decisions on where to compromise can only be made when the client's needs are fully understood and prioritized.

To maximize student viewing, a non-center aisle is preferred. In addition, cross aisles are highly desirable.

2.3.1 Writing Boards

Writing boards are required in most lecture theatres, though it is important to note that use of these in larger spaces should be discouraged, as distant students are unable to read the written information.

Board selection is driven to a degree by faculty demands, with a definite leaning towards white marker boards in the absence of strong objections from any prime users.

It is desirable to maintain ready access to the boards when other media are in use. Covering all the writing boards in a lecture hall when a projection screen is required will cause problems for users. Lecturers like to move quickly from one medium to another and therefore, they should not have to retract a screen to get to the writing surface.

In practice, many existing theatres do not provide sufficient space at the front of the room to achieve the desired result, and projection screens will interfere with board usage. Designers of new theatres should provide multiple imaging and display areas, with easy access to writing boards at any time.

2.3.2 Projection Screens

Projection display techniques are increasingly being used in University teaching. Such techniques present magnified images to the audience on projection screens.

(Projection screens: Simple Rules for Theatre Planning
The University expects designers to provide for the following projection facilities in lecture hall developments:

- A4 Overhead Transparency Projection.
- Dual A4 Overhead Transparency Projection.
- 35mm Slide Projection.
- Dual 35mm Slide Projection.
- Occasional 16mm Film Projection.
- Video Projection.
- Computer Data Projection.

Planning for projection display requires consideration of the most distant viewer situated at the most acute angle to the screen. The toughest task is the projection of computer information, which is normally designed to be read quite close to the screen.

Optical calculations should be performed by the audiovisual consultant for each project; however, the following simple rules can be applied with success during general lecture theatre planning exercises.

Experience on campus shows that whilst the viewing angle and closest viewer rules can be stretched a little, the furthest viewer rule must not be stretched at all. The ratio of six screen heights to the furthest viewer is already higher than that recommended by some other campus standards.

Given the great variety of room shapes and sizes, no two lecture halls will have the same presentation capabilities.

Separate screens should be provided for overhead transparency projection wherever possible. The use of motorized screens is discouraged, with the preferred option being to project onto the wall above the writing board area. In most cases the writing boards must be lowered to expose the screen area, however this takes less time than waiting for a motorized screen to unroll.

Rule 1. Furthest Student. No student should be positioned further than six screen height multiples from the projection screen.

Rule 2 Closest Student. No student should be positioned closer than two screen height multiples to the projection screen.

Rule 3 Horizontal Viewing Angle. Students should be positioned within an arc of 45 degrees off the centerline of projection.

Rule 4. Screen Position. The base of the screen should generally be at least 1.35 m clear of the floor at the front of the lecture theatre.

Rule 5. Vertical Viewing Angle. Students should be limited to 15 degrees maximum head tilt excursion above horizontal, to reference the center of the projection screen.

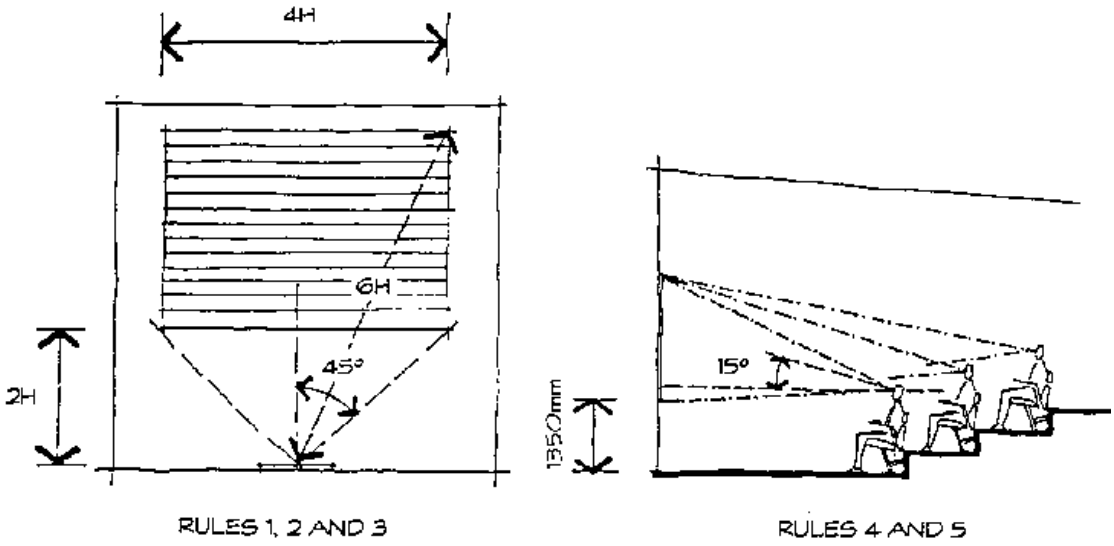


Fig.1 & 2

Note: Rules do exist for Screen Legibility. These are of little practical use, as they involve assumptions on typographic sizing, an area in which the lecture hall designers have very little practical control.

Accommodating all these rules in a multiple screen, multiple board lecture halls is an exercise in compromise.

2.3.3 Seating Rake, Aisles, and Visibility

The lecture hall floor should be raked to provide a clear view of the display areas and the presenter from every seat. The rake is preferably provided by tiering of the theatre floor. Each tier or step should be a minimum of 6".

More aggressive tiering can be provided, however it usually creates projection and screen viewing problems - it should be contemplated only in very small theatres or where existing conditions must be retained. In steeply raked lecture halls, the front rows of seats may need to be tilted back slightly to compensate for excessive screen heights and vertical viewing angles. This type of lecture hall is not preferred at UMBC.

Some modern lecture theatre projects use a ramped floor, with a small amount of rake. This approach is successful in smaller theatres where adequate ceiling height is provided for the projection screens. It does limit visibility of the lecturer and of any practical demonstrations. In large theatres it leads to problems with ceiling height and vertical viewing angles. This type of lecture hall is not preferred by UMBC.

It is generally accepted that center aisles should be avoided, as the best viewing seats will be lost. The location of aisles however will be determined not only by sightlines considerations but also by the requirements for good access both between the rows and to and from the theatre.

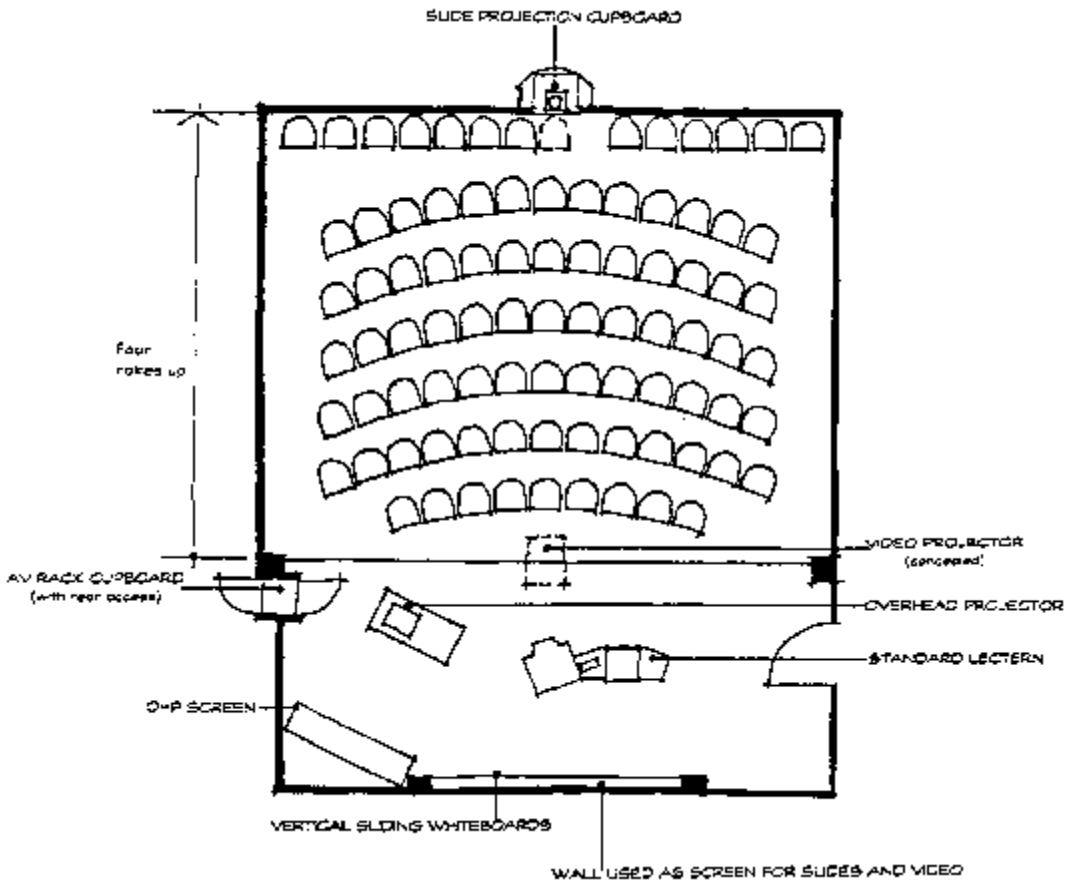
Each seating row should be offset by one half width, to improve visibility.

Cross aisles to provide better student access to seating is highly desirable. However, entrances/exits from the center aisles to general building circulation should not be incorporated into the design because they allow light to reach the screen during projection.

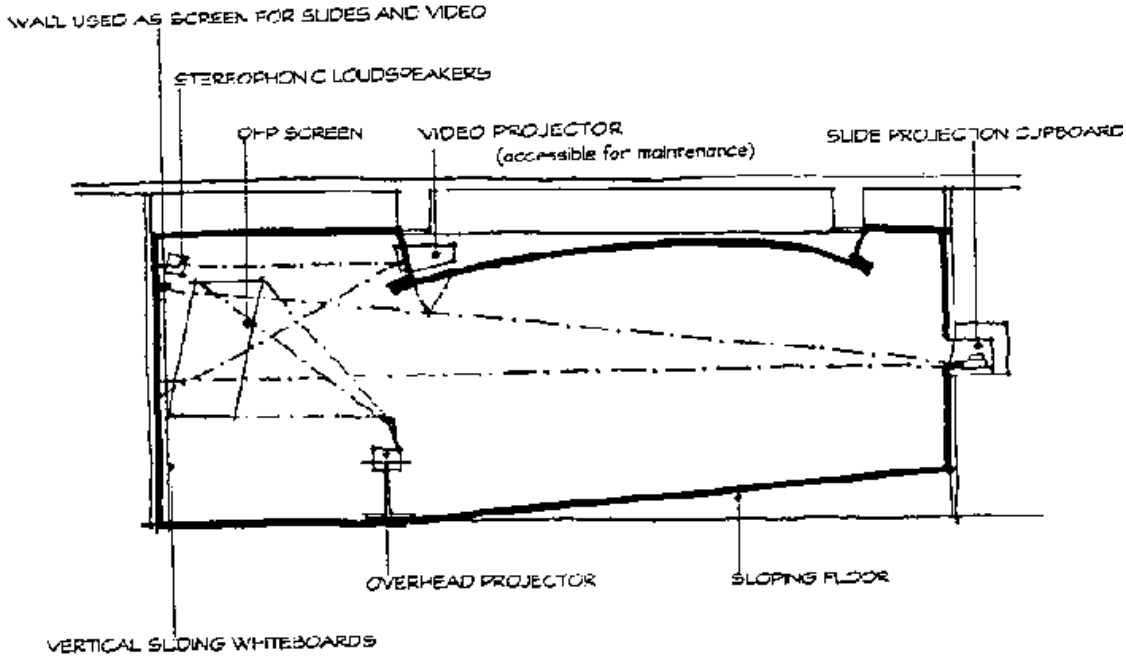
2.3.4 Lectern, Stages, and Podia

The University expects that its standard lectern design will be used in each theatre project, unless directed otherwise (refer to section 3.0).

The installation of stages and podia is discouraged by the University. Flat floors are preferred at the front of all conventional lecture halls, including large halls.

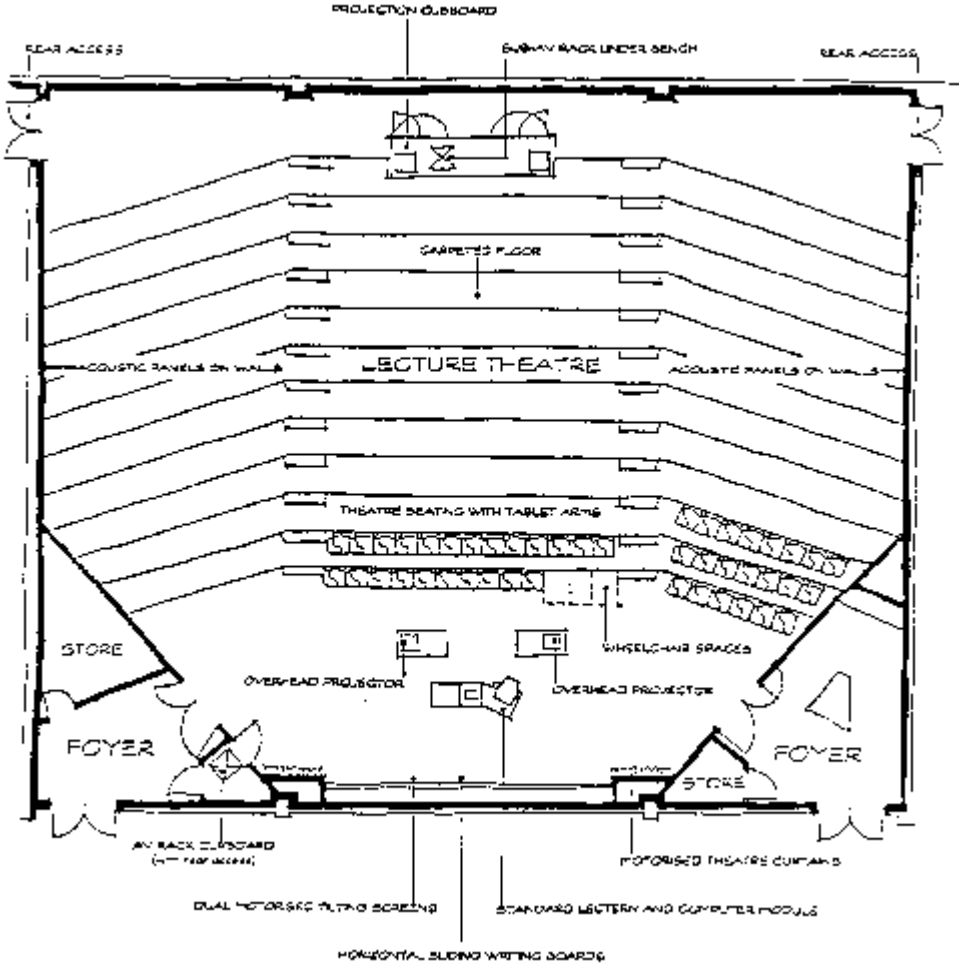


(Floor Plan: Specific Example of a Small Theatre), Fig. 3
NOTE: If a second projection screen is provided or required, either install in opposite corner or locate on front wall but split to allow use of the writing surface.

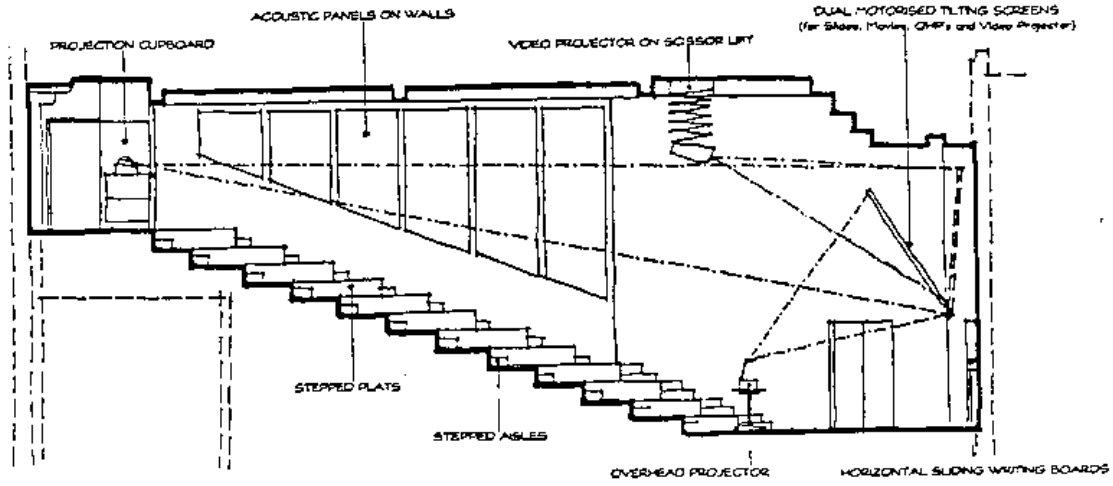


(Section View: Specific Example of a Small Lecture Hall), Fig.4

(Floor Plan: Specific Example of a Large Lecture Hall), Fig. 5



NOTE: The above example does not reflect UMBC's desire to provide cross aisles.



(Section View: Specific Example of a Large Lecture Hall), Fig. 6

NOTE: It is not to be construed that the rake of seating shown above is representative of UMBC's criteria as set forth in text.

2.4 Physical Access and Movement

Well-designed lecture halls permit comfortable access and egress. Designers must comply with the requirements of the Building Code in matters such as aisle widths, distance to aisles and exits, seating row spacing, and disabled persons access. Designers should be mindful of other considerations which affect the physical access and movement such as foyer or lobby spaces, door locations, seating row lengths, and access for latecomers.

A sufficient number of doors are to be provided for a maximum clearance time of 5 minutes for quick and efficient changeover between lectures and with at least one door at or near the rear of the theatre for the entry of latecomers.

The front row of seats is to be at the same floor level as the adjacent entry doors for disabled persons access. Wheelchair spaces must be located towards the center front row rather than near the side.

The Building Code does not have any minimum requirement for the number of wheelchair spaces in a lecture hall or teaching space. It might be reasonable to allow for two wheelchairs in teaching spaces of up to 200 seats and to provide one additional space for each additional 100 seats or part thereof.

2.5 Public Amenity - Foyers and Public Spaces

These areas may be found necessary for pre/post lectures, seminars, meetings or other gatherings. They should be inviting and be serviced with adequate toilet and washroom facilities.

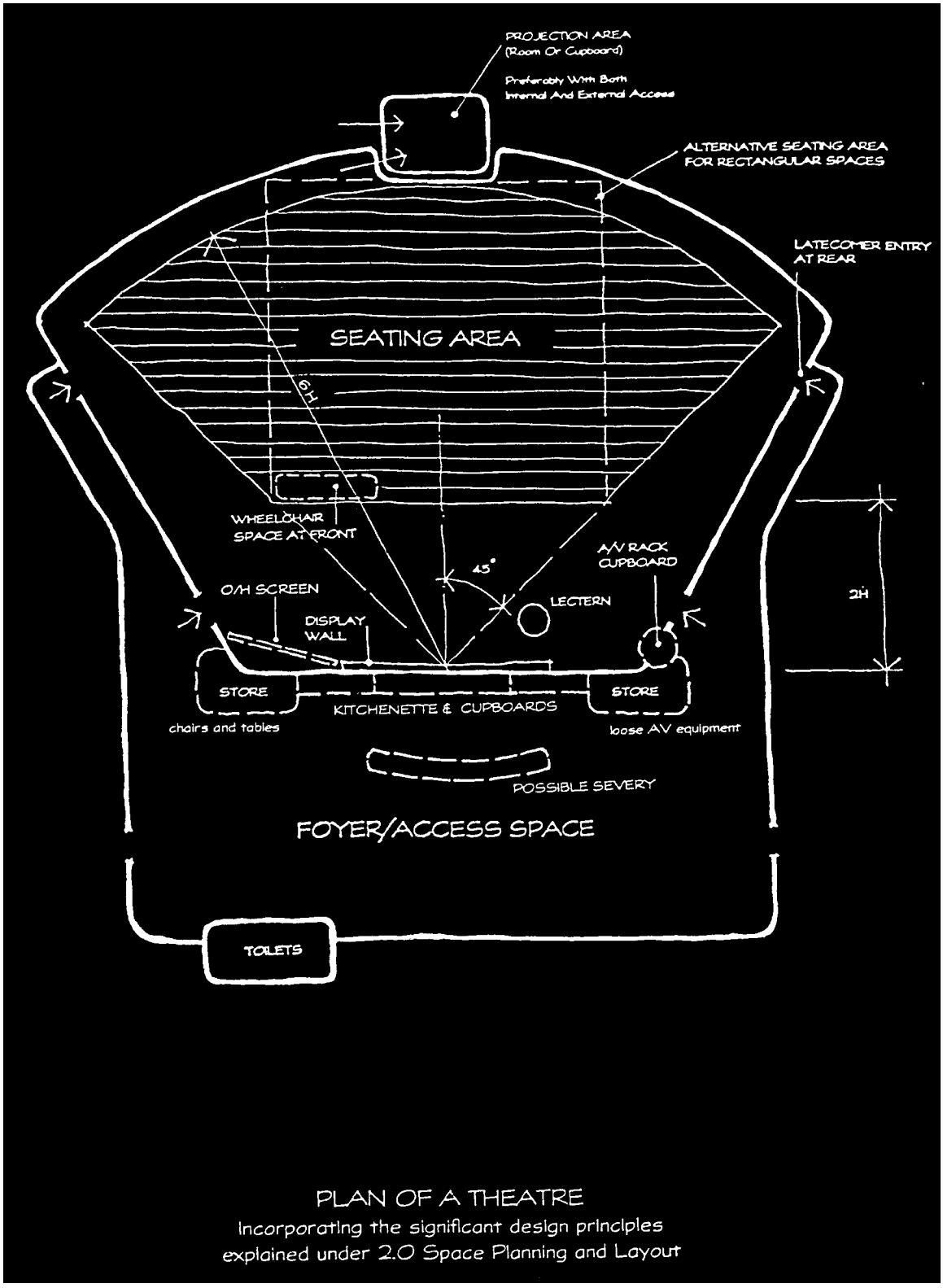
Other considerations may also include the provision of a kitchenette for tea and coffee making and possibly the provision of space from where food and drink might be served. In unusual circumstances the design brief might require catering facilities. Where kitchenette facilities are not proposed, dedicated 15A sockets should be considered for the connection of urns, etc.

Secure storage spaces are always an important provision as an adjunct to public amenity areas.

Where appropriate, consideration should be given to the provision of adjacent free space with facilities for display.

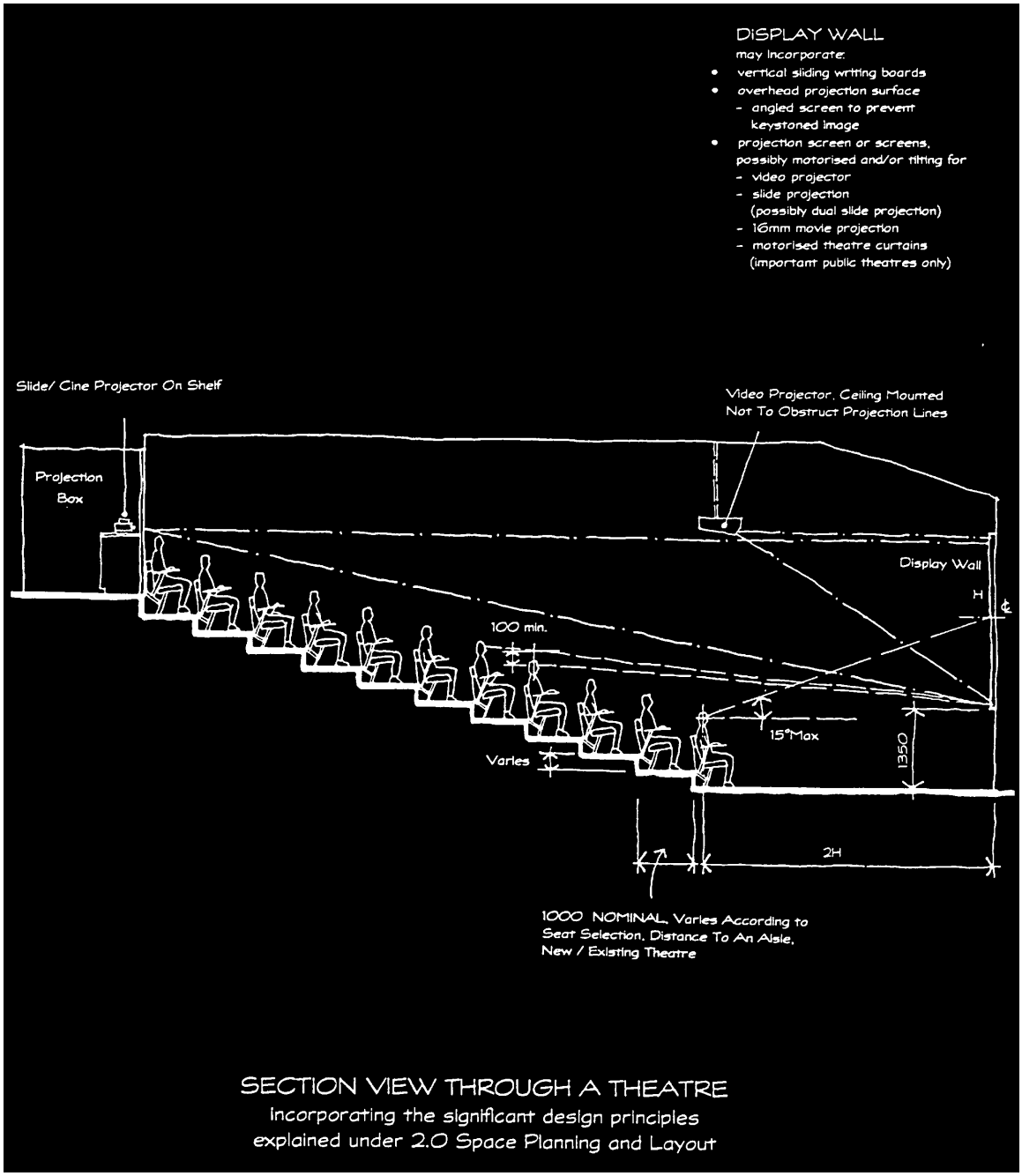
In general however, public spaces as above will only become possible in the planning and construction of large, modern lecture theatres. The University undertakes refurbishment/refitting works to many existing lecture theatres, both large and small. In most of these cases, space for the public amenities as described above is either limited or unavailable. **To minimize disturbance, proper acoustical design is essential to foyers, lobbies, and public spaces that adjoin lecture halls.**

In public spaces (foyers), electrical outlets should be 20 amp circuits, and be spaced every 20 feet.



(Plan of a Large Lecture Hall), Fig. 7

NOTE: Width of room shall allow for simultaneous use of two projections. In addition, if there are two projectors, then the 45 degree site line should be taken from the center of each screen to establish seating layout.



(Section View Through a Lecture Hall), Fig.8

3.0 ARCHITECTURAL AND ENVIRONMENTAL STANDARDS

3.1 Ambiance

Lecture Halls should be designed to be attractive and comfortable spaces. Experience suggests some correlation between high lecture attendance and well designed lecture halls.

The form of the spaces should generally suit the function. There should be minimal fenestration to walls near or at the front of the theatre so as not to detract from the main focal point i.e. lecturer and boards and screens.

Care should be taken, however, to design spaces which are not merely functional. Design solutions should be attractive architecturally and should, where possible, allow for the later inclusion of works of art.

Colors should be chosen to suit the character of the space. Light colors are generally preferable but care must be taken to avoid glare on whiteboards and projection screens.

3.2 Floors, Walls and Ceilings

3.2.1 Floors

Carpets are required in all teaching spaces for acoustic and aesthetic reasons.

University requires the laying of standard lecture hall carpet in lecture halls. For carpet types, use UMBC Design Standards as the starting point for discussions. The direct stick method generally increases carpet life and is a more practical method of carpeting stepped floors.

On the nosings of stepped aisles and stairs, use "Protect-A-Tread" safety stair nosings, with bullnose edge and insert strips in keeping with the carpet color.

3.2.2 Walls

In general wall surfaces should be durable and easy to clean. The lower portion of the wall should be constructed from or lined with hard-wearing materials, resistant to scuffing and scratching, e.g. masonry (with anti-graffiti treatment) or laminate finish.

Where plasterboard or plaster-glass is used, high quality workmanship is necessary to produce a level and straight surface in particular near the front of the theatre which may regularly be highlighted by spotlights, board lights, and the like. These materials, particularly plasterboard, should only be used where impact damage is unlikely.

Acoustic panels may be required on side and back walls. The Consultant may choose to integrate panels into the general fenestration and design context of the hall. Maintenance and cleaning ability of acoustic panels is critical.

3.2.3 Ceilings

The Consultant will define the shape of the ceiling to suit particular acoustic requirements.

A number of appropriate options are available in the selection of materials for ceilings; however, particular care should be taken in the finish of plasterboard or plaster glass ceilings particularly if uplighting is to be used.

If adequate room is available the ceiling space should be easily accessible for servicing of light fittings and mechanical equipment, in preference to using scaffolding within the space.

3.3 Furniture and Fittings

3.3.1 Seating **and Writing Surfaces**

All new lecture halls to have fixed continuous tables. Selection of chairs (either movable or fixed) to be determined on a project by project basis.

Should an occasion occur that fixed seating (either tablet arm or theatre seating) is used, then the seating should be secured to the riser for ease of floor cleaning and preferably with each individual seat being staggered with respect to the seats in adjacent rows. In rooms with fixed theatre seating or tablet arm chairs, seats are to be set back as far as possible so as to avoid injury by feet slipping down between the seat back and the step.

Fixed seating can be secured to a continuous gently raking floor although unobstructed sight lines cannot be guaranteed.

Fixed seating shall provide all seated people with a clear unobstructed view to the front of the theatre.

The Consultant shall select the appropriate seating and attached tablet arm.

The range of proprietary seating currently available varies from simple polypropylene shell type (with or without upholstered finish) to high quality maximum comfort seats with padding and fabric upholstery incorporating all requirements for correct posture.

Tablet arms must be the fold-down type of arm. The support mechanism is to be robust and require minimum maintenance. The tablet surface will have a durable anti-graffiti finish.

Where very large tablets are used they can all be mounted on the right hand side of the seat. Where medium size tablets are used then 10% must be mounted on the left hand side of the seat. Tablet arms with small tablets are not to be used.

Seating Tablets

Fabrics for upholstered seating must be carefully chosen for suitability in terms of appearance and durability. Fabrics must be commercial upholstery grade and recommended by the manufacturer for the intended purpose. Selected fabrics shall be stain resistant. Special care should be taken by the seat manufacturer to ensure that the fabric can be treated with a stain resistant compound and that the treatment is compatible with the permanent adhesive bonding of padding materials.

3.3.2 Furniture Generally

Loose mobile table or tables may be requested to be placed at or near the entry to halls for the distribution of lecture material. Individual user groups will have different requirements.

No loose chairs shall be permitted at the front of the hall.

The University has a standard Lectern design which incorporates many functions. This item is discussed under a different sub-section.

3.3.3 Equipment Cupboards

Equipment Rack (Cupboard(s)) Enclosure

Most lecture halls require a dedicated joinery enclosure to house the AV equipment. The AV equipment normally conforms to the "international 19" rack" mounting standard, and can be readily fitted to a steel or aluminum rack frame contained within the joinery. The enclosure is ideally recessed completely into a wall at the front of the lecture theatre, providing ready access to presenters. With the door closed, the enclosure door face is then flush with the wall.

The rack enclosure (cupboard(s)) must provide clear rear access for equipment maintenance. Where rear access cannot be provided, the rack should be mounted on wheels to allow rack removal for service. This arrangement requires that the lecture theatre floor be continued into the base of the cupboard - no false floor or skirting can be used. It should be noted that provision of rear access is strongly preferred by the University. All rack cupboard doors are fitted with the standard keylock for AV services access. The front door of the cupboard is fitted with conventional hinges. **If there is need to use a equipment rack with no rear access, UMBC will use a rack by Middle Atlantic Products which has its top and bottom secured with the rack on hinges that allow it to swing out.**

Good ventilation must be provided. Natural convection is adequate, though forced (fan driven) ventilation is occasionally required. Natural convection does require generous air inlets at low level and outlets at high level.

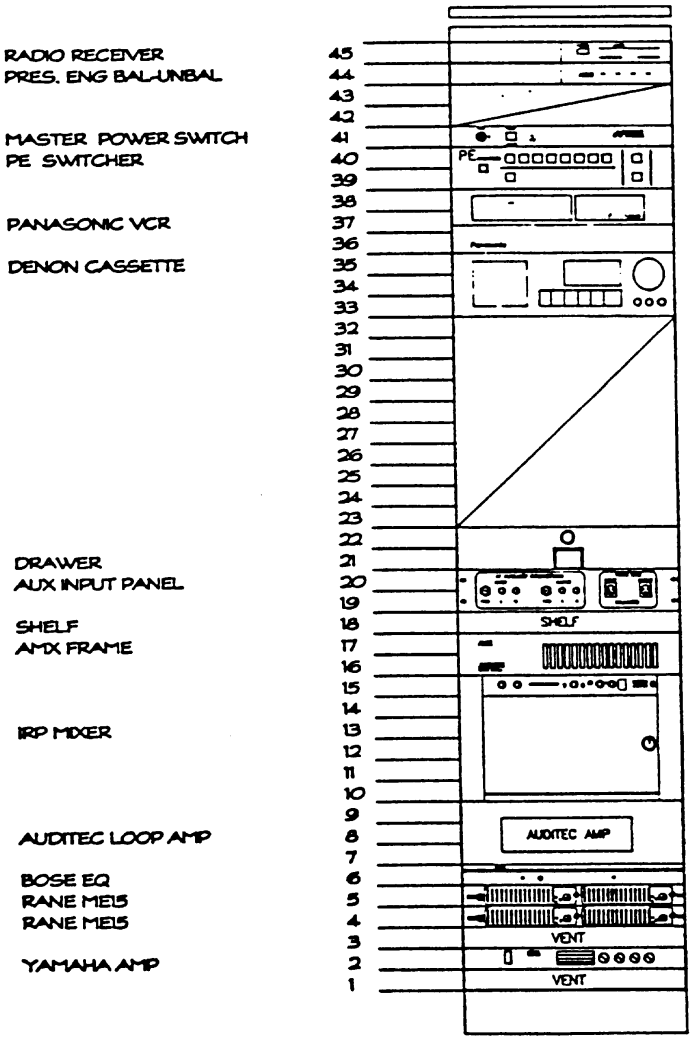
The internal enclosure carcass usually provides a mounting surface for audio visual cable looms and ducts, power distribution conduits etc. Adequate clearance must be provided for these services plus the actual metal rack frame. At least 150mm clear space is required behind the equipment rack frame, inside the enclosure.

Minimum internal dimensions for a rack enclosure are 2.5’ x 2.5’ (depth x width). Cupboard height varies with the size of the rack installation, however, two common formats do occur. In the first, the height is around 2000mm, allowing for installation of a full height (44ru) equipment rack. In the second, the enclosure is much lower, usually no more than one meter high, often built with a bench-top for use by presenters. In these cases the cupboard needs to be twice as wide, to allow for installation of two half-height rack frames.

Designers should select rack enclosure locations based on proximity for lecturers, access for service, and access for installed services - cabling and the like. In many cases a duct or cable tray will be needed to carry cables into the ceiling space and a further duct will be needed to carry cable to the lectern workstation. The AV equipment enclosure is frequently accessed by presenters, and contains equipment, which controls and facilitates presentations. It must be carefully planned and located to ensure the satisfaction of users and service staff.

A regulated power supply should be fitted to serve this enclosure.

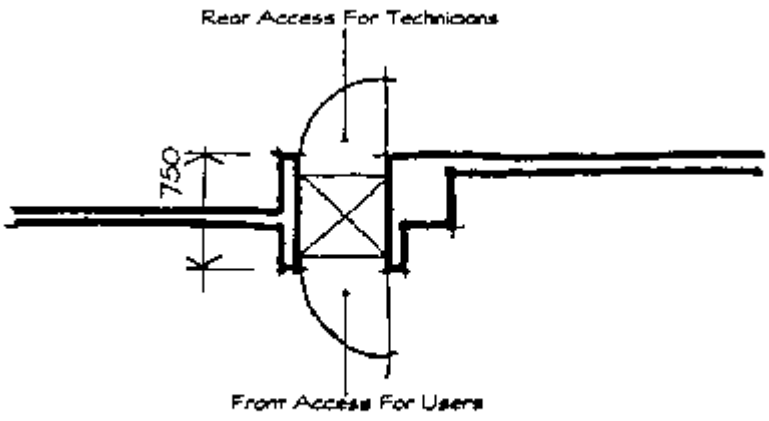
Referencing Figure 9, usable access items should be at a range of motion (height) for both wheelchair use as well as someone standing.



NOTE:
Equipment for use by Technicians only shall be blanked-off to prevent use by others

LECTURE THEATRE - TYPICAL RACK LAYOUT

Fig.9



EQUIPMENT RACK WITH REAR ACCESS

Fig. 10

Projection Room or Enclosure

The facility is ideally located along the back wall of the lecture hall.

The space will require a bench for placement of slide or movie projectors with sufficient height to clear audience heads with optional fixed front glazing or lockable sliding window.

The room or cupboard should be physically secure and capable of suppressing projector noise during operation.

Adequate power outlets are required.

Locking systems for all doors including joinery to be the standard University common keyed AV service access lock.

Adequate shielded lighting is necessary inside the cupboard/ room.

Internal dimension of a projection facility will depend on available space. Cupboards, rooms, and cabinets may be planned as fully recessed or protrude into the teaching space.

Dimmer Closet

Each lecture theatre is fitted with remotely controlled electronic dimming for house lights and specialty light services. The dimmer units are usually purchased as multi-channel devices, fed with power from the main lecture hall switchboard. I n new developments the dimmers are usually installed adjacent to the switchboard, thus requiring switchboard closet with generous capacity.

In refitted lecture hall projects, space for the dimmer unit(s) must often be provided within the hall. The dimmer closet must not be physically adjacent to the AV systems rack, and must provide convection cooling to match the dimmer manufacturers specification. Note that dimmers can generate substantial and undesired acoustic and electromagnetic radiation - the closet must prevent the noise from disturbing lecture theatre activity, but only sensible positioning can protect against interference with AV electronics.

Within the closet, ready access to the dimmer unit is required by service staff. A large quantity of electrical and control cables will run from each closet . Consultant should plan for ducts or cable trays as required. Dimmers must be mounted at a height which allows ready access for a standing technician, without using a ladder or having to crouch or kneel down.

3.3.4 Lectern Unit

The University has developed a standard lectern design, intended for use in all lecture halls. In reality a specialized teaching work-station, the lectern provides expected facilities in the form of lighting, an area for presenter's notes, plus microphones. In addition, the lectern houses a touch-screen or pushbutton control panel, a computer monitor, and up to three permanently installed computers.

One section of the lectern module is dedicated to the computers. Most lecture theatres are equipped with an Apple Macintosh and an IBM compatible PC. Some theatres also require a SUN or SGI workstation. Interface and switching equipment is also housed within the lectern carcass, along with required power outlets, video and audio link cables, computer data link cables, telephone, and LAN connections.

The lectern design, whilst standardized in a spatial sense, can be modified to better match the aesthetics and design direction of individual lecture hall projects. However changes to the design must be approved by the Project Coordinator and undertaken with extreme care, as the base concept is quite highly evolved and includes many features required to support the installed systems. In addition, the lectern shall have the capability of flexible height adjustments to accommodate wheel chair users as well as those of short stature and flat panel displays in lieu of conventional deep monitors shall be provided.

A floor duct or trench is required to carry electrical and AV wiring to the lectern. The duct must be compartmented to provide separation between services.

Lectern position is usually developed by the AV consultant, in conjunction with projection screen and writing board positions.

The lectern must be securely fixed in position to meet electrical regulations. Internal fittings and electronics packages are accessed via several hinged doors and removable access panels.

Substantial ventilation is needed to support the installed equipment. Each lectern includes dual computer grade fans with speed controllers, with power switched automatically under AV system control. Fans, speed controllers, and internal power wiring are supplied and installed by the electrical contractor.

The lectern light is a standardized unit, supplied by the University, through the Project Coordinator and installed by the Electrical Contractor.

A standard power supply outlet and graphics input is provided for a portable (laptop) computer.

The lectern doors and access panels are secured with the standard AV access keylock.

The installed computer monitor or panel is screw fastened to the lectern carcass to improve equipment security. Microphones must be fixed to the platen with tamperproof screws.

Design and construction of the unit should be carefully conceived so as to provide a well damped, rigid structure - excessive resonance or box-like boominess in the final fabrication can lead to unpleasant performance characteristics when microphones are in use.

Equipment requirements and positions must be qualified for each individual project, usually in conjunction with the AV systems consultant.

Equipment requirements and positions must be qualified for each individual project, usually in conjunction with the AV Systems Consultant.

3.3.5 Soft Furnishings

Lecture halls do not require windows - in cases where windows exist, effective control of natural lighting must be achieved. This is accomplished with selected, light-excluding curtains or blinds.

The designer should endeavor to exclude as much light as is necessary to enable projected information to be easily read. Where cinematic conditions are required, 100% blackout should be aimed for, with no annoying light leaks at perimeters of the treatment. Light-excluding tracks are often needed on all sides to achieve complete light sealing.

Curtains and blinds are usually activated electrically, with control from the AV control system. Closure (blackout) is then automatic whenever a screen-based display is selected for use within the hall.

Heavy curtains or roman blinds are preferred for acoustic reasons, as they provide an effective contribution to the damping of sound reflections within the space.

Motorized drape systems can be very noisy - care must be taken to ensure that selected tracks and motors are not excessively noisy, as this does interrupt presentations when the curtains are activated.

3.4 Electrical & Lighting Services

This information is provided as guidelines only. It is the responsibility of the selected Consultant to provide appropriate systems. At a minimum, provide the following:

3.4.1 Energy Management Issues

The use of electrical power in lecture halls is actively regulated to minimize energy consumption. Many power circuits, and all lighting circuits, are connected to the AV control system, which regulates service delivery based on input from a range of switches and sensors. Control software is programmed to ensure that lighting and power are shut down when the room is not occupied.

Selection of light fittings is an important factor in energy management. Directional tungsten filament downlighting is necessary to provide good illumination when projection systems are in use. Fluorescent lighting is usually also available for use when projected displays are not required. All fluorescent fixtures to be fitted with Helvar electronic dimming ballasts.

3.4.2 Power Supply

Each lecture theatre should have a dedicated electrical distribution board, usually a sub-board fed from the main building supply. Requirements for individual circuits are quite high; therefore, switchboards should be planned with generous capacity and wiring space. Adjacent wall area should be available for installation of dimming and power control equipment.

Most lecture theatre dimmers will require a 3-phase supply at up to 40 amps per phase. In some cases, smaller dimmers require a single-phase supply at up to 40-amp capacity.

Some lecture halls require a stabilized supply for power to demonstration and experimental equipment. In these cases the necessary equipment should be installed within the electrical or dimmer closet. Ventilation requirements must be adjusted to support the stabilizer operation.

Lecture hall power should be relatively clean and stable adjacent industrial operations must be treated skeptically, and supply planned so as to eliminate any chance for disturbance to lecture hall supply.

3.4.3 General Power Distribution Outlets

Each lecture hall should be serviced by a generous provision of strategically placed general power outlets, positioned at or near skirting level, and wired to standards. Power outlets fall into two categories, those of a general nature for cleaning services, demonstration equipment, etc. and power outlets connected to the lectern, which are generally used to plug-in overhead projectors. The latter type, labeled "OHP Power", require activation of the touch screen on the lectern in order to operate. Generally, one such power outlet is provided on the lectern carcass; at least two other "OHP Power" outlets will be required at the front of the theatre, either located on the floor adjacent to the OHP station or on the walls under the projection screens. The power outlets required for general purposes only will be distributed around the theatre and located no closer to the front than the first row of seats.

3.4.4 Specialist Power Requirements

The specialist power requirements for each space should be tabulated by the AV Consultant, and then reviewed with the project Electrical Consultant for implementation. Specialist services are planned to allow for complete supply and installation of working systems by the electrical contractor, thus eliminating any service demarcation issues.

Earth leakage circuit breakers should be installed on circuits where user intervention with equipment is expected. Many circuits are switched or regulated by dedicated control units, which respond to requests from the AV control system. I n this manner, power to say a slide projector is automatically turned on when required, and safely turned off at the completion of a presentation. The following table lists typical "special power" requirements for a medium sized lecture hall.

Ct #	APPLICATION C/B	Control	Max Load	Phase
1	Slide projector power	ELB PCU	10 amp	Common
2	Overhead projector	ELB PCU	10 amp	Any
3	Video projector power	ELB none	15 amp	Common
4	AV rack power	ELB none	15 amp	Common
5	Computer power#1 (lectern)	ELB PCU	15 amp	Common
6	Computer power #2 (lectern)	ELB none	15 amp	Common
7	General AV power (lectern)	ELB PCU	15 amp	Common
8	Motorized screen power	MCU	10 amp	Any
9	Motorized curtain power	MCU	10 amp	Any

Legend: ELB / earth leakage circuit breaker
PCU / Power control unit (specified by AV consultant)
MCU / Motor control unit (specified by AV consultant)
Common / The common electrical phase chosen for all AV service supply

3.4.5 Lighting Planning

Lecture halls are lit by a combination of 120-volt tungsten filament down lighting and fluorescent light fittings. Lamp cost, lamp life, and ease of replacement are all-important factors in the selection of fittings. Typically, the University requires the use of conventional GLS down light fittings in low-ceiling spaces, and PAR lamp equipped fittings in areas with higher ceilings. The latter fitting is the preferred type. Fluorescent units are fitted with low brightness diffusers and Helvar electronic ballasts.

Light fittings are segmented into circuits, which compliment the room functions. Up to twelve separate circuits may be required in an average lecture theatre. The drawing depicts a typical circuit arrangement marked on to a reflected ceiling plan.

3.4.6 Lighting Control

Control of individual lighting circuits is achieved by multi-channel dimmer units, which use solid state devices to regulate the electrical waveform fed to the lamp. Some important characteristics required of the dimmer are as follows:

Minimal EMI & RFI emissions
Minimal acoustic emissions
Individual MCB for each output circuit
Local override control with push button operation
Remote control by RS.232 signal from the AV systems
Simple access to low voltage control terminations
Adequate separation between low and high voltage areas inside dimmer unit
Active mains supply waveform tracking and output compensation
Automatic reboot on power-up
In-built surge limiters
Soft-start switching
Halogen cleanup cycle for low voltage lighting

For heat dissipation purposed, dimmers must be surface-mounted, not recessed into wall cavities Consideration should be given for the installation of an hour-run meter where incandescent lamps are specified

The dimmers are controlled by RS.232 commands generated in the AV control system, as a response to user input or time reference. Multiple lighting "scenes" are created in the control software, and requested as required for different lecture hall situations. Maximum lighting levels are regulated within the software, with lamp filaments protected through limiting of power levels, thus reducing operating costs. Gentle ramped activation from cold eliminates thermal shock, further extending lamp life. User interfaces to the lighting control system include simple push button panels located at entry doors. LED indicators provide status indication for users. Buttons provide direct access to on, off, and preset dim lighting levels. The lighting systems are interfaced through software to the major operating states of the lecture theatre. For example, if a lecturer selects "VHS" from the list of media choices on the lectern control screen, the control system will automatically adjust the lighting circuits to provide optimum viewing conditions for the VHS videotape.

3.4.7 Specialist Lighting

In addition to the down light and fluorescent fittings, certain specialist light fittings and circuits are usually required. The following list covers most possibilities, which do vary somewhat from hall to hall.

- White board lighting - Usually directional fluorescent fittings designed to avoid glare.
- Computer keyboard illumination - Close pattern spotlight illumination from the ceiling.
- Aisle lighting - **Aisle lighting, connected to emergency lighting/generator to be provided in all lecture halls. However, it should not interfere with the room's projection capability/visibility form the student prospective**. Low power tungsten filament indicator lamps fitted to the end of fixed seating rows. Aisle lighting recessed into the walls or stair tread sides may sometimes be necessary but should generally be avoided due to cost.
- Slide projector enclosure service light.
- Lectern spotlights.

- Document spotlights.

Larger halls which are used regularly for public activities, seminars and conferences will also require additional spotlight circuits for flexible illumination of presentation zones, displays, committee tables, and the like. Lighting must be planned so as to provide quality illumination of the subject, while protecting projection screens from unwanted wash or spill.

3.4.8 Maintenance Issues

Fluorescent fittings equipped with electronic ballasts (and connected to dimming control equipment), must be treated as systems, rather than individual fittings. Tube replacement should be undertaken on a "whole room" basis at periodic intervals, as demanded by effective tube life. University policy should be to relamp each theatre during the summer semester break. Tubes should not be replaced on an individual basis, as new tubes will exhibit totally different dimming characteristics to aged tubes. Fittings must be planned to allow simple replacement. In large theatres with high ceilings access is required above the ceiling on permanent catwalks.

3.5 Mechanical Services

Note: This information is provided as guidelines only. It is the responsibility of the selected Consultant to provide appropriate systems. At a minimum, provide the following:

3.5.1 General Requirements

The Consultant should refer to the Standard Brief for Consultants sections on Mechanical Services for policy in regard to Heating, Ventilation, and Air Conditioning, Energy Management and Building Controls. In general all mechanical services are controlled by the University's BAS (Building Automation System). Manual on/off control is available only on the mechanical service switchboard.

Where BAS is not available in a building, air conditioning, heating, and ventilation should be electrically controlled using motion detectors (of a type agreed with the Architectural and Engineering Services Manager), timers, clocks, and space temperature sensors as appropriate, including preconditioning.

Lighting is not controlled by BAS, but is controlled by the user as a part of the AV controls. Full fresh air ventilation is preferred for lecture halls; however, fresh air damper open/close control may be fitted to allow preconditioning of the space to be executed in an energy efficient manner. Noise levels from mechanical equipment are to be kept to a minimum. In determining acceptable noise levels, designers should consider the following criteria: - NR 30 (Noise
Rating) -

3.5.2 HVAC Controls

The user call for ventilation is by means of motion detectors fitted in the theatre. Ventilation and Air Conditioning), take a variety of factors into account. The user should not be required to operate the HVAC directly.

3.5.3 Fresh Air Supply

In medium and larger halls, consideration should be given to the fitting of variable speed fans, which allow for the air volume to be varied according to the level of occupancy.

3.6 Acoustics

3.6.1 General

All teaching spaces need to be designed for proper acoustic performance with use of appropriate materials to floors, walls, and ceilings. Care should be taken by the Consultant to allow for features, which will reduce, noise penetration to and from the lecture hall to acceptable levels. In the design of large halls it is advisable to seek the advice of an Acoustics Consultant. The Audiovisual Consultant should also be involved in the acoustic planning process.

Acoustics should address the needs of both the instructor and the students.

3.6.2 Reverberation

Reverberation times within teaching spaces are now commonly set very low. The practice of deliberately engineering highly reverberant teaching spaces is no longer valid. The use of modern audiovisual equipment requires short reverberation times. The community has grown to accept amplified sound reinforcement as a normal process, and is rewarded by high speech intelligibility in correctly engineered spaces.

Mid-band reverberation times, measured as RT60, should be assessed for average sized lecture halls (50 to 150 persons). For larger theatres, slightly longer times are acceptable. Increasing use of recorded (amplified) program material demands less reverberant spaces. The application of videoconference

equipment for distance education is also driving the reduction in reverberation times, as electronic echo cancellation must be used to ensure conference success.

3.6.3 Ambient Noise

Ambient noise from mechanical systems and adjacent areas must be carefully controlled. Steady state noise levels should be limited to NR30, though this is often difficult to achieve. Reaching satisfactory performance in this area requires decisive efforts from all members of the design team.

3.6.4 Isolation

Effective isolation assists with reduction in ambient noise. STC ratings for walls and doors must be planned to support the NR30 objective defined above. Double sheet drywall construction is often required, and all barrier walls should extend slab-to-slab in multi level buildings. Where windows exist, double-glazing is often required. All engineering planning must be completed in balanced manner - mechanical services treatment must be accompanied by suitable barrier isolation if ambient noise objectives are to be met. Conversely, barrier treatments should not be contemplated unless accompanied by suitable mechanical noise reduction.

3.7 Safety and Security

Note: This information is provided as guidelines only. It is the responsibility of the selected Consultant to provide appropriate systems. At a minimum, provide the following:

3.7.1 General

The designer will need to be fully conversant with the Building Code requirements for lecture halls in relation to the following items: - aisle widths - tiered row spacing - distance of seats from an aisle - escape routes and exit doors - exit and emergency lighting - aisle lighting Consideration of fire protection measures is essential for both new and existing refurbished lecture theatres. The engagement of a building Code Consultant may be necessary in some cases for expert advice on existing buildings or spaces which may not conform to current building regulations.

The University does not have a policy for the locking and security of lecture halls. Details of security keylocks are noted in UMBC's Design Standards. Keying alike to all Audiovisual cupboards and enclosures is required using the University's nominated lock(s).

3.7.2 Emergency Lighting and Exit Lighting

It is necessary that emergency lighting design is in accordance with the relevant code but the Consultant can have an influence in the selection and placement of fittings.

Early in the design stage, the Consultant shall approach the Architectural and Engineering Services Manager to establish the appropriate type of emergency lighting system to be specified.

Exit light fittings shall be of the maintained type. Emergency light fittings shall be of the non-maintained type. Legends for exit signs shall be green lettering on black background.

3.7.3 Aisle Lighting

Aisle lights **is** required in lecture halls.

3.7.4 Fire protection services

Fire protection is a mandatory consideration in all buildings including teaching spaces and lecture halls, both refurbished and new. The Consultant is obliged to seek advice from relevant consultants and a Building Code Official or Consultant in all matters affecting fire protection and safety

3.7.5 Keylocks

Three types of keylock are required in each teaching space or lecture hall: (a) locks for main entry doors, which are master keyed to the University system. These locks are opened and relocked by the relevant Building Supervisor; (b) locks for AV equipment access by lecturer's including AV rack cupboard user access doors, lectern touch screen cover, computer module front access doors, projection room (or cupboard) door and AV storage enclosure if provided; and (c) locks for service access to AV and electrical equipment by AV Technician only, including lectern center column door, computer module rear doors, AV rack cupboard rear doors, and electrical and mechanical distribution boards Note: Keys for Technician's access will also unlock keys to lecturer enclosures.

Lecture hall accommodation will be enhanced by the provision of a separate lockable storeroom for loose items as follows: audiovisual equipment, mics. Etc., overhead projectors and their trolleys, loose furniture including chairs and tables, and other sundry items.

Refurbishment projects will in many cases have limited space available; however, the Consultant should investigate and provide for the storage of miscellaneous items.

3.8 Sundry Issues

3.8.1 Clocks

If deemed necessary, clocks should be installed in the lecture hall, primarily for reference by the lecturer. Clocks should be mounted on the rear wall or on the side walls towards the rear.

3.8.2 Graphics and Signage (including signage for the disabled)

Signage and graphics will follow University standards. Any signage placed inside the lecture theatre is to be unobtrusive and not distract from the main functions of the lecture hall.

Provide the following standard University signs in selected locations inside and outside the hall or teaching space:

“No Eating / Drinking" and "Audio Loop"

In addition, the following instructions and labels should be incorporated in the lecture hall:

The AV touch screen lid should bear a discreet notice on the inside "Close After Use".

In the Projection Box slide projectors should be labeled "Left" and "Right" and carry basic instructions for use.

Include glazed vision *'slots" in entry doors as a means of determining if the hall or teaching space is in use. The "slots" should be small so as to minimize the entry of light from external sources; a suggested size is 40mm wide by 75mm deep, however the designer may design the "slot" to suit the particular door design.

3.8.3 Works of Art

Opportunities to hang or display works of art, tapestries, etc. may be required in some hall designs.

4.0 AUDIO VISUAL & PRESENTATION FACILITIES

4.1 AV Facility Development

Many unique solutions have evolved over time, and the Consultant should be aware of the frequent need for retention of specific (often seemingly old fashioned) teaching tools in some areas. Assistance from a nominated Audio Visual Specialist should be obtained in all cases, and the Specialist should be involved in preliminary planning with the building designer.

The ability to project computer and video information to a class or group is now essential in many courses, driven by the exponential increase in computer usage by both teaching staff and students.

This need for versatile, large screen electronic display systems is the dominant factor influencing the design of AV facilities, and typically the most expensive single equipment element of any presentation system. Other technologies have grown up around the electronic display capability, and the expectations of users have become more sophisticated. No longer can a lecture theatre hold only a writing board and an overhead projector - such spaces are in very low demand.

The increase in diversity of the AV support services has generated a need for some standardization in lecture hall equipment levels. The University has responded by developing a standardized approach to many areas of teaching space development a new lectern design has successfully evolved, the 19" equipment rack has been accepted as a universal equipment installation method, light dimming and environmental control has evolved considerably, and mechanical services for cooling are now more common.

It is desirable to have the capability in lecture halls to both video tape the course as well as send (transmit) the course to other locations. However, this capability must be integral with the room lighting and acoustics.

However, not all-teaching spaces need to be "fully equipped". Consequently the University has elected to define four levels of facility development, being Basic, Intermediate, Advanced and Special.

4.2 Basic AV Facilities

The University considers basic facilities to all teaching spaces to be as follows:

- Writing boards with suitable illumination.
- Overhead projection screen sized and positioned appropriately.
- Quality overhead projector with trolley.
- Video/Data monitor or television with VHS video recorder.
- 35mm slide projector with remote control and appropriate screen.
- Simple light dimming to complement AV projection.
- Blackout of daylight where necessary.
- Simple lectern with reading light and room lighting controls.

Nomination of whiteboards versus chalkboards is made on a project basis. Trolley and projector selection is standardized, as recommended by the Office of Instructional Technology Technical Support Group and the Instructional Technology Advisory Group.

4.3 Intermediate AV Facilities

Many spaces have been upgraded to intermediate standard, providing limited multi-media functionality, by the addition of the following equipment to the Basic AV Facilities:

Video/data projection unit, ceiling mounted
Computer interface equipment as required

4.4 Advanced AV Facilities

In cases where funding limits the acquisition of technology, the University has made a policy of developing the building infrastructure to allow for the future addition of technology as, and when, desired. This policy places clear responsibilities on the audio visual services designer and project architect to consider the full range of services when planning the building envelope. It also impacts on selection of lighting control and environmental services in even very basic teaching spaces, as these systems must be capable of integration at a future date.

- A4 overhead transparency projection
- Dual A4 overhead transparency projector capability (side-by-side)
- Overhead projector trolley
- 35mm slide projection
- Slide projector cupboard
- Large screen video projection (tri-system capable)
- Large screen computer output display, capable of resolution and scanning speed to match the dominant computer platform populations. At the present time, this requires a maximum horizontal scan rate of 65Khz and a bandwidth in excess of 70Mhz.
- Fixed primary projection screen(s), between writing board frame.
- Fixed (tilted) OHP screen at one side
- Sliding whiteboards
- Quality stereo sound system for videotape and recorded audio replay
- Public address system for microphone amplification
- Automatic microphone management
- Lectern microphones / hard wired / gooseneck type
- Presenter microphones / lapel type
- Audio/video switcher for source selection
- Audio link from PC in the lectern
- Audio link from Mac in the lectern
- Cassette replay
- Audio recording (cassette) of lectures
- VHS video replay
- Video/audio auxiliary input at front of room
- Display interface for IBM PC (VGA)
- Display interface for Apple Mac
- Display interface for laptop computers
- Permanent PC and Mac (supplied by the client)
- LAN connections for all computers
- 17" multiscan panel at the lectern for computer preview
- Telephone in the AV rack for support purposes only
- University standard lectern **(copy to be provided to selected Consultant)**
- Laser pointer
- Equipment racking with rear access
- AMX or Creston logic control system
- Cordless hand control
- Touch screen control panel

- Push button panels at entry doors
- Automatic preset lighting dimmers
- Fluorescent lights with Helvar electronic ballasts for dimming
- 120volt (long life) PAR downlights
- Presenter spotlights
- Computer keyboard light
- Aisle lights
- Exit lights
- Writing board lights

4.5 Special AV Facilities

Special facilities share all of the above features, plus the addition of further services to meet special needs. The following list covers many of the "specials" required in differing spaces.

- 35mm slide projection (side-by-side)
- Capability for 35mm multi-image presentation
- 1 6mm film projection capability
- 1 6mm film projection (anamorphic) capability
- Electronic copying whiteboard (mobile)
- Audio monitoring in the projection room (where existing)
- Talk-back microphone in the projection room (where existing)
- Ceiling microphones for recording / monitoring
- Presenter microphones / wireless / hand held type
- Audience response (question) microphones / cabled
- Audience response (question) microphones / wireless
- Conference microphones / cabled / desk type
- Compact disc replay
- Digital compact cassette (DCC) replay
- DVD disc replay
- Broadcast television reception (VHF/UHF)
- S-VHS video replay
- Document camera (ceiling mounted or table mounted)
- Recording camera (fixed or remote controlled)
- Projection room video monitoring
- Projection room computer output monitoring (multiscan)
- Projection room touch screen for system control
- Video/audio routing switcher for room and service linking
- Video/audio link cables
- Display interface for SUN Sparkstation and/or SGI
- Audio conference system
- ISDN connection
- Video conference system

4.6 Lifts For Video Projectors

Where video projectors are suspended from the ceiling, a motorized lift shall be provided where the distance from the floor to the underside of the projector exceeds 14’ 6”.

5.0 SPECIAL PLANNING ISSUES

5.1 Facilities for the Disabled

Disabled persons' access to lecture theatres shall generally be in accordance with relevant current Standards.

It is important that these **seating locations** allow a clear view of all lecture theatre media.

An audio loop for the hearing impaired shall generally be installed in all teaching spaces unless an alternative provision, such as the use of wireless transmitters is employed. All lecture halls and teaching spaces are to be "signed" accordingly.

5.2 Public Access

Design of lecture halls must be completed with multiple user groups in mind. While the prime users are certainly the various faculties and their students, consideration should be given to the increased use by the wider community.

The University does draw considerable benefit by providing facilities to conferences, seminars, and the like - usually during semester breaks when classes are not sitting.

These public access events should be considered during teaching space design.

Signage, access, bathrooms, and other services should also be planned with public use in mind.

5.3 Video Teaching and Conferencing

The University is developing facilities to deliver educational courses via video. The University also wishes to take advantage of new conference techniques involving video communication with remote participants. These two needs require individual consideration and planning:

5.3.1 Teaching Using Video Links

Sometimes known as "telelecturing", video links deliver the sounds and images from a campus lecture or presentation to participants at remote locations. The remote students may participate in-groups or singly. The local lecture may be specially staged for video delivery, or may be a regular lecture attended by students on campus but also video delivered to remote sites. This latter process is likely to remain common for some time, though a growth in specific video-delivery classes is forecast. In most cases the educational process is delivered to the remote site through the use of ISDN digital networks, with all sites connecting to the public switched ISDN service. These then are dialup events, which do not require dedicated cabling between sites.

It is also likely that campus lecture theatres will be used as "receive sites" for educational programs produced elsewhere.

The technology used for this type of event requires carefully engineered environmental performance. The Consultant should work closely with the Audiovisual Consultant. Important planning considerations are as follows:

- Minimization of reverberation times and ambient noise.
- Planning correct viewing angles for local audience and for TV cameras.
- Incorporating extra TV cameras, including a document camera over the lectern, audience camera, and presenter camera ï extra lighting services including document lighting, presenter lighting, audience/ participant lighting.
- Use of rear projection if possible, to guarantee projected image quality.

- Careful selection of lighting types to protect projected images on screen.
- Extra cupboard space for equipment racks and systems,
- Installation of ISDN data cabling.
- Improved mechanical systems, better cooling, with lower noise levels.
- Modified standard lectern to provide document viewing area.
- Extra audiovisual cabling.
- Extra monitors for presenter use. These special technical services require careful integration with the building and the fitout. Detailed planning is needed at all stages.

5.3.2 Videoconferencing

This service differs from video teaching in the same way that a lecture differs from a meeting. A videoconference is a meeting, which uses technology to link two groups of people. The numbers involved are usually much smaller than intelelecturing, though the equipment is somewhat similar.

The environmental requirements and equipment positions are quite different from telelecturing. Consequently, a good video link lecture hall does not make a good videoconference room.

Videoconference facilities are usually limited to small or medium capacity spaces, with microphones for most participants and no lecturer at the front of the room. One audience directly faces another, via the video medium. T he University does intend to develop videoconference rooms to complement the video lecture theatres.

Most of the project and construction requirements listed above also need to be applied for these smaller spaces.

- Minimization of reverberation times and ambient noise.
- Planning correct viewing angles for local audience and for TV cameras.
- Incorporating extra TV cameras, including a document camera, and audience cameras
- Extra lighting services, including document lighting, presenter lighting, audience/ participant lighting.
- Preference for rear projection if possible, to guarantee projected image quality.
- Careful selection of lighting types to protect projected images on screen.
- Extra enclosure space for equipment racks and systems.
- Installation of ISDN data cabling.
- Improved mechanical systems, better cooling, with lower noise levels.
- Modified standard tables, to provide document viewing area and microphone mounting positions.
- Extra audio visual cabling.

6.0 Standard Description of Lecture Halls based on technology capabilities.

To guide the renovation of existing lecture and the design of new lecture halls, a standard description of lecture halls has been developed based on the technology capabilities assigned to each room.

It should be further noted that excluding section and subsection titles, changes from the original standards for lecture halls are represented in **bold type**.

6.1 TYPE I Advance Technology Auditorium Classroom (Lecture Hall):

General purpose lecture hall with installed video/data projector, media cart, PC & Mac computers, VCR, DVD player, document camera, auxiliary computer/video/data inputs and outputs, touch screen system controller, and light control system.

6.2 TYPE II (Advance Technology Video Origination):

A lecture hall provided with one or two remote controlled video cameras for video origination. T his feature supports the use of videoconferencing and distance education.

General-purpose lecture hall with all items described in Type I.

6.1 ROOM TYPE: I
SQ. FT.: varies

DESCRIPTION:
Advanced Technology **Lecture Hall**

INTENDED USE:
Intended to provide a good learning environment for use of multimedia. Systems available consist of installed large display video projector(s), analog and digital storage devices, computer network connections, and touch screen systems controller. Video origination is optional. If Video origination desired, see 6.2 Room Type II.

SPECIAL ROOM REQUIREMENTS:

Architectural:

- Evaluate width/length proportions of room; in most cases a slightly rectangular room with the teaching station at the narrow end of the room and the entrance at the rear of the room is most desirable.

- Coordinate design of front of room with technology requirements to promote effective technology use; in all cases, the front of room design must consider the need to use projection and marking surfaces simultaneously; select equipment needed at teaching station as part of this process.

- Minimum front of room height: 12' minimum, rear height: 8' (higher preferred).

- **Stepped or sloped floor if student stations are greater than 80 with communication cabling beneath floor.**

- Construct securable Media Equipment Closet (3' w x 4' d x 8' h) or Media Equipment Cabinet (dimensions will vary with room and equipment configuration) at front of room for equipment control rack. Design of room will determine whether to choose Closet or Cabinet. Locate near instructor station. Design so that equipment is serviceable from back without security compromise. For equipment to be installed in Closet or Cabinet, see Equipment Requirements section.

- Install lockable motorized, low-voltage-controlled, roll-up door (2' or 3' w x 7' h) on Media Equipment Closet; door should have manufacturer installed safety stop features.

- Install chair rail if loose seating is used.

- Coordinate seating arrangement with technology requirements; distance from the first row of seating to the screen shall be 1.5 to 2 times projected image width

- Evaluate need for Projection Booth; if one is constructed, it shall meet the following requirements:
  - 42 asf minimum size.
  - angled projection window 4' above floor.

- Projection shelf 30" deep inside.

- Floor to ceiling walls.

- Air conditioned.

- Door from corridor and from inside auditorium.
- Dimmable light.
- Low voltage connections to teaching station.
- If booth is not constructed, provide folding shelf large enough for slide or film projector.
- Install unistrut at appropriate ceiling or booth location for installation of projector(s); caution: projector location must not interfere with image path of film or slide projection.
- Provide complete blackout capability.
- Provide acceptable acoustics.
- Anti-static finishes (floor covering, upholstery).
- Floor covering durable (15-20 year life), easy to clean, cost effective to maintain**; carpet is preferred.**
- Choose all finish colors with consideration of impact of full artificial light on colors chosen and higher lighting output requirements of low **reflective** materials.
- Also choose colors compatible with video origination (light, neutral).

Mechanical:

Note: This information is provided as guidelines only. It is the responsibility of the selected Consultant to provide appropriate systems. At a minimum, providet he following:

- HVAC system capable of maintaining human comfort conditions summer and winter; 65% rh maximum
- For rooms with outside wall exposure with heat loss in excess of 200 BTU/ft of wall, provide a "skin" heating system, preferably radiant fin tube controlled inversely with outside temperature
- Provide 15 cfm/person of conditioned outside air; for variable air volume systems, ensure outside air provision is maintained.
- HVAC system and components shall not exceed NC35.
- HVAC shall extend to Projection Booth (if Booth constructed).

Electrical:

Note: This information is provided as guidelines only. It is the responsibility of the selected Consultant to provide appropriate systems. At a minimum, providet he following:

- The following installation of junction box and conduit will provide the connectivity among equipment items and locations described by this program. Install 20" x 20" x 6" junction box in Media Equipment Closet or Cabinet. nstall these conduit requirements:
  - 3/4" from junction box to roll-up door controller.
  - 3/4" from junction box to screen controller.
  - (2) 2" from junction box to Projection Booth.
  - 3/4" from junction box to speakers.
  - 3/4" from junction box to IR repeaters.
  - 2" from junction box to master volume control box.

- 2" from junction box to MCO.
- 2" from junction box to projector.
- 3/4" from junction box to architectural dimming system equipment in Electrical
- Equipment Closet.
- 1" from junction box to low-voltage control panel in bldg. Electrical Equipment Closet
- Provide 1 2" conduit from camera positions to booth.
- Separate all power cabling from low voltage wiring.
- Consider provision of low voltage pathway for communications access at each station;
- Interconnect with Media Equipment Closet (optional).
- Provide microphone inputs at front of room (number depends on size of room).
- Ground audio components to a common ground.
- All audio system power from the same electrical phase.
- Provide 3 low voltage controlled electrical circuits in the Projection Booth, accessible to the technology controller.
- Provide separate circuits for lighting control system and audio/video control system
- Lighting design for classrooms shall use multi-level switching and dimmable fluorescent fixtures for general seating area; lighting controlled from locations as described in other items in this section.
- Board lights (if required) can also use either of these control schemes.
- Lighting control system needs to be interfaced with the technology package. Important design features are multi-zone, multi-scene, multi-station control and contact closure type audio-visual interface for communication with technology controller.
- Provide light at teaching station that is independent of room light.
- Provide extra lighting, or design for future installation of extra lighting to support TV origination from the front of room; ability to light talent/instructor without spill on project screen is imperative.
- Design lighting control so that it is zoned from front to back.
- Provide integrated dimming system. Control locations shall include single scene controller at each door, multi-scene controller at presentation station, with master controller and audio/visual interface in Media Equipment Closet; label all controls clearly with engraved two-color plastic equipment labels.
- Use low brightness, directional lighting fixtures and lenses; the luminaires shall be capable of 1% minimum light output; consult recommendations of Illuminating Engineering Society and Engineering Standards.
- Evaluate need for light over chalkboard; use focused light if appropriate; provide manual control at teaching station; chalkboard lights should have their own on/off switch
- Provide low voltage circuitry as needed to control selected media, lights, screen, chalkboard; provide manual control as well as computer.
- Provide 3 duplex outlets each at front and back (left, center, right); at least 2 conveniently be accessible quad outlets each side; outlets at back of room are in addition to those in Projection Booth.
- Provide line level sound jack in booth.
- Provide duplex outlets and standard power to all camera positions (including booth location); floor mounted outlets preferred.
- Provide dedicated circuitry for classrooms; power should be clean at the panel with protection for equipment provided by surge stripes on racks or carts.
- Provide boxes for mic outlet and a two gang AC receptacle.
- Install 4" x 4" x 4" box for low-voltage light control. Should be located on wall near instructor station. Must be accessible at all times.
- Install 4" x 4"x 4" box for master volume control. Should be spaced 2" from and aligned with light control. Must be accessible at all times.

Telecommunications:

- Install pathway according to UMBC Telecommunication Standard to bring voice, data, and video from source outside room (IDF closet) to standard communications outlets in the Media Closet (voice outlet should articulate with sound systems), Projection Booth (interface with house sound system) and front of room; campus cable connection (receive/return) shall be provided in the Media Closet.

- Telecommunications wiring shall be no closer than 18" **to** fluorescent lights and associated ballast.

EQUIPMENT REQUIREMENTS:

- Choose all seating with consideration for ergonomic principles.

- Accommodate wheelchair users according to ADA criteria

- Equipment for teaching station:

  If tablet arm chairs chosen for classroom seating:
  - Option A: Table, 24" d x 60" l x 29" h, PVC edge, laminate work surface, 12" modesty panel with either T or C base, locking casters if needed, finishes to match building finish standards
  - Option B: Work Unit like Steelcase series 9000, 25" d x 60" l x 29" h; finishes to match building furniture and finish standards

  If tables and stackable chairs chosen for classroom seating, Teacher's station will match student tables and must provide clearance no less than 27.5".

  For either tablet arm or table/chair seating, a table lectern in natural oak or stained to match architectural wood in building may be provided if requested by user

- High intensity overhead transparency projector (4000 lumens).

- VHS VCR

- Video Projector(s)

- Telephone

- Tuner

- Document camera

- Lectern

- UPS (sufficient to accommodate computing equipment for 30 minutes)

- Laser disc

- Audio Cassette

- Audio CD

- PC

- Unix or other high end workstations (optional)
- MAC
- 35 mm slide projector (optional)
- 16 mm projector (optional)
- Video camera (optional)
- External inputs interface
- 18 lf of chalkboard; board 4' high; depending on room configuration,
- Sidewall may require board as well
- Installed sound system if >80
- Sound amplification if >80
- Assistive listening devices if sound/PA systems used
- Projection screens: minimum screen size should be 6' with actual size determined by room dimensions; consider installing additional screens when:
  - the room is significantly wider than it is deep.
  - the chalkboard space is limited when front screen is in use.
  - it is likely that more than one projection device will be used simultaneously.
- 1 pencil sharpener at back of room (mounted securely, not on dry wall partition)
- **Install line voltage (120v) electric clock(s) with large, easy-to-read digital numerals that is centrally controlled at Physical Plant. They should be located so they are visible to the instructor.**
- **Provide a campus phone that will provide access to AV Services, Campus Police, Physical Plant and call campus phone numbers.**
- Receptacles for recycled paper and trash

6.2 ROOM TYPE: II
SQ. FT.: varies

DESCRIPTION:
Video origination addendum to Type I: Advanced Technology Auditorium Classroom specifications

INTENDED USE:
This feature in an Advanced Technology Auditorium will support the use of videoconferencing for teaching and learning. Room systems will produce origination of audio and video for two-way communication. Control systems will be sufficiently user friendly to enable operation by the instructor, although the capability may exist for additional cameras and operators to be brought in for special events. Cameras will capture live video of the teaching area and the audience, with at least one designated area for audience feedback.

SPECIAL ROOM REQUIREMENTS:

Architectural:

- Minimum of two mounted camera locations and two auxiliary camera locations (to allow a camera and operator to be brought in as needed). Generally a camera location at the back of the room focuses on the teaching station and a location at the front of the room focuses on the audience. Depending on size and shape of room, additional camera locations of either type may be desirable.

- At least one designated location for audience participation. Depending on size of room, additional locations may be desirable.

- Use neutral colors for walls.

- Use acoustic wall panels to improve sound quality.

- Use solid, neutral colors for table surfaces and tablet arms (avoid white and wood grain).

- Use non-reflective, uniform texture, non-pattern backdrops.

- Avoid dark backgrounds and wood grain paneling.

- Avoid reflective objects (glass, mirrors, whiteboards) in the camera field of view. NOTE that this specification may be in conflict with instructor need to write on board at front of room..

- Carpet should be used throughout.

- Fixed seating should be cushioned; other seating should be cushioned whenever possible.

- Drape to cover chalkboard. (Optional).

Electrical:

Note: This information is provided as guidelines only. It is the responsibility of the selected Consultant to provide appropriate systems. At a minimum, providet he following:

- Provide 1 2" conduit from all camera positions to junction box in booth, or to junction box in media equipment closet at front of room if there is no booth.

- Provide duplex outlets to all camera positions. Wall outlets or outlets installed as part of fixed equipment are preferred over floor outlets for auxiliary locations. Location would depend upon characteristics of the actual room.

- Provide microphone inputs at selected locations for audience participation (number and location depends on size and shape of room).

- Provide light bar at an appropriate ceiling location to reinforce lighting at front of room. Ability to light talent/instructor and audience participation location(s) without spill on projection screen is imperative.

Telecommunications:

- Install pathway according to UMBC Telecommunication Standard to bring voice and data from source outside room (IDF closet) to standard communications outlets at audience participation location(s) (e.g., telephone, USM Interactive Video Network, teleresponse, fax).

  Solution recommended for approximately the next five years, after which it is that a digital broadband network will be in place.

- Campus cable receive connection shall be via the Sub-split CATV system.

- Campus cable return connection shall be coax to the main trunk in the building machine room where it will connect to the mid-split cable system for transmission back to the head end at OIT Head-end.

- Fiber is an alternative for the campus cable return connection if a specific building has an available fiber line that could be assigned or this purpose.

EQUIPMENT REQUIREMENTS:

- Two video cameras at minimum; three may be required to cover designated audience participation location. Prefer low-light visibility cameras with remote pan/tilt/zoom controls.

- Micro controller and software for camera control.

- Audio components, including Acoustic Echo Canceler, wireless and wired microphones, instructor-controlled mute button.

- **Install line voltage (120v) electric clock(s) with large, easy-to-read digital numerals that is centrally controlled at Physical Plant. They should be located so they are visible to the instructor.**

- **Provide a campus phone that will provide access to AV Services, Campus Police, Physical Plant and call campus phone numbers.**

- Modulator(s)/Demodulator(s)

Note on use of whiteboards:

Use of a gray rather than white writing surface and a matte marker combined with setting the lights at 45 degree angles helps to avoid glare. If white surfaces must be used, careful positioning of the lights seems to improve the situation.