THE TELECOMMUNICATIONS REQUIREMENTS

OF ACADEMIC FACILITIES

A Summary of the Work of the Study Group on
the Telecommunications Requirements of Academic Facilities

to the

Maryland Higher Education Commission

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INTRODUCTION

At the request of the Secretary of Budget and Fiscal Planning, the Secretary of Higher Education convened the Study Group on the Telecommunications Requirements of Academic Facilities. The charge to the Study Group was

> to advise the Secretary of Higher Education on appropriate guidelines for those situations in which the State should finance the installation of telecommunications capabilities in new academic facilities, taking into consideration the following factors: institutional type, building type, enrollment level of the institution, disciplines/degree programs, and other relevant factors.

There was also concern on the part of the Department of Budget and Fiscal Planning (DBFP) about the appropriateness of certain specific campus requests for new facilities in which the cost for telecommunications equipment being requested exceeded $2 million dollars for individual buildings.

The Study Group was composed of campus academic administrators familiar with the use of advanced instructional technologies. The Study Group held a number of meetings in which they defined their task to be to determine those minimum functional capabilities necessary in different types of instructional rooms or spaces for students and instructors to be able to benefit from advanced telecommunications. This report is a summary of the discussions of the Study Group.

The recommended functional capabilities developed by the Group are contained in the tables displayed on the following pages.

In discussing the need to incorporate planning for information technologies into new construction design, the Study Group developed several related recommendations. These are presented in the section of "Recommendations and Further Actions" at the end of the report.

II

MINIMUM FUNCTIONAL REQUIREMENTS FOR TELECOMMUNICATIONS

IN NEW ACADEMIC FACILITIES

In order to define the necessary functional capabilities of academic facilities, rooms and spaces, the individual room or space must be seen as part of a system for the delivery of instruction. Within the system, there are two types of capabilities:

> *Process capabilities* define what one should be able to do in a space.

> *Environmental capabilities* define the conditions needed for a specific activity.

It should be noted that certain capabilities empower the instructor, while others empower the students.

In the pages that follow are a series of tables which provide a classification of academic facilities and the minimal functional telecommunication capabilities required for these facilities to accomodate the use of modern information technologies in instruction.

The description of functional capabilities in these tables refers to the need for access to "networks." Networks can provide access to data, audio, video, or multi-media. The scope of the network can range from a local area network in a building, to a campus-wide network, to a state/regional network, or to an international network (such as Internet). Generally speaking, the geographic range of networks is not a cost issue for building construction, unless specific technology (such as a satellite downlink requiring special anchoring) is involved, or if there is need to house a network center in the facility to support a local network or a video studio to produce programming.

In the tables that follow, academic spaces are classified in several categories. This classification provides a conceptual framework which can be used to determine the specific engineering and electronic hardware and equipment which is needed within each type of facility: classrooms, lecture hall, etc. It is anticipated that each new facility program statement will include a justification of how many rooms of each type are required by the institution requesting the new facility.

Herein classrooms and lecture hall are divided into a hierarchy according to the functional capabilities required, with "Level I" rooms being the least complex, and "Level III" facilities being the most complex. The capabilities described are to be cumulative -- that is, the capabilities of more complex rooms are to be achieved by adding them to the capabilities of less complex rooms. The spaces discussed are:

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Level I | Instructional spaces providing potential access to external networks (e.g., all instructional spaces will have this capability).

Level II | Rooms permitting faculty access to external networks, providing faculty with certain automated instructional capabilities.

Level III | Rooms providing both faculty and students interactive access to external networks.

The tables begin with the environmental capabilities of all academic buildings. The functional requirements of classrooms and lecture halls are then discussed. Finally, special purpose rooms and faculty offices and their needs are discussed.

It is intended that, if adopted by the State, the minimum functional capabilities included in these tables will be provided to architects as guidance for the design of new construction.

A. Academic Buildings

Academic buildings constructed in the future must have an infrastructure which allows maximum flexibility for adaptation to changing technologies. This has many implications: from adequate acoustics to accessible conduits for wiring. Most importantly, all new buildings must accommodate the ubiquitous computer and its related accessories in terms of space and electrical hardware. Recognition must be given to the added space which may be required for additional telecommunications equipment, including control rooms where necessary. The building itself must be hardwired into high-capacity lines or cables--fiber optic or T-1 or T-2 lines--which will be the umbilical cord linking the building to information networks.

Table 1. Academic Buildings

Facility type	Process Capabilities	Environmental Capabilities
Academic building		1. Building-wide wiring should ensure effective signal strength in delivering voice, data, and video to all spaces (offices, classrooms, etc.) and linkages with external networks that permit simultaneous access from all rooms. 2. Installed conduit should provide for maximum flexibility as telecommunications needs change. 3. Building should provide demonstrated access to information sources via telecommunications, including a control area if not otherwise available. 4. Building should explicitly address storage for equipment adjacent to instructional spaces in which the equipment is used.

B. All Instructional Spaces

All instructional spaces in new construction must have the *capability* to be "smart classrooms." They must have passive features which permit the installation of extensive information technology equipment in the future if needed.

The Study Group was unanimous in the opinion that all instructional spaces should be designed to allow faculty members to utilize electronic instructional devices--computer-generated graphics, video display screens, video monitors, access to electronic networks external to the building and to the campus. It is not necessary for students in all instructional spaces to have such capabilities.

Table 2. All Instructional Spaces

Facility type	Process Capabilities	Environmental Capabilities
All instructional spaces **Level I.**	**Faculty** 1. Must have access to external telecommunications networks from within the instructional space. 2. Must be able to display and present mediated information that has been received via telecommunications networks. 3. Must be able to display and present within the room mediated information that originates with the instructor. **Students** Must be able to use laptop computers.	1. Climate and light controls must accommodate origination, reception, presentation, and display of mediated information. 2. Wiring and cabling of the space must ensure appropriate location of outlets and complete connectivity of all mediated information sources. 3. Space must have appropriate acoustical treatment for mediated instruction, including acoustics within the space and acoustical insulation of the space from adjacent rooms. 4. All students must have unobstructed view of all displays of information.

C. Classrooms

The Study Group was not unanimous in its approach to classroom telecommunication needs. Some felt that each classroom, in addition to the basic capabilities of all instructional spaces, should provide students as well as faculty access to all networks and to full electronic capabilities. Others supported a two-tiered approach to classrooms, which is displayed in Table 3. By dividing classrooms into two levels according to the students' access or lack of access to

Table 3. Classrooms

Facility type	Process Capabilities	Environmental Capabilities
Classroom **Level II.**	**Faculty** 1. The room must provide for effective enhancement or projection of live presentations and mediated information that originate within the room. 2. Must be able to display and present mediated information that has been received via telecommunications networks. **Students** 1. The classroom layout and wiring must permit use of the space for small group activities that include connectivity to telecommunications networks. 2. Students must be able to individually access on a computer mediated information that originates in the room (e.g., a local area network exists for the room).	Same as Level I.
Classrooms **Level III.** **Teleclassroom**	**Faculty** 1. The room must accomodate remote video and audio recording and transmission of live interaction and mediated information presented or displayed as part of the instructional process. 2. The faculty must be able to receive and send mediated information (data,audio, video, print) between the classroom and external sites via telecommunications networks **Students** Students must be able to receive and send mediated information (data, audio, video, print) between the classroom and external sites via telecommunications networks.	In addition to capabilities of all instructional spaces: Enhanced acoustical treatment and climate and lighting controls to accomodate video and audio reception, transmission and recording.

external networks, it was felt that institutions requesting new construction would be required to make distinctions among their classrooms based on projected use. It was felt there was no need for every classroom to be a "teleclassroom." However, all agreed that Level II and III classrooms needed to be capable of permitting a full utilization of computer networking *within* the classroom, with the instructor having the capability to call up the work of individual students using a video monitor or a projector for all members of the class to see.

D. Lecture Halls

A lecture hall normally has tiered seating for 100 or more students. A distinction of levels of capabilities was developed for lecture halls as for classrooms. In effect, in Level II lecture halls, students would be observers, but the room would permit faculty members to access external networks. Basically, this would allow students to view non-interactive programming which might be received from satellites or land-line video networks. Level III lecture halls would be equipped for video-teleconferencing, with the students taking part through interactive video and audio. Simultaneous translation capability would permit international teleconferences or even live courses.

Table 4. Lecture Halls

Facility type	Process Capabilities	Environmental Capabilities
Lecture hall **Level II.**	**Faculty** 1. The room must provide for effective enhancement or projection of live presentations and mediated information from within the lecture hall. 2. The room must accomodate remote video and audio recording and transmission of live interaction and mediated information presented or displayed as part of the instructional process. **Students** None	In addition to capabilities of all instructional spaces: Enhanced acoustical treatment and climate and lighting controls to accomodate video and audio reception, transmission, and recording.
Lecture hall **Level III.**	**Faculty** 1. The room must provide for simultaneous translation capability. 2. The faculty must be able to receive and send mediated information (data,audio, video, print) between the lecture hall and external sites via telecommunications networks. **Students** Students must be able to participate in audio and video transmission and reception between the lecture hall and external sites via telecommunications networks.	

E. Special Purpose Rooms

There are many types of special purpose spaces on a campus. The Study Group felt it would be impractical and unwise to attempt to establish guidelines for each imaginable type of special purpose facility. Therefore the Group adopted the principles set forth in Table 5.

Table 5. Special Purpose Rooms

Facility type	Process Capabilities	Environmental Capabilities
Special purpose rooms: **Media center/ library** **Lanquage lab** **Science lab** **Computer lab** **Multi-media simulation room** **Network Center** **and others**	Process capabilities should be specified for each specialized room as part of the design process. The specifications should include any enhancement of reception, distribution, presentation, display, and interconnectivity for all forms of mediated information appropriate to the room.	1. Environmental capabilities will change, depending on the specialized needs of the room. The design should explicitly address enhanced needs for climate and lighting controls, acoustical treatment, design of seating, and presentation/display functions. 2. The design should explicitly address need for specialized treatment of floors, ceilings, walls, conduit, and support beams to accommodate heavy equipment or unique equipment positions.

F. Faculty Offices

In a truly automated campus, with a computer network linking all living, working and instructional spaces, the faculty office may well become the premier instructional space. That is, the faculty member will have the capability to transmit his/her courses from his/her office. S/He will use the office to produce and transmit all forms of computer graphics, to access and transmit digitized data from commercially produced laser CD-ROM systems, to give his/her lecture over interactive video and audio, and to transmit documents to students electronically, including tests.

Although this office *cum* electronic classroom is still in the future, new construction containing faculty offices should be designed with this future in mind. This may mean somewhat more space and a great deal more electronic network access than now is common.

Table 6. Faculty Offices

Facility type	Process Capabilities	Environmental Capabilities
Faculty offices	1. Faculty should have appropriate access to voice, data, and video networks, including electronic mail. 2. Faculty should be able to send and receive mediated information via telecommunications networks, including to data servers within the building, if available. 3. Faculty should be able to view and display mediated information that has been received or is to be sent via telecommunications networks. 4. Faculty should be able to view and display within the office mediated information that is originated in the office.	Enhanced acoustical treatment and climate and lighting controls to accomodate video and audio reception, transmission, and recording.

III

RECOMMENDATIONS AND FURTHER ACTIONS

The Study Group has suggested a framework for State policies concerning the telecommunication capabilities of new construction. With this framework in mind the Study Group makes the following three recommendations:

- **The State should adopt the guidelines for "minimum functional capabilities" for telecommunications infrastructure set forth in this report for the programming and design of all new construction of academic facilities.**

- **The State should require that each program statement for proposed capital projects include a comprehensive plan for the telecommunications infrastructure of the facility and this plan should be prepared by a qualified telecommunications specialist.**

- **The State should provide access to a database containing outstanding models of exemplary facilities utilizing advanced telecommunications technologies.**

Recognizing that the guidelines established in this report provide principles rather than construction or mechanical specifications for new academic facilities, there is a need for a further analysis of the specifications needed in order to assure that the recommended functional capabilities exist in a building. There also is a question of the essential equipment which would be needed to achieve the goals of these recommendations.

Therefore, it is further recommended that

- **A consultant with demonstrated expertise in instructional technology be retained to develop a statement as to the specifications needed to assure that new construction will have the capabilities recommended by the Study Group, including an estimate of the programming, design, construction, and equipment and installation costs involved for each separate type of space.**

GLOSSARY

CD-ROM -- An electronic publication on a computer disk (CD) which can be accessed with a computer. It has "read only memory" (ROM), meaning the disk cannot be written on or changed.

Fiber optic line -- A high-capacity telephone line or cable with a core made of glass fibers. Light emitting diodes send light through the fiber to a detector which converts the light back into electrical signals. Fiber optic lines have more bandwidth than any other type of line. They can carry full motion video as well as compressed video.

Mediated information -- Information of any kind which is transmitted by an electronic medium of any type.

Teleclassroom -- A room which is connected by interactive electronic media to any other room allowing for live interaction of individuals at a distance.

T-1 line -- High-capacity telephone lines having sufficient bandwidth to transmit compressed video.

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