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To the Graduate Council:

I am submitting herewith a dissertation written by Emory Childs Harrison, Jr., entitled "A Study of Criteria for Planning Educational Facilities to Make Them Accessible To and Usable By, the Physically Handicapped." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Education, with a major in Administration and Supervision.

Charles E. Trotter, Jr.,
Major Professor

We have read this dissertation
and recommend its acceptance:

Accepted for the Council:

Vice Chancellor
Graduate Studies and Research

A STUDY OF CRITERIA FOR PLANNING EDUCATIONAL FACILITIES TO MAKE THEM ACCESSIBLE TO AND USABLE BY, THE PHYSICALLY HANDICAPPED

A Dissertation

Presented for the

Doctor of Education

Degree

The University of Tennessee

Emory Childs Harrison, Jr.

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ABSTRACT

The purpose of this study was to identify building modifications or equipment that would permit the maximum utilization of a facility by physically handicapped persons and on the basis of this information, develop guidelines for the incorporation of the building modifications or equipment in school construction.

A survey was conducted to identify the criteria that currently exist and are utilized in other states to make facilities accessible to, and usable by, the physically impaired. Concurrently, an extensive review of literature was undertaken to assist in identifying additional criteria related to the elimination of architectural barriers.

A questionnaire was developed from an examination of existing guidelines and a review of the related literature. The questionnaire was submitted to a panel of ten experts who were asked to rate each of the criterion as adequate or inadequate. For any rating of inadequate, the expert was requested to include the modifications necessary to make the criterion acceptable (i.e., adequate).

The questionnaire presented one-hundred and twenty-seven criteria in twenty-four facility areas including: Site, Ramps, Walks, Parking Lots, Curbs, Entrances, Doors, Corridors, Stairs, Elevators, Drinking Fountains, Electrical and Mechanical, Identification, Warning Signals, Telephone, Sanitary Facilities, Auditoriums, Cafeteria/Dining, Classrooms, Gymnasiums and Physical Education, Laboratories, Transportation, and Fire Protection.

The questionnaires were then returned, the data analyzed, and the results incorporated into guidelines reflecting that information deemed necessary by each of the panel members to make the criteria complete, comprehensive and current.

The twenty-four guideline areas were incorporated into a rating sheet utilizing a ten point Likert-Type scale ranging from very unimportant (1) to very important (10).

The rating sheets were submitted to the panel members and they were requested to rate each of the guideline areas. The data obtained from the rating sheets were analyzed and means and modes computed for each of the twenty-four areas. Utilizing mean ratings, the areas were then ranked, highest to lowest.

The findings of this study revealed that 111 of the 127 criteria were adequate as they were presented. Of the 16 that were modified, most had the dimension, measurement or time span increased in order to make it adequate. As regards, priorities, Fire Protection was rated as most important and stairs as least important. Each of the twenty-four guideline areas, however, was rated as either important or very important.

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CHAPTER I

INTRODUCTION

I. GENERAL INTRODUCTION

Most of us use sidewalks, stairways, revolving doors, rest rooms, public telephones, hallways and parking lots without much thought as to their multiple uses. They are accepted as part of our daily activity. For millions of Americans, however, these common structures present tremendous barriers to a normal way of living. If one is bound to a wheel chair, a six inch curb can be just as great an obstacle as a ten foot wall. Steps, a narrow doorway or an inaccessible rest room, restrict handicapped persons and limit their freedom and mobility in the community, business, or perhaps even the home.

Architects in the past have been content when the structures they designed functioned well by accommodating the "average person." Population statistics for the physically handicapped in the United States indicate that one person in ten, however, has some disability which prevents him from using buildings and facilities designed for the average person.

Of particular interest is the realization that physically handicapped youngsters comprise a sizeable percentage of the national school-age population. It has been estimated that from 10 to 12 percent of school-age children, or three to four million, have serious physical handicaps of one kind of another. The National Health Survey indicated

that over two million children under fifteen years of age are affected by blindness, deafness, paralysis, missing or deformed limbs, or other handicaps. Many others are epileptics, have serious speech defects as a result of cleft palate, cerebral palsy or another congenital defect, or suffer from a variety of health impairments (Patterson, 1962, p. 231).

A more specific listing such as that which appears in Rehabilitation and Research in Retardation (1960, p. 95) would indicate that for each 100,000 persons in the general population, there are:

200 persons who are totally blind

300 persons with permanent polio residual involvements

350 persons who are cerebral palsied

700 persons with rheumatic heart conditions

3,000 persons with mental retardation

Children with handicapping conditions are found to some degree in all school divisions throughout the nation. Recent legislation, court cases and parental pressure make it necessary that school architects consider this aspect of the school population in school plant design. Many times, self-contained classes accommodate these children, but if integration of exceptional and normal children is to be a goal of the educational program then the physical and psychological environments must be carefully planned to provide the necessary accommodations.

II. THE PROBLEM

Statement of the Problem

The purpose of this study was to identify building modifications or equipment that would permit the maximum utilization of a facility by

physically handicapped persons and on the basis of this information, develop guidelines for the incorporation of the building modifications or equipment for school construction.

Subproblems

The following subproblems were identified as a necessary part of this study.

1. What criteria currently exist and are utilized in other states to plan facilities to accommodate the physically impaired student?

2. How would experts familiar with the mobility difficulties of the handicapped modify existing data or criteria, to make them more current or more comprehensive and complete?

3. What priorities exist as regards building modification and equipment? What are most important? What are least important?

III. IMPORTANCE OF THE STUDY

Education in any society tends to reflect the political philosophy of that society. Under a democracy, as practiced in the United States, where the State is believed to exist for the welfare of the individual, education must be organized primarily to achieve this end. "All men are created equal" has been interpreted by the courts to mean equality of opportunity. This implies educational opportunity for all children. More specifically, it implies the right of each child to receive help in learning to the limits of this capacity, whether they are average, bright, dull, retarded, blind, deaf, crippled, delinquent, emotionally disturbed, or otherwise limited in their capacities to learn.

One out of every eight children entering our schools today is considered "exceptional" in some way. These include the physically handicapped, the intellectually limited or gifted, mentally retarded and the maladjusted. Although the gap is steadily closing between those who need special facilities and those who are receiving them, research continues to identify subtle environmental factors influencing the performance of these children and necessitating additional facility alterations. A three-story school building can loom above a student in a wheel chair in a terrifying manner and set the tone for his day, even before he enters its doors (Bednar & Haviland, 1969, p. 5).

A handicapped person has the same "inalienable rights" as does any other citizen of the United States. These rights include that of being a whole individual. Dr. Charles E. Caniff, Executive Director of the Association of Rehabilitation Centers and 1960's "Handicapped American of the Year" presents this view point ("Banning Those Barriers," 1964, p. 2).

> For those of us with limited mobility, architectural barriers prevent free access to those buildings which we must enter to work, to vote, to worship, to learn, to play, or even to buy a stamp. To fulfill our responsibility as citizens we often must circumvent these barriers by entering through the rear door, where freight is hauled in and hauled out, and make our way through coal bins, storerooms, and boiler rooms to reach a freight elevator which can accommodate our wheel chairs. Architectural barriers have made us "back door" citizens.

To deny the physically disabled individual access to the benefits of an education is to relegate him to a lesser status in life. This will limit his or her personal independence and the contribution to society that this person could make.

The area of law with regard to discrimination on the basis of racial, religious or sexual distinction has attracted considerable attention within recent years. It can be stated that the existence of architectural barriers at a public supported institution constitutes discrimination as serious as that experienced in the past by other groups. Legal rulings with regard to architectural barriers are just beginning to occur with recent Washington, D. C., and Memphis, Tennessee litigation as important examples. If the law develops with regard to physical disabilities as it has with racial discrimination, one might eventually expect that public agencies would be required to pursue a policy of affirmative action with regard to the elimination of architectural barriers similar to those having to do with hiring policies. This would mean that no new construction could be funded until existing discriminatory architectural barriers had been removed.

IV. BASIC ASSUMPTIONS

The following assumptions were advanced prior to the undertaking of this study in order to define its scope and direction:

1. The physical facilities housing an educational program enhance or hinder that program.

2. A school facility should be equally accessible to all students utilizing that facility.

3. Certain physically handicapped students require some additional assistance in order to gain maximum utilization of a school building.

4. Educators are responsible for identifying those physically handicapped students requiring special assistance in order to gain maximum utilization of the school building and for making the equipment, and facility design features that permit such maximum utilization known to the architect.

5. The essential elements in the planning of a facility to accommodate the physically handicapped can be identified and appraised.

V. LIMITATIONS OF THE STUDY

1. The literature selected for review was limited to that concerned specifically with equipment and facility design features which permit maximum utilization of a facility by physically handicapped students.

2. No brand names or trade names were utilized in this study.

3. The equipment and materials normally incorporated in building construction and utilized by all students were not a consideration of this study.

4. Special curriculum and program requirements were not considered in this study.

VI. DEFINITION OF TERMS

Architectural Barriers. Site obstruction or building design feature denying accessibility to, or use of, a facility by a handicapped person of limited mobility.

Building Modification. A change in facility design, equipment, or site necessary to make the building accessible to, and usable by, handicapped of limited mobility.

Guidelines. Directions or aids for planning facilities.

Physically Impaired. The definitions utilized by the American Standards Association, Inc. (1961, p. 6) were utilized for this study. The physically impaired are the:

1. Non-ambulatory--those individuals who for all practical purposes are bound to wheelchairs, regardless of cause or manifestation.
2. Semi-ambulatory--those individuals who walk with difficulty or insecurity such as those using braces and/or crutches, amputees, arthritics, spastics, pulmonary and cardiac cases, etc.
3. Sight handicapped--those individuals who are totally blind or those whose sight is impaired to the extent that ambulation in public areas is insecure and hazardous.
4. Incoordinates--those individuals with incoordinate movements or palsy from cerebral injury, spinal injury, or peripheral nerve injury.
5. Hearing handicapped--those individuals who are deaf or have a hearing handicap, to the extent that they might be insecure regarding warning signals, etc., in major public areas, industrial areas, etc.

The term physically handicapped was synonymous with physically impaired.

Ramp(s). A path or area of access with a slope or gradient as compared to what would ordinarily be considered a walk. Characterized by a change of level to a point above or below existing ground level. May be interior or exterior.

Walk(s). An exterior pre-determined, prepared-surface path or area of access from one building or facility to another or from one exterior space to another, utilizing existing ground level.

VII. PROCEDURES

The purpose of this study was to identify available equipment and facility design features that would permit the maximum utilization of a facility by physically handicapped students and on the basis of this information, develop guidelines for incorporating this equipment and the building modifications in school facilities. It was assumed that through a review of literature and current practices, and the use of a panel of experts, the equipment and facility design features that contribute to the maximum utilization of a facility by physically handicapped students would be revealed. The information gathered was identified, analyzed and utilized to develop a questionnaire.

Subproblem One

A survey was conducted in order to identify the criteria that currently exist and are utilized in other states to make facilities accessible to, and usable by the physically impaired. A letter was sent to the Chief State School Officer of each of the 50 states and Washington, D. C., and the territories requesting information regarding that states' guidelines utilized to modify a facility so as to make it accessible to and usable by all students. Letters were also sent to numerous national organizations concerned with the handicapped or disabled, requesting the same information. An extensive review of literature was undertaken in an attempt to identify additional criteria related to the elimination of architectural barriers. The sources utilized were primarily periodicals and other publications listed in the Education Index, the Reader's Guide to Periodical Literature, the Encyclopedia of Educational Research,

the Social Sciences and Humanities Index, Dissertation Abstracts International, and those located from a search in the Educational Resources Information Center and card catalog of the main library of The University of Tennessee.

Subproblem Two

It was necessary to determine the adequacy of the existing guidelines and to modify them so as to make them current, comprehensive and complete. From the review of literature, the survey of the guidelines of each state and the information received from the national organizations, a questionnaire was developed incorporating the criteria (i.e., facility modifications and equipment) necessary to make a building accessible to, and usable by, a physically impaired person. This questionnaire was mailed to a panel of ten experts who were asked to react to the questionnaire and modify it so as to make the material reflect the best criteria for making a facility accessible to, and usable by, the physically impaired.

The experts (panel of judges) were drawn from architects, school administrators, school facility planners, special education personnel, and other experts in the field of education of the physically handicapped, all of whom were highly recognized in their respective fields. They were selected because their names appear frequently in literature related to the handicapped and they were often mentioned in conversations with nationally recognized persons in the field of the elimination of architectural barriers.

Each panel member was asked to rate each of the criterion as adequate or inadequate. For any rating of inadequate, the expert was asked to include the modification he would recommend to make the criterion acceptable (i.e., adequate). The questionnaires were then returned, the data analyzed, and the results incorporated into guidelines reflecting information deemed necessary by each of the panel members to make the criterion complete, comprehensive and current.

Subproblem Three

An essential ingredient of the study was to determine the priorities of equipment and building modifications as they are required to make a facility accessible to and usable by, a physically impaired person. Assuming the guidelines would also be used in remodeling or renovating old buildings, all of the criteria might not, for reasons of expense, be included in a remodeling or renovation project. Using the 24 guideline areas, the experts were asked to rate on a Likert-type scale the relative importance of each of the criteria. More specifically, was it more important to have elevators or restrooms available for the physically impaired? While this may seem to be unnecessary, it was felt that at some point, that type of information would be of benefit in the planning procedure, so it was included as a part of this study. The results indicate that all areas included in the guidelines are considered important or very important by the panel members.

VIII. ORGANIZATION OF THE STUDY

Chapter I presents the introduction of the study, the statement of the problem and subproblem, the importance of the study, basic assumptions, and limitations of the study. The chapter also includes definitions of terms used in the study, procedures and sources of data, and the organization of the study.

Chapter II contains a review of the related literature. Emphasis is placed on the equipment or facility design features necessary to make the building accessible to, and usable by, the physically impaired.

Chapter III presents an explanation of the procedures and statistical analysis used in conducting this study.

Chapter IV contains the analysis of data, including the guidelines for making facilities accessible to, and usable by, the physically impaired.

Included are the ratings of the criteria by the panel of experts and the identification of the elements or criteria considered very unimportant or very important.

Chapter V presents the Guidelines for Planning Educational Facilities to Make Them Accessible To, and Usable By, the Physically Handicapped.

Chapter VI contains the summary, findings, conclusions and recommendations relative to this research.

CHAPTER II

REVIEW OF RELATED LITERATURE

I. INTRODUCTION

The process of planning school plant facilities has undergone a gradual evolution and growth process and only within the last two decades has become recognized as an endeavor requiring the attention of competent, specialized persons with a variety of knowledges and experiences.

The planning of educational facilities to make them accessible to, and usable by, the physically impaired did not become a primary concern until the 1960's. Even then, there was little effort to make certain that the necessary changes and modifications were included in building plans.

The purpose of this chapter is to present studies that have been conducted relative to the development of guidelines and criteria for making a facility functional for the physically impaired.

II. RELATED STUDIES

During the process of this study, a paucity of scholarly research was identified. The majority of the writing that was discovered either expressed an extreme amount of concern over the existence of architectural barriers to the handicapped or it contained a plea to help eliminate these architectural barriers and make the buildings accessible to, and usable by, the physically impaired.

Of the studies reviewed for this writing only a limited number were devoted to the development of guidelines for planning facilities. The first was initiated in May of 1958 and was co-sponsored by the President's Committee on the Employment of the Physically Handicapped and the National Society for Crippled Children and Adults. The American Standards Association, now known as the American National Standards Institute, Inc., accepted this project as one of its undertakings. This effort, more often referred to as ASA Project A-117, was conducted by the University of Illinois and coordinated by Dr. Tim Nugent (1960).

The research had several tasks that were specifically applicable to the problem. Since guidelines for planning facilities to make them accessible to, and usable by, the physically impaired did not exist, it was necessary to collect and collate the literature that was available. This collation included any officially recognized building standards that could possibly be utilized or modified to serve this particular project.

To further examine the problem, several experimental research studies were conducted. The first experiment was to construct a ramp for wheelchairs that was adjustable to different positions, lengths or pitches, or combinations of lengths and pitch. Using this facility, the researchers were able to determine the degree of difficulty encountered in negotiating the ramp.

The second undertaking was devoted to determining standstill space, straight ahead space, and turning space required by a wheelchair. To do this, one fixed wall and several movable walls were used. A parallel study was conducted to determine the vertical and horizontal

reach capabilities of wheel chair bound persons.

Research was also undertaken to determine the applicability of commercially manufactured products in solving problems associated with making buildings accessible and functional for the physically impaired. This study was concerned with such topics as floor covering, door hardware, water coolers and other such items normally found in buildings.

The results of this series of studies are found in a document released by the American Standards Association, Inc. (1961), and published by the National Society for Crippled Children and Adults, Inc. This document has served as the official standard of the Association since it was approved on October 31, 1961. The Guidelines were reaffirmed in 1971.

Peter Michel (1972), conducted a study for the Massachusetts Department of Community Affairs and in his report, presented the guidelines and standards for making portions of all public housing projects funded by the State of Massachusetts accessible to, and functional for, the handicapped. More specifically, the guidelines were designed to accommodate the handicaps characteristic of the elderly and the disabled.

The data that was used as a basis for this study were collected from 3000 questionnaires mailed to members of the Massachusetts Association of Paraplegics. Of the 3000 mailed only 951 were returned (Michel, 1972, p. 160).

While a multitude of data was reported, that which has particular relevance to this study was related to design features. Thirteen design features were surveyed to determine if the handicapped person regarded them as essential, helpful or not required. The study had previously

determined that the majority of the handicapped were in four groups: polio, cerebral palsy, paraplegic, and wheelchair (Michel, 1972, p. 181).

The design features that were pertinent to this study were: elevators to all floors; ramps for different levels; railings at stairs; wide doorways throughout; special bathroom facilities; common dining facilities; and emergency call system.

The follow presents a summary of the findings of this report.

ELEVATORS TO ALL FLOORS (Michel, 1972, p. 196)

	Percent Essential	Percent Helpful	Percent Not Required	Percent No Response
1. Polio	46.0	34.0	12.0	8.0
2. Cerebral palsy	10.8	33.8	32.8	23.0
3. Paraplegic	69.7	14.5	13.2	2.6
4. Wheelchair	73.2	13.3	6.0	7.5

An examination of this table reveals that a majority of those with polio, cerebral palsy or those confined to wheelchairs feel that elevators to all floors are essential or helpful.

RAMPS FOR DIFFERENT LEVELS (Michel, 1972, p. 197)

	Percent Essential	Percent Helpful	Percent Not Required	Percent No Response
1. Polio	12.0	42.0	26.0	20.0
2. Cerebral palsy	2.7	13.5	59.5	24.3
3. Paraplegic	73.7	15.8	6.6	3.9
4. Wheelchair	70.0	17.6	4.9	7.5

Concerning ramps for different levels, those confined to wheelchairs and paraplegics regard them as essential or helpful. It would

seem logical that this is of particular importance to those confined to wheelchairs or with severe ambulatory difficulties.

RAILINGS AT STAIRS (Michel, 1972, p. 197)

	Percent Essential	Percent Helpful	Percent Not Required	Percent No Response
1. Polio	78.0	18.0	2.0	2.0
2. Cerebral palsy	36.5	31.1	16.2	16.2
3. Paraplegic	14.5	5.3	46.1	34.2
4. Wheelchair	27.0	10.3	37.5	25.3

Railings at stairs were considered to be essential or helpful by a majority of those suffering from polio or cerebral palsy disorders. This is in direct contrast to the previously presented table and is to be expected since these two maladies present ambulatory difficulties not necessarily confining the victims to a wheelchair.

WIDE DOORWAYS THROUGHOUT (Michel, 1972, p. 197)

	Percent Essential	Percent Helpful	Percent Not Required	Percent No Response
1. Polio	10.0	26.0	42.0	22.0
2. Cerebral palsy	1.4	5.4	66.2	27.0
3. Paraplegic	84.2	10.5	5.3	0.0
4. Wheelchair	76.0	12.8	3.9	7.3

From this table, it can be determined that those classified as paraplegics or confined to a wheelchair view wide doorways as essential or helpful while those victimized by polio or cerebral palsy do not. Again, those with ambulatory handicaps not confining them to wheelchairs

would be more mobile and as a result not as concerned with this feature.

SPECIAL BATHROOM FACILITIES (Michel, 1972, p. 198)

	Percent Essential	Percent Helpful	Percent Not Required	Percent No Response
1. Polio	16.0	30.0	32.0	22.0
2. Cerebral palsy	5.4	5.4	62.2	27.0
3. Paraplegic	68.4	21.1	3.9	6.6
4. Wheelchair	65.3	19.5	7.5	7.7

Special bathroom facilities were seen as essential or helpful by those classified as paraplegics or confined to wheelchairs. Those with polio or cerebral palsy did not share this same viewpoint and had no response or viewed them as not required.

COMMON DINING FACILITIES (Michel, 1972, p. 198)

	Percent Essential	Percent Helpful	Percent Not Required	Percent No Response
1. Polio	10.0	16.0	50.0	24.0
2. Cerebral palsy	9.5	12.2	51.4	27.0
3. Paraplegic	13.2	25.0	35.5	26.3
4. Wheelchair	14.1	27.4	33.8	24.6

Common dining facilities did not seem to be essential or particularly helpful to any of the groups represented. In fact, the majority of each of the groups replied "not required" or "no response."

EMERGENCY CALL SYSTEM (Michel, 1972, p. 200)

	Percent Essential	Percent Helpful	Percent Not Required	Percent No Response
1. Polio	28.0	24.0	32.0	16.0
2. Cerebral palsy	16.2	24.3	35.1	24.3
3. Paraplegic	40.8	38.2	11.8	9.2
4. Wheelchair	49.9	30.6	7.9	11.6

An emergency call system was determined to be essential or helpful by the majority of the groups. Again, the paraplegics and those confined to wheelchairs viewed this feature as more necessary than the other two groups.

In summary, those confined to wheelchairs, or those classified as paraplegics viewed each of the facility design features as more essential or helpful to them than those with polio or cerebral palsy. Perhaps this can be attributed to the degree of difficulty associated with mobility of each of these two groups.

Harold Yuker presented a series of monographs dealing with "The Modifications of Educational Equipment and Curriculum for Maximum Utilization by Physically Disabled Persons." Study Number Ten concerns itself with the transportation of physically disabled students. As reported in this writing it was found that standard school buses were most satisfactory when used for transporting ambulatory or semi-ambulatory persons. Their advantages included their relatively low cost, ready availability and large load capacity. They were, however, not particularly useful for transporting severely disabled children. Vans and compact buses can be readily adapted, through the use of lifts and ramps, to accommodate a limited number of severely disabled students. Adapting

a school bus to provide a more efficient means for entrance and egress for disabled students is much more satisfactory (Yuker, 1967c, p. 22).

While taxies appear to be a suitable means of solving some special transportation problems, they are quite costly. Standard automobiles and station wagons can be used, but they usually prove to be unsatisfactory (Yuker, 1967c, p. 22).

Human Resources Study Number Nine by Yuker is devoted to educational equipment for physically disabled students. The study determined that if suitable equipment was not commercially available, it may be necessary to modify the equipment, or occasionally, even to prepare specially adapted, made-to-order equipment. The primary considerations in the selection and modification of equipment are instructional quality and effectiveness with economy and maximum utility being important subsidiary concerns (Yuker, 1967b, p. 44).

The first section of the monograph presents discussions of furniture and equipment appropriate for use in schools where there are disabled children. The topics discussed include tables and desks, bookcases and storage cabinets, chalkboards, audio-visual aids, communication aids, and mobility and postural equipment. While there are specific points to be made with respect to some of these items, there are basic underlying considerations that apply to all of them. In selecting furniture and equipment for use by disabled persons, questions such as the following should be asked: (1) Is the equipment of an appropriate height, or can the height be adjusted? Because some disabled children are in wheelchairs and cannot stand up, the height of desks, shelves, cabinets, etc., are of primary importance. (2) Has provision been made

for each student in the class to see what is going on with a minimum of moving about? The use of appropriate projection equipment, mirrors, and audio-visual aids can greatly facilitate communication with a minimum of student mobility being required. (3) Is the equipment arranged so that a student in a wheelchair can get to it? (4) Is there special equipment that the student can use at his desk that will make it possible for him to carry out his tasks? Such equipment as electric typewriters, tape recorders, or special chalkboards can often be used to facilitate the education of a child with limited physical capabilities. (5) Is the school concerned with making special equipment available to facilitate the student's mobility? Some schools provide wheelchairs, litters, etc., for their students while others require the students to provide their own mobility equipment (Yuker, 1967b, p. 44).

The previously listed considerations are applicable not only to classrooms, but also to specific educational areas. Care must be taken to see that all areas, including laboratories, library, cafeteria, auditorium, and gymnasium are suitably equipped. In each of these rooms consideration should be given to the height of the equipment and whether a wheelchair fits under it. In each case the items of equipment should be far enough from one another so that wheelchairs can move between them. There should be provision for audio-visual aids and overhead mirrors to facilitate vision from all parts of the room (Yuker, 1967b, p. 45).

In some areas there are other specific requirements. The auditorium should not have steps either leading to it, or in it. There should be a ramp leading to the stage, and auditorium space should be

provided for students to sit in wheelchairs. The gymnasium should have the usual equipment since the current emphasis is on adapting the program of activities to the disabled individual, rather than adapting the physical facilities. Despite this, some modified equipment can be used for those persons with limited strength and dexterity (Yuker, 1967b, p. 45).

In a project conducted at the State University of New York at Albany, a staff of professionals and consultants developed performance criteria for "Making Facilities Accessible to the Physically Handicapped." Aided by a grant from the Vocational Rehabilitation Administration of the United States Department of Health, Education and Welfare, the State University Construction Fund of the State University of New York at Albany sponsored and conducted an industry-wide seminar and collaborated with other universities and professionals with a nation-wide reputation in physical rehabilitation in an attempt to incorporate into guidelines the best known practices in establishing educational environments favorable to the handicapped.

While these criteria parallel quite closely the American Standards Association, Inc. (ASA), guidelines A 117.1-61, there is some additional information in areas not specifically covered by the ASA document such as dining halls, laboratories, gymnasiums, libraries, theaters, lecture halls, and classrooms (Making Facilities Accessible to the Physically Handicapped, Performance Criteria, 1967, p. 23).

III. SUMMARY

The planning of facilities to make them accessible to, and usable by, the physically impaired became an area of primary concern during the 1960's. The real impetus for this planning was generated in many instances by legislative action from the various states. At present, all states, except Kentucky, have legislation related to the elimination of architectural barriers with the majority of this legislation having been passed since 1965.

The development of guidelines and criteria for planning facilities that have no architectural barriers has been slow and at present, only two major sets of guidelines and criteria exist. Most of the other guidelines that are available are variations or modifications of one or both of these and generally incorporate very few, if any changes.

The areas that require particular attention relative to the elimination of architectural barriers include elevators, ramps, railings for stairs, wide doorways, toilet facilities, dining facilities, emergency call and warning systems, transportation, and equipment.

Chapter III contains a discussion of the procedures utilized in this study.

CHAPTER III

PROCEDURES AND STATISTICAL ANALYSIS

As stated in Chapter I, the primary purpose of this study was to identify equipment and facility design features that would permit the maximum utilization of a facility by physically handicapped students, and on the basis of this information, develop guidelines for incorporating this equipment and the building modifications in school facilities being constructed, remodeled, or renovated.

The first task was that of identifying those students defined as physically handicapped and as such requiring assistance by equipment or design feature in order to gain maximum utilization of the facility.

An exhaustive survey of the literature and a letter mailed to the Chief State School Officer in each State and Washington, D. C., requesting criteria for identifying physically handicapped students revealed these frequently mentioned areas:

1. Ambulatory impairments. This category was subdivided into three areas. The first was non-ambulatory, or those confined to wheelchairs. The second category was semi-ambulatory, or those who walk with difficulty or a degree of insecurity such as those using braces, and/or crutches, canes, walkers, amputees, arthritics, spastics, pulmonary and cardiac cases, and other infirmities that make walking difficult. A third area was identified which included incoordinates, or those who walk with incoordinate movements or palsy from cerebral injury, spinal injury, or peripheral nerve injury.

2. Visual impairments. The individuals in this category include those who are totally blind or those whose sight is affected to the extent that walking or mobility in public areas is insecure, hazardous, or difficult. Many states had definitions that stated the limits of blindness in much the same manner as the one utilized in Tennessee. The Rules, Regulations, and Minimum Standards (1973, p. 34) of the Tennessee State Board of Education identify the blind child as "a child whose central visual acuity is 20/200 or less in the better eye with correcting glasses or a peripheral field so contracted that the widest diameter of such field subtends an angular distance no greater than 20 degrees. . . ." While such a precise definition would certainly be necessary for the identification of a child needing special program and curriculum assistance, this degree of precision was not required in planning a facility to make it accessible to, and usable by, the sight handicapped. Rather, a general definition such as stated in the initial sentence of this paragraph was utilized in this study.

3. Hearing impairments. Included in this area are those individuals who are deaf or having an auditory impairment to the extent that the hearing loss interferes with the normal process of education. The State of Florida in its "Procedures for Providing Special Education for Exceptional Students" (1973) provides very precise definitions:

> Deaf: One who is born with, or acquires, prelingually, a hearing loss so severe (pure tone average of 500, 1000, 2000 Hz at 70 dB [ANSI] or more in the better ear) unaided, that he cannot learn speech and language through normal channels.
>
> Hard of Hearing: One who is born with or acquires a hearing loss which may range from mild to severe (pure tone average of 500, 1000, 2000 Hz between 30 and 69 dB [ANSI] in the

better ear) unaided, and whose speech and language, though imperfect, are learned through normal channels.

Again, such a definition would be desirable for identifying those students needing special program or curriculum assistance, but this degree of precision was not required for the planning of a facility. Thus, a general definition such as the one presented initially was utilized in the preparation of this study.

Using these three areas as guides, a questionnaire relative to making facilities accessible to, and usable by, the physically impaired was constructed. The American Standards Association Specifications for Making Buildings and Facilities Accessible to, and Usable by the Physically Hanidcapped (1961), and the Performance Criteria developed by the State University of New York at Albany, N. Y. (1967), were used as models in developing Guidelines for Making Facilities Accessible to, and Usable by the Physically Handicapped. In order to ensure that the criteria utilized in the questionnaire were as valid as possible, a letter was mailed to the Chief State School Officer of each State and Washington, D. C., requesting the criteria or guidelines used in that state in planning facilities for the handicapped (see Appendix A). Concurrently, a survey of literature was undertaken to locate officially recognized standards and determine their applicability to this problem and the manner by which these standards could be utilized to serve the purpose of this study.

From the guidelines and criteria gathered from all sources, a questionnaire, Guidelines for Making Facilities Accessible to, and Usable by, the Physically Handicapped, was developed. A copy of this instrument is included in Appendix B.

In order to determine the appropriateness of these guidelines, a panel of experts was identified and asked to evaluate each of the criterion as to its adequacy.

The experts were identified and validated in a variety of ways in order to ensure that they were adequately qualified. First, during the review of the literature, certain names continually appeared or were frequently referenced as a source of information. Letters were mailed to the Chief State School Officer in each State and Washington, D. C., requesting the names of persons in that State that might be able to provide some assistance with this study. These two sources were collated into one list and numerous telephone calls made to various persons on the list.

Again, assistance was requested in identifying persons qualified to help with this project. From these three sources, a panel of ten experts was selected to assist with evaluating the selected criteria that constituted the Guidelines for Planning Facilities to Make Them Accessible to, and Usable by the Physically Handicapped.

These ten experts were then contacted by both telephone and letter and requested to serve as a panel member for this project. A copy of the letter sent to each of the panel members may be found in Appendix C, and each of whom agreed to serve (Appendix D). The Guidelines for Planning Facilities to Make Them Accessible to, and Usable by, the Physically Handicapped were then mailed to each of the ten panel members. They were asked to evaluate each of the criterion as "adequate" or "inadequate." If the criterion was rated as "inadequate," they were asked to provide the information or make the necessary change to that

criterion that would in their opinion make it "adequate." A copy of the cover letter that accompanied the instrument is presented in Appendix E.

After each of the panel members had returned the initial set of instruments, they were analyzed to determine the rating of each of the criterion. A percentage was computed for each criterion in order to ascertain the degree of "adequacy" or "inadequacy." For the purpose of this study it was assumed that any criterion receiving a rating of 80 percent or greater was "adequate." Those receiving a rating of less than 80 percent were examined further utilizing the comments and suggestions of each of the panel members to correct the inadequacy.

Upon completion of the revision, the guidelines were again submitted to the panel. Enclosed with the guidelines was a rating sheet (see Appendix F). The panel members were again asked to react to the guidelines. A copy of this document may be found in Appendix G. This ranking was to determine the importance of each guideline area as regards the accessibility and usability of the facility by the physically handicapped. It was determined that since the guidelines would be applicable to renovation and remodeling projects as well as new construction, that ascertaining the relative importance of each guideline area to total facility accessibility and usability would be invaluable in planning a building remodeling or renovation. To ascertain this information, a ranking sheet utilizing a Likert-type scale ranging from one to ten was mailed to each of the panel members. A rating of one was "very unimportant" and a rating of ten was "very important." Upon receiving the rating sheets from the panel members, the sheets were analyzed to determine the modal and mean rating of each of the guideline

areas. The guideline areas were then rearranged in descending order with the guideline area receiving the highest rating at the top.

The presentation and analysis of data are reported in Chapter IV.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

I: INTRODUCTION

The major problem that was investigated in this study was to identify building modifications or equipment that would permit the maximum utilization of a facility by physically handicapped persons and on the basis of this information, develop guidelines for the incorporation of the building modifications or equipment in school construction. The major problem was divided into three subproblems which have been previously identified. The first problem was stated as follows:

Subproblem One

To determine what criteria currently exist and are utilized in other states to plan facilities to accommodate the physically impaired student.

A letter was mailed to the Chief State School Office of each of the 50 states and Washington, D. C., requesting information regarding that state's guidelines used to plan or modify a facility so as to make it accessible to, and usable by, a physically impaired student. Letters were also dispatched to numerous national organizations related to the handicapped or disabled with the same information requested.

Thirty-eight responses were received from the 51 requests initially mailed. Of the 38 responses, 28 provided information that was valuable in the completion of this study. The remaining 10 responses included 7 states or territories that had no provisions for planning facilities to accommodate the physically impaired and 3 states that had redirected the

request to another state agency and as of this writing no response to the follow-up correspondence had been received.

Twenty-four of the 28 states replying in the affirmative used the American National Standards Institute, Inc., guideline A117.1-61. There were two methods of adopting these standards. One was the acceptance of the standard by legislative enactment or more specifically, presenting in legislative session a bill to adopt A117.1-61 as the state guideline. Upon passage of the bill, all that was necessary was to make available copies of A117.1-61 to be distributed to the appropriate people when requested. The other method was to duplicate or reproduce the standards "in toto" and distribute them from the state level, giving credit to ANSI A117.1-61 as the source of the data.

Three respondees, Maine, Kentucky, and Washington, D. C., have guidelines, but they are extremely general and do not elaborate beyond a few lines stating that facilities are to be made accessible to, and usable by, the handicapped.

New York has rather extensive performance criteria, which was developed with the help of a grant from the Vocational Rehabilitation Administration of the United States Department of Health, Education and Welfare. The State University Construction Fund developed these criteria in 1967 as a part of a seminar on Making Facilities Accessible to the Physically Handicapped. Written in narrative form, this document presents standards and dimensions quite similar to those recommended by ANSI A117.1-61. A supplement to the ANSI A117.1-61 is made by including several diagrams. An important difference is that this document makes reference to additional instructional areas (classroom, lecture halls,

and locker rooms), which also need to be considered when planning educational facilities.

In summary, an analysis of the procedures and plans utilized by each of the states responding to the survey revealed that there is similarity between and among the states as regards making facilities accessible to, and usable by, the physically impaired. Frequently, the ANSI Standards A117.1-61 were used as the guidelines. Those states not using this document either have little assistance or guideline information available, or have no standards other than a mention that the facilities should be so equipped.

Subproblem Two

To determine the adequacy of existing guidelines and to modify them so as to make them current, comprehensive, and complete, a questionnaire, Guidelines for Planning Educational Facilities to Make Them Accessible to, and Usable by, the Physically Handicapped consisting of 127 criteria selected from the various guidelines utilized in planning facilities for the handicapped was developed.

The criteria were arranged in two major categories (exterior and interior) with each of these having sub-categories. The exterior sub-categories included site, ramps, walks, parking lots and curbs. The interior criteria were related to entrances, doors, corridors, stairs, elevators, drinking fountains, electrical and mechanical, identification, warning signals, telephones, and sanitary facilities. Those elements considered as special areas of the interior included auditoriums, cafeterias/dining halls, classrooms, gymnasium and physical education.

Transportation, while not an interior area, was nevertheless a special area and was included in this category.

Frequency and percentage of the adequate and inadequate ratings by the panel members were calculated for each of the criterion and are presented in the following series of tables. A copy of the revised guidelines is presented in Appendix G.

Table I reveals that nine out of ten panel members rated the site criterion as adequate.

TABLE I

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR THE SITE CRITERION

Criterion	Adequate	Inadequate	Percentage
The grading and preparation of the site should be such that it attains a level with a normal entrance to the building.	9	1	90

The reaction of the panel members (90 percent adequate rating) suggests that this criterion is correct and is an acceptable statement relative to site preparation. This would also indicate that site preparation is an extremely vital element in the planning of an educational facility. The implications are that through adequate site preparation, it would be possible to eliminate some architectural barriers such as steps, steep walkways and steep ramps.

The comments made by the panel members suggest that the building should be equally accessible from the playground, the physical education

facilities, or any adjacent areas such as shops. The single rating of inadequate was given because this panel member thought the statement was unclear. Subsequent contacts with this particular panel member, however, resolved this rating.

Ramps were regarded by the panel as a very important element in planning facilities so as to eliminate architectural barriers. An examination of the ramp criteria in Table II reveals that 100 percent of the panel members felt that a ramp should be provided if there is a level change from the walkway or parking lot to the building.

Upon further examination, it was noted that two of the criteria were identical (level approach, minimum of 6 feet long and 6 feet of straight clearance at the bottom) and in the final guidelines only one was included (level approach, minimum of 6 feet long). Each of these criterion received an adequacy rating of 100 percent, thus the elimination of the duplication was considered to be justified.

Seven of the ten panel members (70 percent) indicated that a non-skid surface, a minimum of 32 inches wide, should be provided. The three ratings of inadequate all made reference to the ramp's being too narrow. The comments suggested that the ramp be as wide as the entry way.

Additional comments noted that while 32 inches wide is adequate, consideration should be given to the type of railings used. If, for example, concrete were used, there is a danger that a 32 inch wide ramp would not be adequate to avoid skinned knuckles. Thus, a wider ramp would be needed.

TABLE II

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR RAMP CRITERIA

Criteria	Adequate	Inadequate	Percentage
A ramp should be provided if there is a change of level from the walkway or parking lot to the building.	10	0	100
Level approach, minimum of six feet long.	10	0	100
Non-skid surface, minimum of 32 inches wide.	7	3	70
Rest platform a minimum of 4 feet, 6 inches every 30 feet.	7	3	70
Slope no greater than 1:12 or 8.33%.	10	0	100
Handrails on one side, preferably two, 32 inches high measured from the surface and extending one foot beyond the top and bottom of the ramp.	8	2	80
A 5 x 5 foot level platform at the top if a door swings out onto the platform. (3 x 5 foot if the door does not.)	7	3	70
Six feet of straight clearance at the bottom.	10	0	100
Ramps exposed to the elements should be protected by a canopy, or equipped to melt ice and snow.	8	2	80

Seven of ten panel members remarked that a 4-foot, 6-inch rest platform should be provided at 30-feet intervals on the ramp. Two of the three not rating the criterion as adequate expressed the opinion that the rest platform was not essential. The third dissenting member remarked that perhaps the rest area should be larger.

All ten (100 percent) of the experts rated the criterion on slope (no greater than 1:12 or 8.33 percent) as adequate.

As regards handrails, eight out of ten panel members regarded the criterion as adequate. One of those rating the criterion as inadequate questioned the one foot extension (to provide stability). The other expressed concern that the railing was too high for use by all children and suggested that a mid-rail be provided.

Eighty percent (eight of ten) of the panel members reacted that ramps should be protected from the elements by a canopy, or equipped to melt ice and snow. The two members not rating this criterion as adequate related that if adequate snow removal were practiced, no other provisions would be necessary.

Table III presents the data regarding the criterion for planning walks.

It was revealed that at least one entrance without steps should provide access to the facility. Eight of the ten experts rated this criterion as adequate. The two inadequate ratings reflected that more than one such entrance should be planned.

A slope or gradient no greater than 5 percent was judged to be an adequate criterion by 100 percent (ten of ten) of the panel members. Additionally, walks with a gradient of 5 percent (the maximum allowable)

TABLE III

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR WALK CRITERIA

Criteria	Adequate	Inadequate	Percentage
There should be at least one entrance without steps providing access to the facility and including the following:	8	2	80
Slope or gradient no greater than 5%. (Five % gradients must have level rest areas every 60 feet.)	10	0	100
Non-slip surface minimum of 48 inches wide.	9	1	90
Wherever walks intersect other walks, ramps, or driveways, they should blend to a common level.	10	0	100
A walk should have a level platform 5 x 5 feet if a door swings out onto the platform. (3 x 5 feet if the door does not.)	9	1	90
Gratings, man-holes, and similar obstructions should not be located in the walk surface.	9	1	90

should have a level rest area every 60 feet.

The surface of the walkway should be of non-slip material and be a minimum of 48 inches wide as related by nine of ten experts. The lone inadequate rating expressed concern that the walkway surface be wider.

Each of the panel members (100 percent, ten of ten) agreed with the criterion that walks should blend to a common level whenever they intersected with other walks, ramps or driveways.

At those points where a walk has a door swinging onto the platform, having a five foot by five foot level platform was judged as a valid requirement by 90 percent (nine of ten) of the experts. The inadequate rating was given by a panel member who suggested that the platform be six feet square.

Ninety percent (nine of ten) of the panel members agreed that gratings, man-holes, and similar obstructions should not be located in the walk surface. One panel member rated this criterion as inadequate and suggested that if gratings were of special construction, they could be used. The special type construction, however, was not discussed further by this respondent.

Parking lots that have been adequately planned were judged as being extremely important by the entire panel. The ratings as presented in Table IV reflect this concern.

An examination of the table reveals that each of the criterion, with the exception of the one referring to the percentage of spaces to be reserved for the disabled was rated as adequate. To correct the one non-adequate rating the panel member suggested that 5 percent of the

TABLE IV

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR PARKING LOT CRITERIA

Criteria	Adequate	Inadequate	Percentage
Special parking for the disabled should be located as near as possible to the facility served.	10	0	100
Three to 5 percent of the parking bays should be reserved for disabled persons and identified and marked as such.	9	1	90
The bay should be a minimum of 9 feet wide with a 4 foot aisle between every two spaces.	10	0	100
The area designated for the disabled should be designed so that movement behind cars or across lanes of traffic is not necessary.	10	0	100
Ramps should be provided if there is a level change from the parking lot to the adjoining walk.	10	0	100

spaces be reserved for the handicapped.

One of the criterion, however, was found to be inadequate during subsequent research and was changed. A parking bay that was a minimum of nine feet wide and having a four foot aisle was found to be too narrow to accommodate the average width car of today and still allow sufficient space for the occupants to get in and out of the car. Thus, this criterion was modified to read " . . . minimum of 10 feet wide with a 2 foot aisle between every two spaces."

In evaluating the criterion for curbs, the panel members rated two of the three criteria as adequate. The results of this rating are reported in Table V.

The panel members unanimously agreed (100 percent; ten of ten) that pedestrian and vehicular surfaces should be blended to a common level at their points of crossing or intersection.

However, the criterion that suggested that the curb be no more than one inch above the adjacent roadway surface was regarded as inadequate by 60 percent (six of ten) of the panel members. It is significant to note that of the 127 criteria, only 6 of the criteria had ratings of 60 percent or lower. In this particular instance, each of the panel members that rated the criterion as inadequate had the same suggestion for changing the criterion to correct the inadequacy.

The suggestion of eliminating the one inch adjustment between the pedestrian and roadway surface is best explained by one panel member who replied "A one inch high adjustment in surface between a walk and a roadway can prove difficult for some handicapped persons and a tripping hazard for the more able bodied." This expert continued by explaining

TABLE V

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR CURB CRITERIA

Criteria	Adequate	Inadequate	Percentage
At pedestrian crossings, traffic sign junctions, street corners, junctions with vehicle parking areas, and other suitable crossing points, pedestrian and vehicular surfaces should be blended to a common level.	10	0	100
The curb should not be more than 1 inch above the adjacent roadway surface. This may be achieved by ramping the pedestrian surface to the vehicular surface.	6	4	60
For identification, the ramp and curb should be of a color contrasting with the adjacent surface. For the blind, it is advantageous if the ramp and curb have a distinguishing surface texture (e.g., patterned or coarse finish).	9	1	90

that "this feature is sometimes incorporated to control the flow of water along a gutter, but I feel it is not essential if the ramping plane of the walkway intersects the roadway. . . ."

In regard to identification and marking of the curb cut, 90 percent (nine of ten) agreed that the curb should be of a color that contrasted with the adjacent surface. Also, they related that it was advantageous if the ramp or walkway and the curb had a distinguishing surface texture such as a patterned or coarse finish to assist the blind with identification.

The following tables contain the evaluation of those criteria concerned with the interior of the building.

One of the areas of concern in making a facility accessible to the handicapped is the entrance. The criteria as presented in Table VI reflect this concern.

TABLE VI

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR ENTRANCE CRITERIA

Criteria	Adequate	Inadequate	Percentage
At least one primary entrance to each building shall be usable by individuals in wheelchairs, on crutches or wearing braces.	8	2	80
This entrance should be on a level to make elevators accessible.	10	0	100

Eighty percent (eight of ten) of the panel members regarded the criterion requiring that at least one primary entrance to the facility be usable by physically handicapped persons as adequate. The two responses of inadequate expressed a concern that one primary entrance was not sufficient. One response suggested that all entrances be accessible to the handicapped and the other suggested that two entrances be usable by the handicapped because of the possible need for a rapid egress during an emergency.

All of the panel members (100 percent; ten of ten) agreed that the primary entrance should be on a level to make elevators accessible, based on the assumption that elevators are provided in the facility.

One of the main areas of concern in planning for the accessibility of a building is that of doors. Table VII examines the criteria developed as regards doors and doorways.

The criterion that specified a thirty-two inch wide door entry was regarded as inadequate by 50 percent (five of ten) of the panel members. The concern of the five experts marking the criterion as inadequate was that the doorway be wide enough to allow easy passage. Three of the five suggested that the doorway be thirty-six inches wide while the other two specified that the door have a thirty-two inch clear opening, regardless of door width. During the course of this study, it was discovered that the Rules, Regulations and Minimum Standards (1973) of the State of Tennessee require that doorways be thirty-six inches. Normally, a door upon opening will occupy two inches of the width of a doorway. Thus, a thirty-six inch door would allow a thirty-four inch opening. To meet the minimum regulations already in effect in the State,

TABLE VII

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR DOOR CRITERIA

Criteria	Adequate	Inadequate	Percentage
Minimum of 32 inches wide.	5	5	50
Threshold no greater than 3/4 in., no vertical rise more than 1/4 in.	5	5	50
Floor should be level, on inside and outside, for 5 feet in the direction of the door swing.	7	3	70
Kick plates at least 16 in. high of a material or finish to withstand the abuse of crutches, wheelchairs, canes, etc.	9	1	90
Depth between 2 doors (inner and outer) must be a minimum of 6 ft., 6 in. to insure that a wheelchair cannot be trapped between the two.	10	0	100
Handles should not be more than 3 ft., 6 in. from the floors. Horizontal level handles are preferred. Handles on doors opening to danger areas (e.g., boiler rooms, loading platforms, etc.) should be knurled to serve as a warning of danger for the visually handicapped.	10	0	100
All double acting doors should have viewing panels with the lower edge 3 feet from the floor.	9	1	90
Doors with large areas of glass should have markings to avoid accidents.	9	1	90
Pressure required to open the door should not exceed 8 lbs. (5 lbs. preferred).	9	1	90
If automatic door closers are used, a 4-6 second time delay should be provided.	5	5	50

this criterion was modified to read a "minimum of thirty-four inch wide clear opening in the doorway."

Fifty percent of the experts regarded as inadequate the criterion specifying that a threshold be no greater than three-fourths inch. With each inadequate rating, the concern was expressed that the three-fourths inch threshold was too high. Four of the five that marked the criterion as inadequate suggested that the threshold be flush with the floor level. The other suggested that a one-half inch threshold be permitted.

Having the floor level for five feet in the direction of the door swing was determined to be adequate by 70 percent (seven of ten) of the respondents. One of the panel members suggested that the wording was unclear and remarked that the floor should "be level for five feet on both sides of the door opening." The other two responses were given inadequate ratings because these panel members desired a larger (six feet and seven feet, respectively), level area.

Nine of the ten experts regarded sixteen inch kick plates of a mar or scratch resistant material as a desirable feature and marked the criterion as adequate. The inadequate response was accompanied by the comment that "kick plates are not essential if the door material itself resists marring from wheel chairs, canes, etc."

Assuring that a minimum distance of six feet, six inches be provided between two sets of vestibule doors was identified as an adequate requirement by 100 percent (ten of ten) of the panel members.

Ten of ten (100 percent) of the panel members identified horizontal, level handles, no more than three feet, six inches from the floor as a desirable feature of facility accessibility.

Additionally, having doors that lead to danger areas (such as boiler rooms, or stairwells) equipped with knurled handles was regarded as a valuable criterion by all of the panel members (100 percent; ten of ten).

Equipping double acting doors with viewing panels having the lower edge three feet from the floor was regarded as necessary by 90 percent (nine of ten) of the panel members. The inadequate response was given by a panel member who suggested that double acting doors not be used in facilities.

Frequently, pedestrians will not see, and walk into, a glass door. Thus, nine of the ten (90 percent) panel members agreed with the criterion which stated that doors having large areas of glass should utilize markings, such as decals, on the door to help prevent accidents.

It was regarded as significant by 90 percent (nine of ten) of the panel members that the pressure required to open the door should not exceed eight pounds. One panel member remarked that "the pressures required to open a door vary widely and are related to door checks, external wind pressure, and the relative pressure within a building." This expert continued and suggested that perhaps power-assisted doors might be appropriate.

The criterion which specified that "if automatic door closers are used, a 4 to 6 second time delay should be provided" was regarded as adequate by only 50 percent (five of ten) of the panel members. In each instance of disagreement, the length of the time delay was questioned. The panel members objecting to the adequacy of this statement were unanimous, however, in their suggestion that a 10 to 12 second delay

be provided because they said, 4 to 6 seconds is not sufficient time for someone with ambulatory difficulties to successfully negotiate the doorway opening.

Devoting attention to the planning of corridors is essential if the facility is to be fully accessible to, and usable by, the physically impaired. The following criteria (Table VIII) reflect the opinions of the panel members as regards the criteria for planning corridors.

TABLE VIII

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR CORRIDOR CRITERIA

Criteria	Adequate	Inadequate	Percentage
Corridor must be a minimum of 5 feet wide.	9	1	90
Low hanging or projecting fixtures (door closers, fire extinguishers, ceiling lights, exit signs, water fountains, etc.) are a hazard to the visually handicapped and should be avoided. (Minimum of 7 feet is recommended.)	10	0	100
Floors should have non-slip surfaces when possible.	10	0	100
Floors on a given story should be on common level, or connected by a ramp.	10	0	100

In the guidelines, the minimum width of a corridor was established as five feet because this was the minimum width that would allow two wheelchairs to meet and pass each other. It should be noted that the 90 percent response (nine of ten) was acceptable under the assumption

established in this study for determining adequacy of criteria. The one inadequate ranking was given because in the opinion of the panel member, "I believe this requirement may be excessive for interdepartmental corridors not part of the main exiting system and used primarily by staff or limited numbers of students."

The Rules, Regulations, and Minimum Standards of the Tennessee State Board of Education mandate that all corridors be a minimum of six feet wide. Thus, this criterion was changed to comply with these regulations.

The remaining three criteria were given unanimous (100 percent; ten of ten) approval by the panel of experts. Thus, they expressed the concern that low hanging or projecting fixtures be avoided in the corridors and that floors have non-slip surfaces when possible. This non-slip surface may be achieved either as a result of the surfacing material used, or through the application of a commercially available non-slip wax.

While it may seem an insignificant factor, stairs are important in the total accessibility of a facility. Table IX examines the criteria relative to the planning and design of stairs.

Installing stairs that had risers no greater than seven inches, with no projecting nosings was regarded as a necessity by 80 percent (eight of ten) of the panel members. The two panel members who remarked that this criterion was inadequate suggested that the riser height be no greater than six inches.

An integral feature of riser height is tread depth. Forty percent (four of ten) of the panel members marked this criterion as

TABLE IX

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR STAIR CRITERIA

Criteria	Adequate	Inadequate	Percentage
Risers should not exceed 7 inches with no projecting nosings.	8	2	80
Stair tread should be at least 14 inches wide.	6	4	60
Handrails should be 32 inches above the surface. They should be uninterrupted for the full length of the stairs and extend 12 inches beyond the top and bottom step. This extension should not become a hazard itself.	9	1	90
Landings and floor levels should be distinguished from stairs by contrasting color or texture.	10	0	100
All stairways should have a minimum of 25 footcandles of illumination. Handrails diameter whether circular or oval should be 1-3/4 to 2 inches.	10	0	100
Studs or markings on the rail's inner surface assist the blind in becoming aware of the presence of landings or the end of the stairs.	10	0	100

inadequate. It was discovered that tread depth and riser height are interrelated functions and their dimensions are governed by building codes. Therefore, this criterion was omitted from the guidelines.

The criterion concerning handrail height and length was judged as adequate by 90 percent (nine of ten) of the experts. The one inadequate rating was given by a panel member who was concerned that the thirty-two inch height was too high for primary grade children.

Landings and floor levels should be distinguished from stairs by contrasting color or texture. This criterion received unanimous (100 percent) approval of the ten panel members.

In order that the stairwells be adequately illuminated, it was specified that the light level be at least twenty-five foot candles. Additionally, hand rail diameter should be large enough to comfortably grip, but not so large as to provide an insecure hold. Thus, the rails should be one and one-half to two inches in diameter. This criterion was rated as acceptable by all ten (100 percent) of the panel members.

While those in wheelchairs will probably not be negotiating stairs, those with other handicaps, such as the blind, will be utilizing them. To assist them, a criterion was presented which required studs or markings on the rail's inner surface at some point near the landing or near the end of the stairs. The panel unanimously (100 percent; ten of ten) approved this.

In some instances, due to site size, land costs, geographical limitations, or other unforeseen situations, it may be necessary to construct a multi-story facility. It is possible that these same limitations could prohibit site preparation that would allow the building

to be approached at all levels by walks or ramps.

The criteria contained in Table X apply to the including of elevators in multi-story facilities.

The panel members were in agreement (90 percent; nine of ten) that an elevator should be provided in multi-story buildings where access to floors other than the entrance level cannot be reached by ramp or walkway. The inadequate response was given because in the opinion of this panel member "In cases where all educational facilities and resources required by a student are provided on a level accessible to the handicapped and where duplicate classroom or facilities are provided on other than this level, it does not seem appropriate to mandate an elevator."

The criterion relating to elevator size was termed adequate by 100 percent (ten of ten) of the panel members.

The appropriate height of the elevator controls was established at 54 inches in the guidelines and was viewed as adequate by 80 percent (eight of ten) of the panel members. Two of the experts utilized in this study suggested that this be amended to 48 inches. Subsequent research revealed that 48 inches was a more appropriate height and the guideline was revised to reflect this research.

In order that those persons using the elevator be protected from the door closing on them, a sensitive safety edge plus a sensing device to prevent such closing was specified. While the panel members consented (90 percent; nine of ten) that this was a valid requirement, it was discovered that this criterion, unless reworded could lead to some difficulties with installation. This flaw was pointed out also by one of the panel members who reacted by stating that "Each elevator company

TABLE X

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR ELEVATOR CRITERIA

Criteria	Adequate	Inadequate	Percentage
Elevators should be provided in multi-story buildings where access to floors other than the entrance level cannot be reached by ramp.	9	1	90
Cab-size should be a minimum of 5 ft., 1 in. x 5 ft., 6 in. wide.	10	0	100
No control should be more than 54 in. from the floor.	8	2	80
Doors should have a sensitive safety edge plus a sensing device to prevent closing when entering or exiting.	9	1	90
On opening, the doors should remain open at least 8 seconds.	7	3	70
Closing should be 3 to 3-1/2 seconds.	9	1	90
Horizontal rails 36 in. from the floor should be provided.	9	1	90
The interior surface should be of a material resistant to scarring and marring by wheelchairs, crutches, braces, etc.	10	0	100
Elevators should be automatically operated, stop precisely at the floor level and be self-leveling.	10	0	100

provides safety features to prevent door closing when entering or exiting. The safety edge referred to in the guidelines is a proprietory feature of one company and I would suggest substituting an 'either/or' rather than a plus to the section as written." In order to avoid any difficulties with proprietorship, this criterion was modified to read " . . . sensitive safety edge and/or a sensing device. . . ."

The length of time that an elevator door should remain open was presented in the guideline as eight seconds (70 percent; seven of ten) of the panel members marked this as adequate. Of the 30 percent (three panel members) that marked it as inadequate, two suggested that the time span be longer. The third remarked that occasionally the door opening and closing times are set by building codes and that an adjustable time span is a feature of all elevator companies. Additional study suggested that a time span of ten to twelve seconds be used as the criterion.

Ninety percent (nine of ten) of the panel members reacted that a door closing time of three to three and one-half seconds was adequate. The remark made regarding the previous criterion as to opening and closing times being set by building codes was applicable to this criterion.

Requiring horizontal rails, 36 inches from the floor was considered to be an adequate criterion by 90 percent (nine of ten) of the experts used in this study. The inadequate rating was given because this expert was concerned that very small children would not be able to reach the rail. When the revised guidelines were completed, reference was made to the fact that the "users of a facility should be considered and that

some modifications of the revised guidelines to accommodate these persons might be necessary."

The remaining two criteria, specifying that the interior surface of the elevator be mar and scratch resistant and that the elevator be automatically operated and self-leveling were given 100 percent approval by the panel members. The remark was made, however, that in reality, the "interior surface of the elevator cab is a function of aesthetics and is not directly related to accessibility and usability by the handicapped."

In providing for the total accessibility and usability for a facility, drinking fountains should be given some consideration. As presented in Table XI, several criteria were included in the guidelines.

TABLE XI

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR DRINKING FOUNTAIN CRITERIA

Criteria	Adequate	Inadequate	Percentage
Drinking fountains should be set in a recessed area no less than 36 inches wide.	10	0	100
The upper edge should not be more than 34 inches above floor level.	10	0	100
Controls and spouts should be located up front and both hand and foot operated.	9	1	90

Placing a drinking fountain in a recessed area 36 inches wide was regarded as an adequate criterion by each (100 percent; ten of ten) of the panel members, as was the criterion that specified that the

upper edge of the drinking fountain should not be more than 34 inches above the floor level.

Ninety percent of the panel members marked as adequate the criterion which stated that drinking fountains should have controls and spouts located on the front edge of the fountain and be both hand and foot operated. The remark made by the panel member regarding the dual (hand and foot) controls was that it "seems excessive"; however, no other comment was made.

As regards electrical and mechanical criteria, the panel members agreed (more than 80 percent adequate rating) with all of the criteria. Table XII further explains the rating.

TABLE XII

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR ELECTRICAL AND MECHANICAL CRITERIA

Criteria	Adequate	Inadequate	Percentage
Controls for light, fire alarms, and similar devices should be accessible to the handicapped.	10	0	100
In areas to be utilized by the handicapped the electrical outlets should be no less than 18 inches from the floor.	10	0	100
Controls and switches should be 36 inches to 40 inches above the floor.	10	0	100
Switches should have no more than two switches per plate.	9	1	90

The criteria as presented (Table XII) were rated by the panel members as being adequate. However, in order to be consistent with other control heights and serve as some assistance to the blind, the height of the electrical and mechanical controls was modified to parallel these criteria. As regards the one inadequate rating relative to having no more than two switches per plate, the experts commented "the number of switches per plate is a function of design, rather than quantity."

Table XIII reviews the criteria for providing adequate identification for facilities in order to permit those with physical handicaps to be fully mobile and function in the facility.

TABLE XIII

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS OF IDENTIFICATION CRITERIA

Criteria	Adequate	Inadequate	Percentage
Raised letters or numbers should be used to identify rooms or offices. The plaque should be located on the wall on the handle side of the door.	10	0	100
Markings should be 54 to 66 inches (preferably 60 inches) from the floor.	10	0	100

The panel members agreed (100 percent; ten of ten) that raised letters or numbers should be used to identify the various rooms. These markings should be located on the wall, 54 to 66 inches (preferably 60 inches) from the floor on the handle side of the door.

Warning signals are an integral part of planning a facility for total accessibility.

As presented in Table XIV, the panel members rated this criterion as adequate.

TABLE XIV

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR WARNING SIGNALS CRITERIA

Criteria	Adequate	Inadequate	Percentage
Both visual (blinking lights) and audible (horns, bells, etc.), warning signals should be provided throughout the facility.	10	0	100

The installation of both visual and audible signals should be installed in order that all handicapped persons be accommodated. This would ensure that both the blind and the deaf be adequately warned in the event of an emergency.

The panel members rated as adequate (100 percent; ten of ten) the criterion that specified that telephone service should be provided for the handicapped. Table XV reviews the ratings of the remaining criteria.

Each of the criteria listed in this table was rated as adequate by 100 percent (ten of ten) of the panel members. During the course of this study, however, it was determined by contacting the telephone company that telephone equipment which complied with these criteria was not currently available. To modify the criteria so that they could be utilized in providing telephone service for the handicapped the only

TABLE XV

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR TELEPHONE CRITERIA

Criteria	Adequate	Inadequate	Percentage
Adequate telephone service should be provided for the handicapped.	10	0	100
Telephones should be wall mounted with no legs or enclosure to prohibit access. Underside clearance should be at least 30 inches.	10	0	100
Dial should be push button and no more than 39 inches from the floor.	10	0	100
Coin slot should be no more than 36 inches from the floor.	10	0	100
Volume control or amplifier should be incorporated whenever possible.	10	0	100

necessary modification, required the coin slot to be no higher than 48 inches from the floor rather than the 36 inches as specified in the guidelines. Since this 48-inch reach was within the capability of the handicapped and paralleled the other reach specifications used in the guidelines, the modification was made.

The panel members regarded sanitary facilities as extremely important in the total planning of the building as evidenced by the 90 percent (nine of ten) ratings given the guideline criterion which specified that sanitary facilities should be made available to, and usable by, the physically impaired. The following four tables will present the criteria relative to the planning of the various sanitary facilities. (See Table XVI.)

TABLE XVI

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS OF THE CRITERION REQUIRING SANITARY FACILITIES

Criterion	Adequate	Inadequate	Percentage
It is essential that an adequate number of sanitary facilities be made available to, and usable by, the physically impaired.	9	1	90

Ninety percent (nine of ten) of the panel members regarded this criterion as adequate. The one response of inadequate was given because, as the panel member suggested, "You should specify the number, percentage or whatever."

Of the sanitary facilities, the toilet stall generated the most varied response. This can be attributed to the type of training received relative to using the facility. According to the literature, there are two methods for transferring from a wheelchair to the toilet. One is the side-transfer in which the wheelchair is rolled beside and parallel to the toilet, and the person transfers to the seat. The other, and one most frequently utilized according to the experts is the frontal transfer in which the wheelchair is rolled up to face the toilet and the patient transfers to the seat. Because the frontal transfer is the one most often used, this facility was planned to permit this type of transfer. One major reason for not including the design for the side-transfer stall is that at present, one essential piece of equipment that is required for this transfer is available commercially, but as of this writing, had proved to be unreliable. This was determined in

conversations with two of the panel members familiar with this method of transfer. Table XVII reviews the criteria for toilet stalls.

TABLE XVII

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR TOILET STALLS

Criteria	Adequate	Inadequate	Percentage
The sanitary facilities should include one toilet stall that:			
is 39 to 42 inches wide and 58 to 66 inches deep	7	3	70
has an outswinging stall door at least 32 inches wide	8	2	80
has a toilet seat 19 to 20 inches above the floor	7	3	70
has handrails on each side 33 inches high, parallel to the floor, 1-1/2 inch in diameter, with 1-1/2 inches clearance between the wall and the rail, and fastened securely at the ends and the center.	9	1	90

The width of the toilet stall was rated as adequate by 70 percent of the panel members. One panel member related that the stall should be 36 inches wide, while another suggested that it should be 5 feet, 6 inches square. A third authority specified that the stall be 42 inches wide. The revised guidelines now read "is 42 inches wide. . . ."

The second criterion which concerns itself with door width received a rating of 80 percent (eight of ten).

Both of those panel members marking the criterion as inadequate suggested that the thirty-two inch measurement was adequate if it were clarified that the width was to be clear and free of obstructions. Since this was the intention of this criterion, the statement was modified to reflect this suggestion and to read "has an outswinging stall door that provides at least thirty-two inches clear space in the door opening."

The criterion regarding toilet seat height was rated as adequate by 70 percent of the experts. Two of those responding to the criterion as inadequate suggested that the seat height be changed to eighteen inches. The third suggested that "one high and one low" be installed.

Securely fastened handrails located on each side, 33 inches high, parallel to the floor, 1-1/2 inches in diameter, and with 1-1/2 inches clearance between the wall and the rail was rated as an adequate criterion by nine of ten (90 percent) of the experts used in this study. The panel member rating the criterion as inadequate remarked that the height of the rail (33 inches) was too high for children.

The experts agreed that wall mounted urinals were preferred rather than stall urinals. Table XVIII examines the response of the panel members relative to this criterion.

TABLE XVIII

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS OF THE URINAL CRITERION

Criterion	Adequate	Inadequate	Percentage
Wall urinals mounted so that the front rim of the bowl is not more than 19 inches from the floor are preferred rather than the stall urinals.	10	0	100

All of the panel members (100 percent; ten of ten) agreed that this criterion was adequate. Their suggestions were, however, that some statement relative to the flush system of the urinal be included in the criteria. Therefore, a criterion was added that stated "A manual flush system installed no more than 40 inches from the floor should be utilized."

In order that the handicapped be able to practice proper habits of hygiene and grooming, sinks and mirrors should be available to, and usable by, these persons. Table XIX presents the criteria related to sinks, mirrors and dispensers.

A wall hung lavatory basin with a 29-inch clearance between the sink and the floor was regarded as adequate by 90 percent (nine of ten) of the panel members. The inadequate response was accompanied by the comment that the height of the top edge of the lavatory basin was not specified.

However, sinks normally have a 4-inch apron (difference between the top and bottom edge) so that the top edge may be calculated to be 33 inches from the floor.

Insulating drain pipes and hot water pipes under the lavatory to protect the user was regarded as an adequate criterion by 100 percent (ten of ten) of the panel members.

The criterion specifying that self-closing faucets not be used was given an 80 percent rating (eight of ten) by the panel members. The two dissenting ratings were by members who stated that in their opinion self-closing faucets would be adequate and could serve "a function of limiting potential flooding conditions in public washrooms."

TABLE XIX

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR SINKS, MIRRORS, AND DISPENSERS

Criteria	Adequate	Inadequate	Percentage
The lavatory basin should be wall hung, or contained in a counter top with a minimum of 29 in. of clear space between the sink or counter apron and the floor. This clear space should be 18 in. deep (i.e., front edge of sink to the wall).	9	1	90
Drain pipes and hot water pipes under the lavatory should be insulated to protect the user.	10	0	100
Self-closing faucets should not be used. Faucet handles must be easy to manipulate and should clear the adjacent wall by 1-1/2 in.	8	2	80
Hot water faucet on the left and cold on the right should be standard.	10	0	100
Mirrors and shelves should be provided at a height as low as possible, and no higher than 40 in. from the floor measured from the top of the shelf and the bottom of the mirror. A full length mirror starting 2 ft. from the floor is desirable.	10	0	100
Towel racks, towel dispensers, soap dispensers, etc., should be mounted no more than 40 in. from the floor.	9	1	90

Installing the hot water faucet on the left side and the cold water on the right was given unanimous approval (100 percent; ten of ten) by the panel members.

The panel members rated the criteria stating that "mirrors and shelves be no more than 40 inches from the floor measured from the top of the shelf and the bottom of the mirror" as adequate, with 100 percent (ten of ten) of the members concurring.

Towel racks, towel dispensers, soap dispensers, etc., should be mounted no more than 40 inches from the floor. Ninety percent (nine of ten) of the experts shared this rating. The rating of inadequate was accompanied by a comment which stated that these accessories "should be lower for small children."

In order for a set of guidelines for planning an educational facility be comprehensive, it must address those areas that are particularly applicable to school construction. Such areas include the auditorium, cafeteria, gymnasium, laboratories, and library. Also, some attention should be given to the problem of transporting the handicapped to the facility. The following section of this writing presents the guidelines relative to these special areas.

The considerations for making an auditorium accessible to, and usable by, the handicapped are presented in Table XX.

The panel members were in unanimous (100 percent; ten of ten) agreement that a reserved area should be planned to accommodate those handicapped that are wheelchair bound. This area should be an unobstructed space rather than special seating.

TABLE XX

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR AUDITORIUM CRITERIA

Criteria	Adequate	Inadequate	Percentage
A reserved area or areas should be planned to allow chairbound people to remain in their wheelchairs.	10	0	100
The space provided for each chair should be 4 ft., 9 in. x 3 ft., 0 in.	9	1	90
Care must be exercised so that the view of those people seated behind is not obstructed.	10	0	100
Consideration must be given to arrangements made for the chair bound so as to minimize obstruction of possible escape routes.	10	0	100
Provisions should be made that earphones can be plugged into sound amplifying equipment, or the facility should be frequency modulated and induction coil looped so that the hard of hearing may benefit from the improved reception.	10	0	100

Ninety percent (nine of ten) of the experts used in this study rated an area four feet, nine inches by three feet as adequate to accommodate the wheelchair. The inadequate response was accompanied by a comment which suggested that "perhaps the space might be wider."

When planning space to accommodate the chair-bound, care must be taken to ensure that the view of anyone seated behind this area is not obstructed. This criterion was given an adequate response by all (100 percent; ten of ten) of the panel members.

Providing possible escape routes for the chair-bound during an emergency becomes particularly important when one considers that an obstruction such as a wheelchair would be extremely hazardous to those able-bodied persons attempting to exit. This consideration was regarded as important by the panel members who were in total agreement (100 percent; ten of ten) that proper planning be exercised.

One-hundred percent of the experts (ten of ten) remarked that provisions should be made to plug earphones into sound amplifying equipment or the facility should be either frequency modulated (FM) or induction coil looped so that the hard of hearing may be accommodated.

The criteria which required that the handicapped be able to obtain food without special services, segregated facilities or the necessity of traveling through the kitchen area was judged as adequate by 100 percent (ten of ten) of the members of the panel (see Table XXI).

It is significant to note that each of the criterion in Table XXI received unanimous approval of the panel members.

Thus, an adequately planned cafeteria/dining hall could accommodate the handicapped by providing: (1) a serving tray slide at the standard

TABLE XXI

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR CAFETERIA/DINING HALL CRITERIA

Criteria	Adequate	Inadequate	Percentage
The handicapped should be able to obtain food without special services, segregated facilities or the necessity of traveling through the kitchen area.	10	0	100
The serving tray slide can be the conventional height of 34 inches.	10	0	100
Should a control railing exist, there should be a 34 inch space between the rail and the serving tray slide.	10	0	100
Self-service beverage or water faucets should be of the type permitting the glass to rest on the counter while being filled.	10	0	100
Dining tables should have a 30 inch clearance from the underside of the table top to the floor.	10	0	100

height of thirty-four inches; a thirty-four inch aisle space between any control rail and the serving tray slide; (3) a beverage dispenser of the type that permits the glass to rest on the counter while being filled; and (4) dining tables that have a thirty-inch clearance between the underside of the table top or eating surface and the floor.

Table XII presents the ratings of the criteria for planning classrooms. Each of the criteria was given approval by all (100 percent; ten of ten) of the panel members.

In addition to the attention normally exhibited in planning a comfortable classroom atmosphere such as including general thermal, visual, acoustic, and aesthetic controls, it is particularly important

TABLE XXII

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS OF CLASSROOM CRITERIA

Criteria	Adequate	Inadequate	Percentage
A minimum of 70 footcandles of illumination should be provided.	10	0	100
F. M. and induction coil loop for the hard of hearing should be provided.	10	0	100
Both bells and flashing lights to signal in the rooms should be provided.	10	0	100
Acoustic control by using carpet and/or ceiling tile is essential.	10	0	100
A diagnostic and testing room of approximately 400 square feet should be available in the facility.	10	0	100

that a minimum of 70 footcandles of lighting be provided. The suggestion was made by panel members that supplemental task lighting for desk tops, chalkboards, and study carrels also be made available in the classroom.

Frequency modulated and/or induction coil loops to permit the hard of hearing to use amplification equipment was also regarded as an adequate requirement for classroom planning.

Signals in the classroom such as those utilized to denote class or activity changes, or identify emergencies should eminate from both audible (bell, horn) and visual (light) systems in order to accommodate those with hearing or sight difficulties.

Acoustical control could be achieved through the installation of carpet or ceiling tiles. In some classroom areas, ceramic art for example, it is inappropriate to install carpet, although acoustic control is still required, thus properly engineered ceiling tiles could be used for sound control.

One of the primary prerequisites in an effective program of providing for the handicapped is the identification of those students to be classified as physically impaired. To assist with this identification, the panel members were in unanimous (100 percent; ten of ten) agreement that a diagnostic and testing room of 400 square feet be available in any educational facility. This room should attempt to provide as optimal an environment for testing as is possible to include thermal, visual, acoustical and aesthetic treatment.

Gymnasium and physical education spaces require some consideration. However, the panel members were in unanimous agreement that the modifications for physical education are of degree of involvement rather than type of activity (see Table XXIII).

TABLE XXIII

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS OF GYMNASIUM CRITERIA

Criterion	Adequate	Inadequate	Percentage
Spaces should be provided in a gym for modified or adapted physical education activities. These adaptations are mostly of degree of involvement rather than type of activity. Modified equipment will normally be usable in the gymnasium utilizing the existing facilities.	10	0	100

The panel members also agreed that any modified equipment that was required could be used in the gymnasium utilizing the existing facilities and would not necessitate a facility modification.

Swimming pools, when installed at schools, are an excellent means of providing exercise for some of the physically impaired. Requiring few modifications, Table XXIV, this facility accommodates a wide range of the physically handicapped.

TABLE XXIV

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR SWIMMING POOL CRITERIA

Criteria	Adequate	Inadequate	Percentage
Access should be provided to the shallow end of the pool by means of steps with handrails, or a sloping ramp.	8	2	80
The pool deck surface should be of a non-slip material.	10	0	100
The dressing room should have a aisle area a minimum of 36 inches wide.	8	2	80

The panel members rated as adequate (80 percent; eight of ten) the criterion which specified that access to the pool should be provided in the shallow end of the pool by means of steps with handrails or sloping ramp. Their comments suggested, however, that the shallow end of the pool was not necessarily the best point of entry. Thus, in the final quidelines, the phrase "in the shallow end" was omitted.

A non-slip pool deck surface was an adequate requirement as judged by all of the panel members (100 percent; ten of ten).

A 36-inch aisle in the dressing area was considered inadequate (70 percent; seven of ten) by the experts. This criterion was modified in the revised guidelines to have an aisle width of 60 inches, the measurement suggested by the panel members.

The shower normally installed in the physical education locker room will not accommodate a physically impaired person. The modifications reviewed in Table XXV are necessary for a handicapped person to shower properly.

The experts agreed (100 percent; ten of ten) that each shower room should contain two specially designed shower cubicles (one each with right and left seats).

The seats should be 19 to 20 inches from the floor (the height of a wheelchair seat) and should be hinged so they can be folded against the wall when not in use. A rating of 80 percent (eight of ten) was given this criteria. The two panel members who responded "inadequate" to this criterion provided assistance by further including specifications for this piece of equipment. Thus, the criterion was clarified by the addition of this description: "The seat should be 14 inches wide, extend the full three-foot length of the shower cubicle and turn the corner for at least 8 inches."

A suitably drained shower cubicle three feet by three feet, with a non-slip floor was given an adequate rating by 90 percent (nine of ten) of the experts. The one rating of inadequate included a comment which suggested that the cubicle be enlarged by one foot.

TABLE XXV

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR SHOWER CRITERIA

Criteria	Adequate	Inadequate	Percentage
Every shower room should contain 2 specially designed shower cubicles. One with a seat on the left cubicle wall, the other with the seat on the right. The seat should be opposite the shower head.	10	0	100
Seats should be 19 to 20 in. from the floor and hinged so they can be folded back against the wall when not in use.	8	2	80
The cubicle should be 3 ft., 0 in. x 3 ft., 0 in., suitably drained, and have a non-slip floor.	9	1	90
The splash curb at the threshold should not exceed 2 in. in height.	8	2	80
A horizontal rail or grab bar circling the cubicle and securely attached to the cubicle wall so that it is 10 to 12 in. above the seat is desirable.	9	1	90
Wrist-type handles for water control should be used.	10	0	100
Soap tray should be 40 in. from the floor.	9	1	90
The water temperature must be thermostatically controlled to a temperature at the supply point of 100° to 120°, giving a temperature at the delivery point of approximately 105°.	9	1	90

Eighty percent (eight of ten) of the panel members agreed with the criterion stating that splash curb height be no greater than 2 inches. The two panel members who disagreed with this statement suggested that no splash curb exist.

A horizontal rail or grab bar circling the cubicle and securely attached to the wall was considered a requirement by 90 percent (nine of ten) of the experts. The one negative (inadequate) response was accompanied by a comment which suggested that perhaps "A vertical bar should be included also."

Wrist-type handles for water control should be used. All of the experts (100 percent; ten of ten) agreed with this criterion.

The requirement that the soap tray be 40 inches from the floor was rated as adequate by 90 percent (nine of ten) of the panel members. It was suggested by one expert that this height might be too high for children.

In the guidelines, the experts agreed (90 percent; nine of ten) with a statement that the water temperature must be thermostatically controlled to a temperature at the supply point of 110° to 120°, giving a temperature at the delivery point of approximately 105°. The comment was made that while this was a safe temperature, it was not comfortable. Further research determined that an alternative method of safely controlling water temperature was to install anti-scald valves on the showers. These valves are commercially available. Additionally, it was suggested that a flexible hose be installed to allow the user to test the water temperature prior to beginning the shower.

Assuming twenty-five stations per laboratory, 1 percent or at least one student station should be provided to accommodate handicapped students according to 90 percent (nine of ten) of the panel members (Table XXVI).

TABLE XXVI

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS FOR LABORATORY CRITERIA

Criteria	Adequate	Inadequate	Percentage
Student stations (1%, or at least one) should be designed to accommodate the handicapped.	9	1	90
The underside of the work surface must be clear 30 inches from the floor and 18 inches deep, with a width for knee space of 28 inches.	10	0	100
Faucets and outlets at these stations should be side-mounted rather than rear-mounted.	10	0	100
A slightly larger than normal wing-type handle for the water and gas faucets should be provided.	10	0	100
Aisles should be a minimum of 36 inches wide.	9	1	90

Although the requirement which specified that at least one student station per laboratory accommodate the handicapped was rated as adequate by the panel members, several comments were included with the ratings. One panel member related, "I would recommend that the number of student stations required be determined best upon statistical occupancy, or more appropriately, that all stations be designed with some

degree of flexibility to accommodate the essential needs of the handicapped." Another member remarked that 5 percent of the stations should be so designed.

The panel members all (100 percent, ten of ten) concurred with the criteria which described student stations. These criteria specified that the underside of the work surface must have a 30-inch clearance from the floor, be 18 inches deep and have a knee space 28 inches wide. The faucets and utility outlets at these stations should be side-mounted rather than rear-mounted and be equipped with wing-lever handles.

The aisle should be a minimum of 36 inches wide to allow for easy access, according to 90 percent (nine of ten) of the experts. The suggestion was made that this 36-inch wide aisle space be unobstructed by chairs, stools, or equipment.

With the increased use of new methods of communication such as radio, television, tape recordings, films and filmstrips, the library has become more than a place to store and safeguard books. Instruction today involves independent research and study utilizing new communication methods. The library then must be a place that will allow all students the opportunity to explore and seek information. The panel members' rating of the criteria for planning such libraries are presented in Table XXVII.

Seventy percent of the panel members agreed that aisle space between book stacks in the library should be four feet wide. Those members rating this criterion as inadequate, however, were divided in their reasons for the inadequacy. One of the experts suggested that the minimum width be increased to five feet, while another suggested that

TABLE XXVII

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS OF LIBRARY CRITERIA

Criteria	Adequate	Inadequate	Percentage
The aisle between the stacks should be 4 ft. wide.	7	3	70
One percent of the study carrels should be accessible to the handicapped.	8	2	80
Tables and study carrels should have a minimum of 30 in. clear space between the underside of the work surface and the floor.	10	0	100
Provision should be made for soundproof booths or study carrels where the blind and hard of hearing may use tape recorders, A. V. equipment, etc.	10	0	100
Bookshelves must not be higher than 6 ft., 0 in. or lower than 9 in. above floor level. Preferred levels are not higher than 5 ft., 9 in. or lower than 1 ft., 3 in.	9	1	90
Card catalogues and dictionary stands should be on bases 20 in. from the floor.	7	3	70

four feet was excessive. The third simply said it was "too expensive" and did not elaborate.

The requirement that 1 percent of the study carrels be accessible to the handicapped also elicited mixed response (70 percent; seven of ten). One of those who rated the criteria as inadequate remarked "that all stations be designed with some degree of flexibility to accommodate the needs of the handicapped." Another suggested that 2 percent of the carrels be so designed. A third remarked that all of the carrels should be accessible.

The panel members were in total (100 percent; ten of ten) agreement that the tables and carrels should have a minimum of 30 inches clear space between the underside of the work surface and the floor.

Providing either sound proof booths or study carrels where the blind or hard of hearing could use tape recorders or other audio visual equipment was viewed as an adequate requirement by all (100 percent; ten of ten) of the panel members.

Ninety percent (nine of ten) of the panel agreed that bookshelves should be no higher than 6 feet or no lower than 9 inches above floor level. The comment made by the expert who marked this criterion as inadequate was significant in that it was suggested to modify the phrase to read, "Bookshelves 'commonly used by the students'. . . ." This would not require that the storage rooms, normally accessible to the librarian or an assistant, accommodate the handicapped.

The experts regarded 20-inch height for card catalogues and dictionary stands as inadequate (70 percent; seven of ten). The three persons reacting that the requirement was inadequate all suggested

that 30 inches was a more appropriate height.

Table XXVIII presents data relative to the criteria for transporting the physically impaired. One of the panel members marked the criteria as adequate but had the following observation: "The Department of Transportation is involved in a number of research projects with respect to the design of buses usable by the handicapped. . . . I believe that this section is inappropriate and should perhaps come under another jurisdiction." For the purpose of this study, however, the data in Table XXVIII are included.

The criterion stating that school buses were satisfactory for transporting ambulatory or semi-ambulatory persons was regarded as inadequate (70 percent; seven of ten adequate) by the panel members. The suggestion was made that the word "some" should be inserted in front of the word ambulatory to modify the phrase to read " . . . transporting 'some' ambulatory or semi-ambulatory persons."

The experts were in agreement (100 percent; ten of ten) that appropriately engineered vans or compact buses (i.e., have open interiors) were an efficient means of transporting those who have difficulty in boarding regular vehicles. Forty-eight inch wide double doors on the side and rear of the van or compact bus were regarded as an adequate requirement by 90 percent (nine of ten) of the panel members. The question was presented by one expert that perhaps the including of both side and rear doors was unnecessary.

Equipping the van or compact bus with a hydraulic lift and platform was considered necessary by 70 percent (seven of ten) of the panel members. Each of those reacting negatively to this criterion

TABLE XXVIII

FREQUENCY AND PERCENTAGE OF ADEQUATE AND INADEQUATE RATINGS OF TRANSPORTATION CRITERIA

Criteria	Adequate	Inadequate	Percentage
School buses are satisfactory for transporting ambulatory or semi-ambulatory persons.	7	3	70
Vans and compact buses with open interiors have been found to be an efficient means of facilitating the transporting of those in wheelchairs and those who have difficulty in boarding regular vehicles.	10	0	100
The front-engine van is best suited for transporting the severely disabled.	9	1	90
Double doors on the side and rear of the van providing an unobstructed entrance at least 48 in. wide are essential.	9	1	90
The van should be equipped with hydraulic lifts having a platform a minimum of 28 x 51 in., lift capacity of 700 lbs., and equipped with a fold down ramp.	7	3	70
Brackets for attaching safety belts and wheel clamps to secure the wheelchairs and individuals should be attached to the interior wall of the vehicle.	9	1	90

remarked that 28 inches was too narrow for the lift platform and that the platform should have a tapered or sloped front edge. The revised guidelines were modified accordingly.

Panel members concurred (90 percent; nine of ten) that brackets for securing the chairs should be attached to the interior wall of the vehicle. It was assumed, but not stated, in the original guidelines that wheelchair bound persons would remain in their chairs while being transported. One authority had several remarks which clarified this criterion and were included in the revised guidelines. The criterion thus reads "wheelchair patients should be transported while seated in their chairs. Seating for them should be arranged so that they face the front of the van."

Subproblem Three

To determine what priorities exist as regards building modification and equipment. What are most important? What are the least important?

Using the revised guidelines (see Appendix G), the twenty-four guideline areas were submitted to a panel of ten recognized authorities. Six of the members of the panel were Special Education teachers and professors. One was an architect nationally recognized as a designer of facilities for the handicapped. One was a nationally known consultant in the area of wheelchair mobility. One member was a governmental consultant specializing in the elimination of architectural barriers and held office in a national organization for disabled veterans. The tenth member was employed by the Tennessee State Department of Education and was a well-known consultant on planning facilities for the handicapped.

Utilizing a ten-point Likert-type scale, the members of the panel were asked to rate each of the guideline areas used in the revised guidelines as to the importance of that area in the accessibility and usability of an educational facility.

Ratings assigned to the twenty-four guideline areas of the revised guidelines by each of the panel members are presented in Table XXIX. The mode and mean rating of each area was also calculated and appears in the table. On the basis of the mean rating, the guideline areas in each of the three major categories were placed in rank-order, highest to lowest as they appear in the table.

It was not the purpose of this data to provide the basis for a complicated statistical analysis, but rather to provide an index of the relative importance of each guideline area to the accessibility and usability of a facility. Therefore, no statistical analysis of the data was conducted other than obtaining a mode, a mean, and ranking each of the twenty-four guideline areas.

Assuming a rating of 5.5 to be the mid-point of the scale, and the equivalent of a neutral (i.e., neither important or unimportant) rating, it is significant to note that none of the guideline areas has a rating of less than 7.6. Thus, the data would indicate that the panel members regard each guideline area as important or very important. An analysis of the modal ratings reveals that twenty-one of the twenty-four guideline areas had a modal rating of 10. One guideline area was bi-modal (8 and 10) and two had a mode of 8. From these data, it could be inferred that the experts used in this study rate each guideline area as important or very important.

TABLE XXIX

RATINGS OF EACH PANEL MEMBER, MODE AND MEAN RATINGS OF THE TWENTY-FOUR GUIDELINE AREAS

Guideline Area	Panel Member										Mode	Mean
	1	2	3	4	5	6	7	8	9	10		
Exterior												
Ramps	10	9	8	10	10	10	9	10	10	10	10	9.6
Walks	8	8	8	10	8	10	8	8	10	10	8	8.2
Site	4	7	10	10	8	10	7	10	10	10	10	8.6
Parking Lots	8	6	8	10	10	10	9	3	10	10	10	8.4
Curbs	10	6	9	10	10	10	5	8	10	10	10	7.8
Interior												
Sanitary Facilities	10	10	9	10	10	10	9	10	10	10	10	9.8
Entrances	10	10	10	10	10	10	8	9	10	10	10	9.7
Doors	10	10	9	10	10	10	8	8	10	10	10	9.5
Elevators	10	8	8	10	10	10	9	7	10	10	10	9.2
Warning Signals	9	8	9	10	8	10	8	5	10	10	10	8.7
Identification	9	8	8	10	8	10	8	5	10	10	8/10	8.6
Drinking Fountains	8	8	7	10	5	10	7	9	10	10	10	8.4
Corridors	7	8	8	10	6	10	7	6	10	10	10	8.2
Telephones	5	8	9	10	10	10	8	2	10	10	10	8.2

TABLE XXIX (continued)

Guideline Area	Panel Member 1	2	3	4	5	6	7	8	9	10	Mode	Mean
Electrical and Mechanical	6	8	8	10	5	10	8	7	10	8	8	8.0
Stairs	10	8	7	10	5	10	4	4	10	8	10	7.6
Special Areas												
Fire Protection	10	10	10	10	10	10	10	10	10	10	10	10.0
Transportation	10	10	9	10	10	10	9	10	10	10	10	9.8
Classrooms	7	10	10	10	10	10	9	9	10	10	10	9.5
Cafeteria/Dining	7	10	8	10	10	10	8	10	10	10	10	9.3
Laboratories	8	9	9	8	10	10	7	10	10	10	10	9.1
Libraries	6	10	8	10	10	10	8	7	10	10	10	8.9
Gymnasiums and Physical Ed.	5	10	8	10	10	10	7	8	10	10	10	8.8
Auditoriums	4	10	8	5	10	10	7	8	10	10	10	8.2

It is interesting to note of the three guideline areas with a mode of less than 10, none of these areas had the lowest or second lowest mean rating.

Fire protection had the highest mean (10.0) and stairs (7.6) the lowest. Ten of the twenty-four areas had mean ratings of 9.0 or higher, twenty-two had ratings of 8.0 or higher and all twenty-four were rated 7.6 or higher.

Chapter V examines the Guidelines for Planning Educational Facilities to Make Them Accessible To, and Usable By, the Physically Handicapped.

CHAPTER V

GUIDELINES FOR PLANNING EDUCATIONAL FACILITIES TO MAKE THEM ACCESSIBLE TO AND USABLE BY, THE PHYSICALLY HANDICAPPED

I. INTRODUCTION

The purpose of this chapter is to present the guidelines as they were developed in this study. The criteria as they are presented in this narrative form are intended to be used as a guide in planning educational facilities to make them usable by the physically impaired. It should be recognized that it is extremely difficult to provide a facility that will accommodate every possible type of physical impairment. The problem of providing for individual differences in body sizes without any handicap is a very real one. Thus, it is particularly important that the potential users of a facility be considered during the planning process. For example, if a facility is to be used by younger and smaller children, such elements as sanitary facilities, handrails, and drinking fountains should be modified to accommodate the user.

A check list form of these guidelines is presented in Appendix G.

II. EXTERIOR

Site

One of the methods of providing easy accessibility is through adequate site preparation. At least one primary entrance to the facility

should be at grade level with little or no use for ramps. In multi-story facilities, this entrance should be located on a floor serviced by an elevator.

Ramps

Ramps should be provided for the handicapped where it is not possible to develop a primary entrance at grade level. This should include provision for the handicapped to approach buildings from parking lots on levels different from the building entrance level.

The ramp should be a minimum of 32 inches wide if it is for wheelchair traffic only. Otherwise, the ramp should be the same width as the entry way. The surface of the ramp should be constructed of a non-slip material. Should the ramp exceed 30 feet in length, a rest platform should be provided. This rest area should be ramp width and at least 4 feet, 6 inches long.

A level approach to the ramp at least 6 feet long is required. At the point where the ramp enters the building, there should be a level platform to accommodate traffic, permit easy access and egress and provide a rest area for wheelchair bound persons. This platform should be a minimum of 5 feet x 5 feet or allow at least 1 foot clearance beyond the door swing.

Handrails, 32 inches high should be provided on each side of the ramp and should extend 1 foot beyond the top and bottom of the ramp. For smaller children, a midrail should be provided at approximately 19 to 21 inches from the floor.

The gradient of the ramp should not exceed 1:12 or 8.33 percent. While steeper slopes are negotiable, they require some additional provisions, such as a 30-inch wide "wheelchair lane," with a 2 inch-high curb, 4 inches wide to allow for emergency braking by turning the wheel of the chair into the curb, much as one parks a car on a steep hill.

Should the ramps be exposed to the elements, a covered canopy and/or built-in snow melting device should be provided to prevent the ramp surface from becoming slippery and hazardous.

Walks

There should be at least one primary entrance without steps providing access to the facility.

The slope or gradient of this surface should not exceed 5 percent or 1:20. In the event that the walk gradient is 5 percent for 60 feet or more, a rest platform 4 feet, 6 inches long should be provided every 60 feet. The surface should be a non-slip material and be a minimum of 48 inches wide.

At those points where a walk intersects other walks, ramps or driveways, the walk should blend to a common level with surrounding surfaces. This does not include major arteries of automobile traffic.

At the entrance of the building, there should be a level platform, allowing a minimum of 5 feet x 5 feet or allow at least 1 foot clearance beyond the door swing.

In order to achieve maximum independence, the handicapped person should be offered every opportunity to move unhindered along key routes. To assist this, gratings, man-hole covers, raised or wide joints in the

walk surface, gravel or cobble stone surfaces, or materials that become slippery when wet should not be included as a part of the walk construction.

Parking Lots

Special parking privileges are normally extended to persons with temporary or permanent disabilities. These parking spaces should be located as close to the facility as possible. While the number of spaces reserved for the disabled would certainly be variable, it has been found that 5 percent is usually adequate. These reserved spaces must be identified to make them available for their intended use.

Another consideration is to make certain that the physically impaired do not have to travel behind parked cars or across lanes of traffic. While parallel parking at the curb adjacent to the destination point is most desirable, it is not always feasible.

In the event that parking bays are required, it is necessary that adequate room be provided for getting in and out of the vehicle. By designing parking bays 10 feet wide and providing an aisle 2 feet wide between every two spaces, the possibility of a handicapped person's having to travel through lanes of traffic or behind parked cars is reduced.

The walkway to the destination point should be at parking lot level, ramped, or properly curbed to provide easy access to neighboring areas.

Curbs

At pedestrian crossings, traffic sign junctions, street corners, intersections with vehicle parking areas, and other suitable crossing points, pedestrian and vehicular surfaces should be blended to a common level. The curb should be flush with the adjacent roadway surface. This may be achieved by sloping the pedestrian surface to the vehicular surface. The curb should be painted a contrasting color with that of the adjacent surface to provide easy identification.

For the blind, it is advantageous that the ramp and curb be constructed of a distinguishing surface texture such as patterned or ribbed finish.

III. INTERIOR

Entrances

At least one primary entrance to the facility should be usable by those individuals with handicaps, including those who are wheelchair bound, those suffering from temporary disabilities (broken arms, legs, post-operative, etc.) and those with other physical impairments. It is important that this entrance be accessible to elevators should the building be multi-story.

Doors

Doors constitute an element of extreme importance in making certain that a facility is accessible to and usable by the handicapped. While important to all with mobility problems, they are of particular concern to those in wheelchairs or on crutches.

All doors to be used by the handicapped should provide a clear minimum opening of 34 inches wide. Should the entrance be at an angle, the clear opening would need to be larger. There should be a level approach extending 5 feet in the direction of the door swing or extending at least 1 foot beyond the door swing.

The threshold should be flush if possible, but no higher than 3/4 inches and have no vertical rise greater than 1/4 inch. This will allow easy access and egress and present few problems to the wheelchair bound.

While double acting doors are not considered desirable, in the event they are provided, a viewing panel should be present with the lower edge of the panel 36 inches from the floor. If the door is largely glass surface, it should be marked so as to prevent accidentally walking into or through it.

Kick plates at least 16 inches high, of a material or finish hard and durable enough to withstand the abuse of crutches, wheelchairs, and braces should be an integral part of the door design.

The force required to open a door should not exceed 8 pounds.

Should automatic door openers and closers be installed, 10 to 12 seconds between opening and closing action is required.

Handles should not be more than 3 feet, 6 inches from the floor. Horizontal level handles are preferred, although large serrated door knobs may also be utilized effectively. Doors opening to danger areas (e.g., boiler rooms, loading platforms, or stairwells) should be knurled to serve as a warning to those who are visually handicapped.

Revolving doors present an insurmountable obstacle to wheelchair users and users of crutches and canes. Those with visual handicaps

experience extreme difficulty in negotiating this type of door also. Therefore, no revolving doors should be incorporated in building designs.

In some facilities, two sets of doors are used at the entrance. When these are planned, there must be a minimum of 6 feet, 6 inches between the inner and outer doors of the vestibule to insure that a wheelchair bound person cannot be trapped.

Doors should be recessed whenever possible and not open directly into the path of hall traffic.

Corridors

A corridor must be a minimum of 6 feet wide, which allows two wheelchairs to pass each other in a head-on direction. Non-slip flooring surfaces should be used. Some waxes or polishes have ingredients which help to make them slip resistant. This is particularly important when tile floors are used.

Floors should be on the same level, or connected by a ramp. Such design features as level changes are aesthetically quite pleasing but present serious obstacles to those with mobility problems.

Low hanging or projecting fixtures such as door closers, fire extinguishers, ceiling lights, exit signs, water fountains, and lockers present hazards to all, but particularly the visually handicapped and should be avoided.

Stairs

Local construction codes should be consulted regarding the tread depth - riser height ratio, when designing stairs. Risers should not exceed 7 inches in height and should have no projecting nosings, as

these present hazards to those with mobility difficulties.

A minimum of 30 footcandles of illumination should be provided. Landings mid-way between floor levels are helpful for those requiring a rest stop during ascent or descent.

Handrails should be 32 inches above the surface and should continue uninterrupted for the full length of the stairs. The rail should also extend 12 inches beyond the top and bottom of the stairs, but this extension should not become a hazard in itself. The diameter of the handrail should be 1-1/2 to 2 inches and be mounted at least 1-1/2 inches from the wall surface. Recessed railings are not desirable and should be avoided. Handrails should be provided on both sides of the stairs whenever possible, so as to be accessible to all users.

Studs or markings on the rails inner surface assist the blind in becoming aware of the presence of landings on the end of the stairs. These markings should be designed so that they do not become hazards themselves.

Elevators

An elevator as an integral feature of a multi-story facility is a reasonable design assumption, quite separate from the specific needs of the handicapped. For the handicapped, however, an elevator is an essential requirement. The level normally used as an entrance into the building should be served by the elevator, as should all other levels that could feasibly be used by the typical building occupant.

Elevators should operate automatically and stop precisely at floor level. Elevator doors that open and close automatically must be

equipped with a pressure-sensitive safety edge or should have a photo-electric cell mechanism to prevent the doors closing when the door opening is in any way obstructed.

On opening, the doors should remain open for 10 to 12 seconds. The closing times should be 3 to 3-1/2 seconds.

The interior cab size should be a minimum of 61 inches x 66 inches. This space will allow a wheelchair to turn around inside. At the entrance to the elevator, a 5 feet X 5 feet, level, unobstructed area should be provided.

Horizontal rails approximately 32 inches above the floor are helpful to those using the elevator. The interior surfaces should be constructed of material resistant to scratching and marring by wheel-chairs, crutches, braces, and prosthetic devices.

The call buttons in the elevator lobbies should be centered at approximately 40 inches above the finished floor.

The operating panel should be centered 40 inches from the floor and utilize buttons that are illuminated and project from the panel board. Additionally, these buttons should be marked with raised or engraved identification adjacent to the button. A PUSH-TO-STOP emergency button raised from the panel should be included. No control button should be higher than 48 inches.

Heat sensitive control buttons should not be used, as all handicapped persons cannot utilize them.

Drinking Fountains

A drinking fountain should be located on each floor in a recessed area no less than 30 inches wide to provide easy access and yet not be a hazard.

The upper edge of the fountain should not be more than 34 inches from the floor. The controls and spouts should be located at the front of the fountain and be both hand and foot operated. The drinking spout should point parallel to the front edge of the fountain.

In the event that special fountain arrangements cannot be provided, a paper cup dispenser should be made available. In such a case, adequate trash disposal must be provided.

Electrical and Mechanical

Controls for lights, fire alarms and similar devices should be accessible to and usable by the handicapped. These controls and switches should be 36 to 40 inches above the floor.

In areas utilized by the handicapped, electrical outlets should be no less than 18 inches above the floor.

There should be no more than two switches per plate. Each of these should be simple and positive action. A push-pad clipped over the switch permits easy operation for forearm or elbow. A large push button is also convenient for those with finger and hand disabilities.

Identification

Raised or notched letters or numbers should be used to identify rooms. The identification plaque should be 54 to 60 inches from the floor and located on the wall adjacent to the handle-side of the door.

Panic hardware bars should be marked with embossed tape, in braille, to indicate the place to which the door leads.

Warning Signals

Both visual and audible signals should be provided throughout the facility. A separate system easily distinguishable from the signals normally used to denote activity or class changes should be used as an emergency warning system.

Telephones

An adequate number of telephones should be provided. The instrument should be wall mounted with no legs or enclosure to prevent access. Underside clearance between the bottom of the instrument or shelf and the floor should be at least 30 inches. The dial should be push button if possible and no more than 39 inches from the floor. The coin slot should be no more than 48 inches from the floor. Whenever possible, an amplifier or volume control on these phones should be provided for the hard of hearing.

A phone mounted to these specifications also serves small children quite well.

Sanitary Facilities

It is essential that an adequate number of sanitary facilities be made available to and usable by the physically handicapped. A restroom for each sex should be provided to include all of the following modifications and equipment with the exception of the urinal which logically applies to males only.

There should be one toilet stall that is 42 inches wide and a minimum of 60 inches deep. The door providing access to this stall should be out-swinging and have a minimum clear opening of 32 inches. The toilet seat should be 19 to 20 inches above the floor to allow for easy transfer by the chair bound. Horizontal handrails should be mounted 33 inches from the floor and fastened securely at both ends and in the center. This rail should be 1-1/2 inches in diameter and mounted so as to provide a 1-1/2 inch clearance between the rail and the wall. Additionally, a vertical rail 18 inches long and of the same dimensions should be mounted with the lower end 33 inches from the floor. This will provide stability for those with ambulatory handicaps.

Urinals

Wall mounted urinals are preferred over floor mounted or stall-type urinals because of the clear space between the lower rim of the fixture and the floor. The front rim of the bowl should be 19 inches from the floor, as this is the mean height of a wheelchair seat from the floor and would allow easy use of the facility. A lever-type manual flush system with controls no more than 40 inches from the floor should be utilized.

Sinks

The lavatory basin should be wall mounted or contained in a counter top so as to provide a minimum of 30 inches of clearance between the floor and the sink edge or counter apron.

Care should be taken that drain pipes and hot water pipes under the fixture are insulated to protect the user from possible burns. It

should be noted that many persons with mobility difficulties have sensory impairments also, requiring this type of protection.

Self closing faucets should not be used. Rather, wrist-blade or lever handles should be installed so that a minimum of 1-1/2 inches of clearance is provided between the handles turning radius and the wall.

As an aid to those with sight deficiencies, the placement of the hot water faucet on the left and the cold on the right should be a standard procedure.

Mirrors and shelves should be provided at a height as low as possible. Another method would be to use a mirror that is mounted in a tilted position, thus providing a full view. If this is not used, then the mirror should be mounted so that the bottom edge of the fixture is no more than 40 inches from the floor.

A full length mirror mounted with the bottom edge 24 inches from the floor is desirable and would be easily utilized by all persons.

Towel racks, towel dispensers, toilet paper dispensers, soap containers and any additional hardware should be mounted to provide a minimum of 40 inches clearance from the floor.

Fire Protection and Safety

One of the problems involved in planning facilities for the handicapped is that of Fire Protection. Obviously, providing adequate access routes will also assist in speedy egress. A major difficulty arises, however, when the facility is multi-story. Elevators, during a fire, are neither a legal, nor a safe means of evacuation. Thus, the handicapped person, particularly the wheelchair user, will be unable to leave the building without some assistance.

A solution to this problem would be to identify each building accessible to the handicapped and provide an area of refuge accessible to them during a crisis. This area of refuge should be located on the side of a firewall away from a potential fire source. This space should be located out of the main traffic circulation patterns and should be equipped with a separate alarm system to indicate that a handicapped person is present in this area of refuge.

Fire extinguishers and alarm boxes should be located throughout the facility at a height no greater than 48 inches. These extinguishers and alarm boxes should be recessed so as to not become an obstacle to the blind.

Automatic fire doors, when adjusted to the pressure required to make them usable by the handicapped may not remain effectively closed in a strong draft created during a fire. Fire doors, to prevent this happening, may be equipped with electro-magnetic smoke-and-heat-sensitive door holders which hold the fire door open during normal use but close during a fire.

IV. SPECIAL AREAS

Auditorium

In an auditorium, it is important that the physically impaired be accommodated as well as others using the facility.

The space provided for each chair should be 4 feet, 9 inches by 3 feet. The number of spaces available will vary, but in general 1 percent of the capacity should be reserved for wheelchair bound persons so that it is not necessary for them to transfer from the wheelchair to

a regular seat. Space to accommodate stacking chairs should be provided in order that an able bodied person accompanying the chair bound person be able to sit with that person. Caution must be exercised so as to not obstruct the view of those seated behind this reserved area.

Additional consideration must be given to exit routes so that the exiting of those with mobility problems will not create any obstruction to a speedy evacuation process. Both the front doorways and the exits at the sides of the stage should be designed to accommodate the physically impaired. This will necessitate ramps, handrailings, and other considerations for such an entrance or exit.

Provisions should be made so earphones can be used as an aid for those with hearing impairments. Either an induction coil loop, or wireless AM or FM transmitter, when combined with head set receivers serves this purpose quite adequately.

It is feasible that the handicapped will be participants in, as well as observers of, activities in the auditorium. Thus, consideration should be given to providing access to the stage and dressing room areas.

Cafeterias/Dining Halls

A person with a physical impairment should be able to obtain the same food and services as other users of a facility without the necessity of segregated facilities to accommodate them or without traveling through the kitchen area via the service ramp to reach the dining area.

Traditional serving lines will accommodate the disabled quite adequately if the control railing has a clear space of 34 inches between the railing and the serving tray slide. The tray slide can still be the regular height of 34 inches.

The beverage and water dispensers should house spigots or nozzles that will permit a glass to rest on the counter while being filled. Aisle space between tables should be a minimum of 36 inches clear space to allow for free traffic circulation. Dining tables should have a 30-inch clearance between the underside of the eating surface or table apron and the floor.

Classroom

Provision for making a regular classroom accessible to and usable by the physically impaired mandates an optimal thermal, visual, and acoustic environment. A minimum of 70 footcandles of illumination should be required with supplemental task lighting available in the classroom. The problem of acoustic control can be aided by the use of carpet. This will not hinder the mobility of those with physical impairments.

Both visual and audible signals should be installed in classrooms. These will serve as indicators of class activity changes, but must be easily distinguishable from those used as the emergency warning system.

A wireless radio or an induction coil loop should be provided to assist the hard of hearing. The equipment may also serve other functions such as individual study and language laboratory assistance.

A small diagnostic testing room of approximately 400 square feet should be available in any facility. This space may serve as an instructional area and conference room when not being used for testing. It should be environmentally treated to provide an optimal learning and testing climate. This mandates that considerable attention be devoted to the thermal, visual (including color), acoustical and aesthetic environment.

Gymnasiums and Physical Education

Adequate space should be provided in the gymnasium to accommodate modified or adapted physical education activities. Adaptation for the physically impaired generally involves a modification of activity through degree or manner of participation as opposed to extensive special equipment modifications. In those instances requiring modified equipment, the fixtures, sockets, and supports normally installed in a physical education facility will usually accommodate any special equipment. A physical therapy room, if needed in the facility, should be located in the Physical Education area.

Swimming Pool

A swimming pool is valuable in a physical education program, but it is of particular value to a handicapped program.

A few facility modifications are necessary to accommodate the physically impaired. The pool deck surface should be of a non-slip material. This provides protection not only for the disabled but also for other users. A flush deck pool should be installed.

Access into the pool should be by means of a sloping ramp or steps equipped with handrails. Either of these adaptations is acceptable. Some attention should be devoted to the surface drainage system of the pool to insure the gutter normally used for debris control does not become a hazard.

Sanitary Facilities (For Each Sex)

A minimum of one toilet stall, lavatory and accessory cluster that meets requirements previously established for a restroom

permits the disabled to use the facility.

Each shower room should contain two specially designed shower cubicles. One should have a seat on the left cubicle wall, the other on the right. In both instances, the seat should be opposite the shower head.

The shower seat height should be equal to the height of the wheelchair seat when the chair is outside of the shower cubicle. The seat should be 14 inches wide, extend the full 3 feet length of the cubicle wall and turn the corner for at least 8 inches on the adjacent perpendicular wall.

The seat should be designed to permit it to be folded back against the wall when not in use.

A horizontal rail or grab bar should encircle the shower cubicle, be 1-1/2 inches in diameter and have 1-1/2 inches clearance between the rail and the wall. The rail should be mounted 33 inches above the shower floor and be securely fastened to the wall.

The cubicle should be a minimum of 3 feet by 3 feet, well drained and have a non-slip floor. An entrance area to the cubicle at least 4 feet by 3 feet should be provided as a private disrobing area and also serve as a drying area when leaving the shower stall.

The splash curb at the threshold of the shower cubicle should not exceed 2 inches in height. This will allow the foot rests of the wheelchair to pass over this curb and permit an easy transfer to the shower seat.

Wrist-blade or lever handles for water controls should be used. The temperature of the water should be regulated so as to ensure that

the handicapped user will not be burned. There are two methods of accomplishing this. One would be to regulate the temperature of the water to approximately 110 to 120 degrees at the supply point, giving a water temperature at the delivery point of about 105 degrees. A second method would be to install thermostatically controlled anti-scald valves on the shower. Either of these methods is acceptable.

The soap tray and towel bar should be mounted no higher than 40 inches from the shower floor.

Laboratories

At least one student laboratory station should be provided to accommodate the physically impaired. This would necessitate that a 30 inch clearance exist between the bottom of the work surface or apron and the floor. This space must also be 18 inches deep and a minimum of 30 inches wide. Hot water pipes in this space should be insulated.

Faucets and utility outlets at these stations should be side-mounted rather than rear-mounted and be equipped with wrist-blade or lever handles. The aisle in this area should be a minimum of 36 inches wide and clear of obstructions.

Libraries

At least 1 percent of the study carrels and library tables should be accessible to the handicapped. This requires a minimum of 30 inches clear space between the underside of the work surface or table apron and the floor.

As it is not economically feasible to design the book stack area to permit total mobility and use by the severely physically disabled,

some assistance should be available to help these persons secure library materials. The bookshelves commonly used by the student body must not be higher than 6 feet or lower than 9 inches above floor level. The preferred levels are 5 feet, 9 inches high and no lower than 1 foot, 3 inches. Providing mobility in this area will, however, permit much of the material on the shelves to be examined without assistance. Thus, the aisle space between stacks should be a minimum of 48 inches.

Card catalogues, dictionary, stands and other reference volumes should be on bases 30 inches from the floor.

Provision should be made for soundproof booths or study carrels where both the blind and hard of hearing may use tape recorders, carousel projectors, and other audio-visual equipment.

Transportation

School buses have been found to be satisfactory for transporting some ambulatory or semi-ambulatory persons. While this is not the optimal arrangement, those provisions are adequate.

For the more severely handicapped, appropriately engineered vans and compact buses with open interiors serve as an adequate and efficient means of transportation. These vans should be equipped with side and rear doors providing an unobstructed entrance of at least 48 inches. Wheelchair bound persons should be transported in their chairs. Seating in the van should be arranged to allow the chairs to face the front of the van.

To assist with entry, the van should be equipped with a hydraulic lift having a platform a minimum of 33 inches by 51 inches, a lift

capacity of 700 pounds and having a tapered front edge to permit easy mounting of the platform by wheelchair persons.

Chapter VI presents the summary, findings, conclusions and recommendations.

CHAPTER VI

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

I. SUMMARY AND FINDINGS

The purpose of this study was to identify building modifications or equipment that would permit the maximum utilization of a facility by physically handicapped persons and on the basis of this information, develop guidelines for the incorporation of the building modifications or equipment in school construction.

The following questions were presented as subproblems related to this study:

1. What criteria currently exist and are utilized in other states to plan facilities to accommodate the physically impaired student?

2. How would experts familiar with the mobility difficulties of the handicapped modify existing data or criteria to make them more current or more comprehensive and complete?

3. What priorities exist as regards building modifications and equipment? What are most important? What are least important?

A survey was conducted to identify the criteria that currently exist and are utilized in other states to make facilities accessible to, and usable by, the physically impaired. A letter was sent to the Chief State School Officer of each of the 50 States and Washington, D. C., requesting that state's guidelines for making facilities accessible to and usable by, all students, including the handicapped. Concurrently, an extensive review of literature was undertaken to assist in

identifying additional criteria related to the elimination of architectural barriers.

Of the 38 states replying, 28 had some guideline information available, 7 had no provisions for planning facilities to accommodate the physically impaired, and 3 had redirected the request to another state agency and as of this writing no additional response had been received.

Twenty-four of the 28 states replying in the affirmative used the American National Standards Institute, Inc. (ANSI) guidelines A117.1-61. Three respondees, Maine, Kentucky, and Washington, D. C., provided generalized statements relative to planning for the impaired, but offered no specific criteria.

New York had an extensive set of performance criteria concerning planning for the handicapped. These criteria parallel quite closely the ANSI document (A117.1-61), however, they were more applicable to educational institutions in that they contained some criteria for areas not found in the ANSI guidelines. These include classrooms, lecture halls, locker rooms, and cafeteria/dining facilities.

A questionnaire was developed from an examination of existing guidelines, a review of the related literature and numerous interviews with educators, facility planners, architects and other qualified persons.

The questionnaire presented one-hundred and twenty-seven criteria in twenty-four facility areas including: Site, Ramps, Walks, Parking Lots, Curbs, Entrances, Doors, Corridors, Stairs, Elevators, Drinking Fountains, Electrical and Mechanical, Identification, Warning Signals, Telephone, Sanitary Facilities, Auditoriums, Cafeteria/Dining,

Classrooms, Gymnasiums and Physical Education, Laboratories, Libraries, Transportation, and Fire Protection.

The questionnaire was submitted to a panel of ten experts selected from architects, school administrators, school facility planners, special education personnel and other experts in the field of educating the physically handicapped.

Each panel member was asked to rate each of the criterion as adequate or inadequate. For any rating of inadequate, the expert was requested to include the modifications necessary to make the criterion acceptable (i.e., adequate).

The questionnaires were then returned, the data analyzed, and the results incorporated into guidelines reflecting that information deemed necessary by each of the panel members to make the criteria complete, comprehensive and current.

Of the 127 criteria examined in this study, 111 were found to be adequate and only 16 were modified by the panel to reflect more comprehensive and current data. In most instances, the dimensions or standards were increased. Time-delays for door openings and closings were increased several seconds. Brightness levels of all areas were increased. Halls were specified as wider than those previously used. The panel also presented data which required that the clear opening in the doorway be made larger. Parking bays for cars were determined to be too narrow to accommodate many of today's automobiles, thus the bay was widened. It should not be inferred that the answer to all inadequacies would be to increase the dimension of the criteria, for then some would remain inadequate. Reach limitations, for example, would prohibit many

heights such as shelves, light and elevator switches, fire extinguishers, and water fountains from being increased.

The twenty-four guideline areas were incorporated into a rating sheet utilizing a ten-point Likert-type scale ranging from very unimportant (1) to very important (10).

The rating sheets were submitted to the panel members and they were requested to rate each of the guideline areas. The data obtained from the rating sheets were analyzed and means and modes computed for each of the twenty-four areas. Utilizing mean ratings, the areas were then ranked, highest to lowest.

On the basis of the ratings, Fire Protection which had a mean and mode of 10.0 was deemed most important and stairs with a mode of 10.0 and a mean of 7.6 was regarded as least important. Assuming 5.5 to be the midpoint of the rating scale and the equivalent of a neutral (i.e., neither important or unimportant) rating, each of the guideline areas was regarded as either important or very important.

On the basis of the analysis of these data, the following findings were made:

1. The grading and preparation of the site should be such that it attains a level with a normal entrance to the building.

2. A properly constructed ramp should be provided if there is a change of level from the walkway or parking lot to the building.

3. There should be at least one entrance without steps providing access to the facility.

4. Adequately constructed special parking for the disabled should be located as near as possible to the facility served.

5. At pedestrian crossings, the pedestrian and vehicular surfaces should be blended to a common level by curbing, with the curb marked by a surface texture or a color contrasting with the adjacent surface.

6. At least one primary entrance to each building shall be usable by individuals in wheelchairs, on crutches or wearing braces.

7. Doors should be constructed to permit easy passage by all who might wish to use them.

8. Corridors should be constructed to allow for adequate circulation and traffic patterns to exist.

9. Stair risers should not exceed 7 inches, have no projected nosings, and be properly equipped with hand rails.

10. Elevators should be provided in a multi-story building where access to floors other than the entrance level cannot be reached by ramps or walk.

11. Adequately constructed drinking fountains should be provided.

12. Controls for light, fire alarms, and similar devices should be accessible to, and usable by, the handicapped.

13. Raised letters or numbers located on the handle side of the door should be used to identify rooms.

14. Both visual and audible warning signals should be provided throughout the facility.

15. Adequate telephone equipment should be provided for the handicapped.

16. Adequate and properly constructed sanitary facilities should be installed in each restroom in order to accommodate the handicapped.

17. Buildings accessible to the handicapped should be identified and marked at all entrances so that during an emergency those personnel answering the call for help would be aware that persons requiring assistance to exit may be present in the building.

18. A reserved area in the auditorium should be planned to allow wheelchair bound persons to remain in their chairs.

19. The handicapped should be able to obtain food without special services, segregated facilities, or the necessity of traveling through the kitchen.

20. Adequately equipped classrooms, including a diagnostic and testing room, should be planned for every facility.

21. Spaces should be provided in the gymnasium for modified or adapted physical education activities. These adaptations are mostly of degree of involvement rather than type of activity. Modified equipment will normally be usable in the gymnasium utilizing existing facilities.

22. At least one student station per laboratory should be designed to accommodate the handicapped.

23. Libraries should be designed to accommodate the physically impaired. This is to include the study carrels and tables, the card catalogue, dictionary stands and those bookshelves commonly used by the student body.

24. School buses are satisfactory for transporting some ambulatory or semi-ambulatory persons while appropriately engineered vans and compact buses with open interiors were found to be an efficient means of facilitating the transporting of those in wheelchairs and those who have difficulty in boarding regular vehicles.

Each of the twenty-four areas presented in the guidelines was rated as important or very important. Thus, in planning a facility to make it accessible to, and usable by, the handicapped, all areas presented in the guidelines should be given the proper treatment to make them accessible and usable.

II. CONCLUSIONS

The findings of this study indicated that there existed a wide difference of opinion between and among the experts regarding criteria for making a facility accessible to, and usable by, physically impaired persons. It was also concluded that through adequate planning of an educational facility, the building may be designed to accommodate both the physically impaired and the able-bodied to the mutual benefit of both. Further, it was determined that for a facility to be fully accessible and usable by all students, all areas of the building normally utilized by the student body during the daily routine should be planned to accommodate the physically impaired. This would include not only the instructional areas, but also those supporting facilities such as dining halls, dressing rooms, and restrooms.

III. RECOMMENDATIONS

It is recommended that: (1) The guidelines developed in this study be adopted by the Tennessee State Department of Education, Nashville, Tennessee, and used for a one-year trial period as a guide in remodeling, renovating, or constructing school facilities. (2) At the end of the one-year trial period, a study be conducted of a facility

which has been remodeled, renovated, or constructed utilizing the criteria presented in this study. A major purpose of such a study would be to determine the adequacy of each of the criteria under actual performance conditions. (3) Further investigation be made to determine the relative cost of constructing a facility which includes provisions for accommodating the physically impaired as compared to the cost of constructing a facility which does not.

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APPENDICES

APPENDIX A

THE UNIVERSITY OF TENNESSEE

College of Education
Bureau of Educational Research and Service

Knoxville, Tennessee 37916

School Planning Laboratory Phone 615--974-2501

January 3, 1974

Dear Sir:

The State of Tennessee has recently enacted legislation designated to provide adequate educational opportunity to all physically handicapped persons of the State. One important facet of this legislation is the provision for making all educational facilities in the State accessible to the physically impaired. We are in the process of developing guidelines to be utilized for constructing, renovating, or repairing educational facilities to fulfill the requirements of this legislature.

I would greatly appreciate any information you have regarding: (1) identification of those physically impaired persons requiring building modification or special equipment to gain maximum utilization of a facility and (2) building modifications or special equipment necessary to accommodate those persons identified as physically impaired.

We would also appreciate the names and addresses of any persons or organizations in your State, that might provide additional information related to this problem.

Thank you very much for your assistance.

Sincerely,

Charles E. Trotter, Jr.
Director

CET/ss

APPENDIX B

Please evaluate the following guidelines by marking each of the criterion either adequate or inadequate.

Adequate is defined to mean that the criterion (or criteria) enables the area or space to be accessible to, and usable by, the physically impaired.

Inadequate is defined to mean that the criterion (or criteria) does not make the area or space accessible to, and usable by, the physically handicapped.

Please check the appropriate column for each of the statements (criteria). Should you rate the criterion as inadequate, please use the reverse side of the page and make the change in the criterion that you consider necessary to correct it.

On the last page, I would appreciate any comments or suggestions relative to this project.

QUESTIONNAIRE ON GUIDELINES FOR PLANNING EDUCATIONAL FACILITIES TO MAKE THEM ACCESSIBLE TO AND USABLE BY, THE PHYSICALLY HANDICAPPED

EXTERIOR

Adequate	Inadequate	
		Site
____	____	The grading and preparation of the site should be such that it attains a level with a normal entrance to the building.
		Ramps
____	____	A ramp should be provided if there is a change of level from the walkway or parking lot to the building.
____	____	The ramp should include:
____	____	Level approach, minimum of 6' long.
____	____	Non-skid surface, minimum of 32" wide.
____	____	Rest platform a minimum of 4'6" every 30'.
____	____	Slope no greater than 1:12 or 8.33%.
____	____	Handrails on one side, preferably two, 32" high measured from the surface and extending one foot beyond the top and bottom of the ramp.
____	____	A 5' x 5' level platform at the top if a door swings out onto the platform. (3' x 5' if the door does not.)
____	____	Six feet of straight clearance at the bottom.
____	____	Ramps exposed to the elements should be protected by a canopy, or equipped to melt ice and snow.
		Walks
____	____	There should be at least one entrance without steps providing access to the facility and including the following:
____	____	Slope or gradient no greater than 5%. (5% gradients must have level rest areas every 60'.)
____	____	Non-slip surface minimum of 48" wide.
____	____	Wherever walks intersect other walks, ramps, or driveways, they should blend to a common level.

Adequate	Inadequate	
____	____	A walk should have a level platform 5' x 5' if a door swings out onto the platform. (3' x 5' if the door does not.)
____	____	Gratings, man-holes, and similar obstructions should not be located in the walk surface.

Parking Lots

____	____	Special parking for the disabled should be located as near as possible to the facility served.
____	____	Three to 5 percent of the parking bays should be reserved for disabled persons and identified and marked as such.
____	____	The bay should be a minimum of 9' wide with a 4' aisle between every 2 spaces.
____	____	The area designated for the disabled should be designed so that movement behind cars or across lanes of traffic is not necessary.
____	____	Ramps should be provided if there is a level change from the parking lot to the adjoining walk.

Curbs

____	____	At pedestrian crossings, traffic sign junctions, street corners, junctions with vehicle parking areas, and other suitable crossing points, pedestrian and vehicular surfaces should be blended to a common level.
____	____	The curb should not be more than 1" above the adjacent roadway surface. This may be achieved by ramping the pedestrian surface to the vehicular surface.
____	____	For identification, the ramp and curb should be of a color contrasting with the adjacent surface. For the blind, it is advantageous if the ramp and curb have a distinguishing surface texture (e.g., patterned or course finish).

INTERIOR

General Considerations

Entrances

____	____	At least one primary entrance to each building shall be usable by individuals in wheelchairs, on crutches or wearing braces.

Adequate	Inadequate	
____	____	This entrance should be on a level to make elevators accessible.

Doors

____	____	Minimum of 32" wide.
____	____	Threshold no greater than 3/4", no vertical rise more than 1/4".
____	____	Floor should be level, on inside and outside, for 5' in the direction of the door swing.
____	____	Kick plates at least 16" high of a material or finish to withstand the abuse of crutches, wheelchairs, canes, etc.
____	____	Depth between 2 doors (inner and outer) must be a minimum of 5'6" to insure that a wheelchair cannot be trapped between the two.
____	____	Handles should not be more than 3'6" from the floors. Horizontal level handles are preferred. Handles on doors opening to danger areas (e.g., boiler rooms, loading platforms, etc.) should be knurled to serve as a warning of danger for the visually handicapped.
____	____	All double acting doors should have viewing panels with the lower edge 3' from the floor.
____	____	Doors with large areas of glass should have markings to avoid accidents.
____	____	Pressure required to open the door should not exceed 8 lbs. (5 lbs. preferred).
____	____	If automatic door closers are used, a 4-6 second time delay should be provided.

Corridors

____	____	Corridor must be a minimum of 5 feet wide.
____	____	Low hanging or projecting fixtures (door closers, fire extinguishers, ceiling lights, exit signs, water fountains, etc.) are a hazard to the visually handicapped and should be avoided. (Minimum of 7' is recommended.)
____	____	Floors should have non-slip surfaces when possible.

Adequate	Inadequate	
____	____	Floors on a given story should be of common level, or connected by a ramp.

Stairs

____	____	Risers should not exceed 7" with no projecting nosings.
____	____	Stair tread should be at least 14" wide.
____	____	Handrails should be 32" above the surface. They should be uninterrupted for the full length of the stairs and extend 18" beyond the top and bottom step. This extension should not become a hazard itself.
____	____	Landings and floor levels should be distinguished from stairs by contrasting color or texture.
____	____	All stairways should have a minimum of 25 footcandles of illumination. Handrails diameter whether circular or oval should be 1-3/4" to 2".
____	____	Studs or markings on the rail's inner surface assist the blind in becoming aware of the presence of landings or the end of the stairs.

Elevators

____	____	Elevators should be provided in multi-story buildings where access to floors other than the entrance level cannot be reached by ramp.
____	____	Cab-size should be a minimum of 5'1" x 5'6" wide.
____	____	No control should be more than 54 inches from the floor.
____	____	Doors should have a sensitive safety edge <u>plus</u> a sensing device to prevent closing when entering or exiting.
____	____	On opening, the doors should remain open at least 8 seconds.
____	____	Closing should be 3 to 3-1/2 seconds.
____	____	Horizontal rails 36" from the floor should be provided.
____	____	The interior surface should be of a material resistant to scarring and marring by wheelchairs, crutches, braces, etc.
____	____	Elevators should be automatically operated, stop precisely at the floor level and be self-leveling.

Adequate Inadequate

Drinking Fountains

___ ___ Drinking Fountains should be set in a recessed area no less than 36" wide.

___ ___ The upper edge should not be more than 36" above floor level.

___ ___ Controls and spouts should be located up front and both hand and foot operated.

Electrical and Mechanical

___ ___ Controls for light, fire alarms, and similar devices should be accessible to the handicapped.

___ ___ In areas to be utilized by the handicapped the electrical outlets should be no less than 18" from the floor.

___ ___ Controls and switches should be 36" to 40" above the floor.

___ ___ Switches should have no more than two switches per plate.

Identification

___ ___ Raised letters or numbers should be used to identify rooms or offices. The plaque should be located on the wall on the handle side of the door.

___ ___ Markings should be 54" to 66" (preferably 60") from the floor.

Warning Signals

___ ___ Both visual (blinking lights) and audible (horns, bells, etc.) warning lights should be provided throughout the facility.

Telephones

___ ___ Adequate telephone service should be provided for the handicapped.

___ ___ Telephones should be wall mounted with no legs or enclosure to prohibit access. Underside clearance should be at least 30".

___ ___ Dial should be push button and no more than 39" from the floor.

Adequate	Inadequate	
___	___	Coin slot should be no more than 36" from the floor.
___	___	Volume control or amplifier should be incorporated whenever possible.

Sanitary Facilities

___	___	It is essential that an adequate number of sanitary facilities be made available to, and usable by, the physically impaired.

Toilet Stall

___	___	The sanitary facilities should include one toilet stall that:
___	___	is 39' to 42" wide and 58" to 66" deep.
___	___	has an outswinging stall door at least 32" wide.
___	___	has a toilet seat 19" to 20" above the floor.
___	___	has handrails on each side 33" high, parallel to the floor, 1-1/2" in diameter, with 1-1/2" clearance between the wall and the rail, and fastened securely at the ends and the center.

Urinals

___	___	Wall urinals mounted so that the front rim of the bowl is not more than 19" from the floor are preferred rather than the stall urinals.

Sinks

___	___	The lavatory basin should be wall hung, or contained in a counter top with a minimum of 26" of clear space between the sink or counter apron and the floor. This clear space should be 18" deep (i.e., front edge of sink to the wall).
___	___	Drain pipes and hot water pipes under the lavatory should be insulated to protect the user.
___	___	Self-closing faucets should not be used. Faucet handles must be easy to manipulate and should clear the adjacent wall by 1-1/2".
___	___	Hot water faucet on the left and cold on the right should be standard.

Adequate Inadequate

___ ___ Mirrors and shelves should be provided at a height as low as possible, and no higher than 40" from the floor measured from the top of the shelf and the bottom of the mirror. A full length mirror starting 2' from the floor is desirable.

___ ___ Towel racks, towel dispensers, soap dispensers, etc., should be mounted no more than 40" from the floor.

Special Areas

Auditoriums

___ ___ A reserved area or areas should be planned to allow chairbound people to remain in their wheelchairs.

___ ___ The space provided for each chair should be 4'9" x 3'0".

___ ___ Care must be exercised so that the view of those people seated behind is not obstructed.

___ ___ Consideration must be given to arrangements made for the chair bound so as to minimize obstruction of possible escape routes.

___ ___ Provisions should be made that earphones can be plugged into sound amplifying equipment, or the facility should be frequency modulated and induction coil looped so that the hard of hearing may benefit from the improved reception.

Cafeterias/Dining Halls

___ ___ The handicapped should be able to obtain food without special services, segregated facilities or the necessity of traveling through the kitchen area.

___ ___ The serving tray slide can be the conventional height of 34".

___ ___ Should a control railing exist, there should be a 34" space between the rail and the serving tray slide.

___ ___ Self-service beverage or water faucets should be of the type permitting the glass to rest on the counter while being filled.

___ ___ Dining tables should have a 30" clearance from the under-side of the table top to the floor.

Adequate Inadequate

Classrooms

___ ___ A minimum of 70 footcandles of illumination should be provided.

___ ___ F. M. and induction coil loop for the hard of hearing should be provided.

___ ___ Both bells and flashing lights to signal in the rooms should be provided.

___ ___ Acoustic control by using carpet and/or ceiling tile is essential.

___ ___ A diagnostic and testing room of approximately 400 square feet should be available in the facility. This space should be acoustically treated and illuminated to 70 footcandles.

Gymnasiums and Physical Education

___ ___ Spaces should be provided in a gym for modified or adapted physical education activities. These adaptations are mostly of degree of involvement rather than type of activity. Modified equipment will normally be usable in the gymnasium utilizing the existing facilities.

Swimming Pool

___ ___ Access should be provided to the shallow end of the pool by means of steps with handrails, or a sloping ramp.

___ ___ The pool deck surface should be of a non-slip material.

___ ___ The dressing room should have a aisle area a minimum of 36" wide.

Sanitary Facilities

___ ___ At least one toilet stall, lavatory and accessory cluster should meet the requirements previously established for a restroom to accommodate the disabled.

Shower

___ ___ Every shower room should contain 2 specially designed shower cubicles. One with a seat on the left cubicle wall, the other with the seat on the right. The seat should be opposite the shower head.

Adequate	Inadequate	
___	___	Seats should be 19" to 20" from the floor and hinged so they can be folded back against the wall when not in use. Seats should be 16" long and 10" deep.
___	___	The cubicle should be 3'0" x 3'0", suitably drained, and have a non-slip floor.
___	___	The splash curb at the threshold should not exceed 2" in height.
___	___	A horizontal rail or grab bar circling the cubicle and securely attached to the cubicle wall so that it is 10 to 12" above the seat is desirable.
___	___	Wrist-type handles for water control should be used.
___	___	Soap tray should be 40" from the floor.
___	___	The water temperature must be thermostatically controlled to a temperature at the supply point of 110° to 120°, giving a temperature at the delivery point of approximately 105°.
		Laboratories
___	___	Student stations (1%, or at least one) should be designed to accommodate the handicapped.
___	___	The underside of the work surface must be clear 30" from the floor and 18" deep, with a width for knee space of 28".
___	___	Faucets and outlets at these stations should be side-mounted rather than rear-mounted.
___	___	A slightly larger than normal wing-type handle for the water and gas faucets should be provided.
___	___	Aisles should be a minimum of 36" wide.
		Libraries
___	___	The aisle between the stacks should be 4' wide.
___	___	One percent of the study carrels should be accessible to the handicapped.
___	___	Tables and study carrels should have a minimum of 30" clear space between the underside of the work surface and the floor.

Adequate	Inadequate	
___	___	Provision should be made for soundproof booths or study carrels where the blind and hard of hearing may use tape recorders, A. V. equipment, etc.
___	___	Bookshelves must not be higher than 6'0" or lower than 9" above floor level. Preferred levels are not higher than 5'9" or lower than 1'3".
___	___	Card catalogues and dictionary stands should be on bases 20" from the floor.

Transportation

Buses

___	___	School buses are satisfactory for transporting ambulatory or semi-ambulatory persons.

Vans and Compact Buses

___	___	Vans and compact buses with open interiors have been found to be an efficient means of facilitating the transporting of those in wheelchairs and those who have difficulty in boarding regular vehicles.
___	___	The front-engine van is best suited for transporting the severely disabled.
___	___	Double doors on the side and rear of the van providing an unobstructed entrance at least 48" wide are essential.
___	___	The van should be equipped with hydraulic lifts having a platform a minimum of 28 x 51 inches, lift capacity of 700 pounds, and equipped with a fold down ramp.
___	___	Brackets for attaching safety belts and wheel clamps to secure the wheelchairs and individuals should be attached to the interior wall of the vehicle.

Please make any comments relative to this study that you feel are appropriate.

APPENDIX C

THE UNIVERSITY OF TENNESSEE

College of Education
Bureau of Educational Research and Service

Knoxville, Tennessee 37916

School Planning Laboratory Phone 615--974-2501

January 24, 1974

Dear

Many states, including Tennessee, have recently passed legislation relative to making buildings accessible to the handicapped, thus recognizing a need that has been largely ignored for years. This legislation has the prospects of having a tremendous impact on school construction or remodeling in Tennessee in particular and on the nation in general.

The School Planning Laboratory, College of Education at The University of Tennessee is currently working with the Tennessee State Department of Education in developing guidelines for making facilities accessible to the handicapped and physically impaired, and thus implementing the legislation in Tennessee.

As a part of our project research, a rather extensive review of literature was conducted. During this review, your name was referenced frequently as being an outstanding leader in the field of planning facilities for the handicapped. In view of your expertise, we would like to request your assistance with our study by participating in a small research project.

Participation in this project is voluntary. While you may withdraw at any time, we would hope that if you agree to participate you will be with us throughout the effort. The project will require your response to two mailouts, each requiring approximately 15 minutes of your time. We expect the project to cover a two-month period. We will need your cooperation in returning each questionnaire as soon as possible because each succeeding mailout is developed from responses submitted to the preceding questionnaire. We will keep you informed as to the progress of the project. You will receive a copy of the final report if you so desire.

Our responsibility as researchers includes guaranteeing that no information be published which will identify individual respondents. Each questionnaire will be coded so that anonymity will be assured.

We would appreciate hearing from you immediately regarding your willingness to participate in this project.

Thank you very much for your assistance in this effort.

Sincerely,

Emory C. Harrison, Jr.
Associate

ECH:lw

APPENDIX D

PANEL MEMBERS

The following is a list of the panel members who participated in this study.

Mr. Hale Donaldson
Supervisor of Planning
Division of Vocational Rehabilitation
State Department of Education
Nashville, Tennessee

Mrs. Rebecca Finn
Special Education Coordinator
Knoxville City Schools
Knoxville, Tennessee

Mr. Peter Lassen
Facilities Consultant
Veterans Administration
Washington, D. C.

Mr. Edward Matthei, A.I.A.
Senior Vice President
Perkins and Will Architects, Inc.
Chicago, Illinois

Dr. Katherine McClure, Director
Exceptional Child Services
Chattanooga City Schools
Chattanooga, Tennessee

Mr. Sheffield Nasser, Director
Special Education
Metro Schools
Nashville, Tennessee

Dr. Tim Nugent, Director
Rehabilitation Education Center
University of Illinois
Champaign, Illinois

Mr. Harold Perry, Director
Special Education
Memphis City Schools
Memphis, Tennessee

Mrs. Leslie Webb, Director
Sequoyah School
Elizabethton, Tennessee

Mr. William Woodrick
Assistant Professor, Special Education
The University of Tennessee
Knoxville, Tennessee

APPENDIX E

THE UNIVERSITY OF TENNESSEE

College of Education
Bureau of Educational Research and Service

Knoxville, Tennessee 37916

School Planning Laboratory Phone 615--974-2501

Dear

Thank you for participating in this project.

Enclosed you will find the first of two questionnaires related to the planning of facilities for the handicapped.

Please review each criterion carefully and judge it as adequate or inadequate. Should you consider the criterion inadequate, use the reverse side of the page and make the change that you think is necessary to make that criterion acceptable (i.e., adequate). Additionally, use the last page of this questionnaire to make any comments or suggestions that you might have relative to this project.

A stamped, self-addressed envelope is enclosed for your convenience in returning the questionnaire.

Very truly yours,

Emory Harrison, Jr.

APPENDIX F

Please rank each of the areas as indicated on the scale. Your ranking should reflect the importance of that area to the total accessibility and usability of the facility by the handicapped. For example, if you feel that site preparation is a very important part of Building Accessibility, you would rank this as such. If you feel it is very unimportant, you would mark it appropriately. All other rankings should be made accordingly.

GUIDELINE AREA	Very Unimportant 1	2	3	4	5	6	7	8	9	Very Important 10
Exterior										
Site										
Ramps										
Walks										
Parking Lots										
Curbs										
Interior										
Entrances										
Doors										
Corridors										
Stairs										
Elevators										
Drinking Fountains										
Electrical & Mechanical										
Identification										
Warning Signals										
Telephones										
Sanitary Facilities										

GUIDELINE AREA	Very Unimportant 1	2	3	4	5	6	7	8	9	Very Important 10
Special Areas										
Auditoriums										
Cafeteria/ Dining										
Classrooms										
Gymnasiums & Physical Ed.										
Laboratories										
Libraries										
Transportation										
Fire Protection										

APPENDIX G

GUIDELINES FOR PLANNING EDUCATIONAL FACILITIES TO MAKE THEM ACCESSIBLE TO AND USABLE BY, THE PHYSICALLY HANDICAPPED

EXTERIOR

Site

The grading and preparation of the site should be such that it attains a level with a normal entrance to the building when possible.

Ramps

A ramp should be provided if there is a change of level from the walkway or parking lot to the building.

The ramp should include:

Level approach minimum of 6' long.

Non-skid surface, minimum of 32" wide if for wheelchair traffic only, otherwise, the ramp should be the same width as the entry way.

Rest platform a minimum of 4'6" every 30'.

Slope no greater than 1:12 or 8.33%.

Handrails on one side, preferably two, 32" high measured from the surface and extending one foot beyond the top and bottom of the ramp.

A 5' x 5' level platform at the top if a door swings out onto the platform.

Ramps exposed to the elements should be protected by a canopy, or equipped to melt ice and snow.

Walks

There should be at least one entrance without steps providing access to the facility and including the following:

Slope or gradient no greater than 5%. (5% gradients must have level rest areas every 60'.)

Non-slip surface minimum of 48" wide.

Wherever walks intersect other walks, ramps, or driveways, they should blend to a common level.

A walk should have a level platform 5' x 5' if a door swings out onto the platform.

Gratings, man-holes, and similar obstructions should not be located in the walk surface.

Parking Lots

Special parking for the disabled should be located as near as possible to the facility served.

Three to 5 percent of the parking bays should be reserved for disabled persons and identified and marked as such.

The bay should be a minimum of 10' wide with a 2' aisle between every 2 spaces.

The area designated for the disabled should be designed so that movement behind cars or across lanes of traffic is not necessary.

Ramps should be provided if there is a level change from the parking lot to the adjoining walk.

Curbs

At pedestrian crossings, the pedestrian and vehicular surfaces should be blended to a common level by curbing.

The curb should be flush with the adjacent roadway surface.

For identification, curb should be of a color contrasting with the adjacent surface. For the blind, it is advantageous if the ramp and curb have a distinguishing surface texture (e.g., patterned or coarse finish).

INTERIOR

General Considerations

Entrances

At least one primary entrance to each building shall be usable by individuals in wheelchairs, on crutches or wearing braces.

This entrance should be on a level to make elevators accessible.

Doors

Minimum of 34" wide clear opening in the doorway.

Threshold, flush if possible, but no greater than 3/4", no vertical rise more than 1/4".

Floor should be level, for 5' in both sides of the door opening.

Kick plates at least 16" high of material or finish to withstand the abuse of crutches, wheelchairs, canes, etc.

Distance between 2 doors (inner and outer) of a vestibule must be a minimum of 6'6" to insure that a wheelchair cannot be trapped between the two.

Handles should not be more than 3'6" from the floors. Horizontal level handles are preferred. Handles on doors opening to danger areas (e.g., boiler rooms, loading platforms, stairwells) should be knurled to serve as a warning of danger for the visually handicapped.

All double acting doors should have viewing panels with the lower edge 3' from the floor.

Doors with large areas of glass should have marking to avoid accidents.

Force required to open the door should not exceed 8 lbs.

If automatic door closers are used, a 10 to 12 second time delay should be provided.

Corridors

Corridor must be a minimum of 6 feet wide.

Low hanging or projecting fixtures (door closers, fire extinguishers, ceiling lights, exit signs, water fountains, etc.) are a hazard to the visually handicapped and should be avoided. (Minimum of 7' is recommended.)

Floors should have non-slip surfaces.

Floors on a given story should be of common level, or connected by a ramp.

Stairs

Risers should not exceed 7" and have no projecting nosings.

Handrails should be 32" above the surface. They should be uninterrupted for the full length of the stairs and extend 12" beyond the top and bottom step. This extension should not become a hazard itself.

Landings and floor levels should be distinguished from stairs by contrasting color or texture.

All stairways should have a minimum of 30 footcandles of illumination. Handrail diameter whether circular or oval should be 1-1/2 to 2".

Studs or markings on the rail's inner surface assist the blind in becoming aware of the presence of landings or the end of the stairs. Care should be taken to ensure that the studs do not become a hazard.

Elevators

Elevators should be provided in multi-story buildings where access to floors other than the entrance level cannot be reached by ramp or walk.

Cab-size should be a minimum of 5'1" x 5'6" wide.

No control should be more than 48" from the floor.

Heat sensitive controls should not be used.

Doors should have a sensitive safety edge and/or a sensing device to prevent closing when entering or exiting.

On opening, the doors should remain open 10 to 12 seconds.

Closing should be 3 to 3-1/2 seconds.

Horizontal rails 32" from the floor should be provided.

The interior surface should be of a material resistant to marring by wheelchairs, crutches, braces, etc.

Elevators should be automatically operated and stop precisely at the floor level.

Drinking Fountains

Drinking Fountains should be set in a recessed area no less than 30" wide.

The upper edge should not be more than 34" above the floor level.

Controls and spouts should be located up front and both hand and foot operated.

Electrical and Mechanical

Controls for light, fire alarms, and similar devices should be accessible to, and usable by, the handicapped.

In areas to be utilized by the handicapped the electrical outlets should be no less than 18" from the floor.

Controls and switches should be no more than 48" above the floor.

Switches should have no more than two switches per plate.

Identification

Raised letters or numbers should be used to identify rooms. The plaque should be located on the wall on the handle side of the door.

Markings should be 54" to 66" (preferably 60") from the floor.

Warning Signals

Both visual (blinking lights) and audible (horns, bells, etc.) warning signals should be provided throughout the facility.

Telephones

Adequate telephone service should be provided for the handicapped.

Telephones should be wall mounted with no legs or enclosure to prohibit access. Underside clearance should be at least 30".

Dial should be push button and no more than 39" from the floor.

Coin slot should be no more than 48" from the floor.

Volume control or amplifier should be incorporated whenever possible on these phones.

Sanitary Facilities

Toilet Stall

The sanitary facilities should include one toilet stall that:

is 42 inches wide and a minimum of 60 inches deep.

has an outswinging stall door that provides at least 32 inches clear space in the door opening.

has a toilet seat 19 to 20 inches above the floor.

has handrails on each side 33" high, parallel to the floor, 1-1/2" in diameter, with 1-1/2" clearance between the wall and the rail, and fastened securely at the ends and the center.

Urinals

Wall urinals mounted so that the front rim of the bowl is not more than 19" from the floor are preferred rather than the stall urinals.

A manual flush system installed no more than 40 inches from the floor should be utilized.

Sinks

The lavatory basin should be wall hung, or contained in a counter top with a minimum of 29" of clear space between the sink or counter apron and the floor.

Drain pipes and hot water pipes under the lavatory should be insulated to protect the user.

Self-closing faucets should not be used. Faucet handles should be lever type and should clear the adjacent wall by 1-1/2".

Hot water faucet on the left and cold on the right should be standard.

Mirrors and shelves should be provided at a height as low as possible, and no higher than 40" from the floor measured from the top of the shelf and the bottom of the mirror. A full length mirror starting 2' from the floor is desirable.

Towel racks, towel dispensers, soap dispensers, etc., should be mounted no more than 40" from the floor.

Fire Protection and Safety

Buildings accessible to the handicapped should be identified and marked at all entrances.

The areas of refuge should be located away from high potential fire sources.

This space should be located out of the main traffic circulation patterns and equipped with a separate alarm system to indicate the presence of a handicapped person.

Fire extinguishers and alarm boxes should be located throughout the facility at a height no greater than 48 inches.

Automatic fire doors should be equipped with electro-magnetic smoke-and-heat sensitive door holders.

Special Areas

Auditoriums

A reserved area or areas equal to 1 percent of the seating capacity should be planned to allow chairbound people to remain in their wheelchairs.

The space provided for each chair should be 4'9" x 3'0".

Flexible space should be provided in order that stacking chairs be used to seat able bodied persons accompanying the chairbound person.

Care must be exercised so that the view of those people seated behind is not obstructed.

Consideration must be given to arrangements made for the chairbound so as to minimize obstruction of possible escape routes.

Provisions should be made that earphones can be plugged into sound amplifying equipment, or the facility should be frequency modulated and induction coil looped so that the hard of hearing may benefit from the improved reception.

Cafeterias/Dining Halls

The handicapped should be able to obtain food without special services, segregated facilities or the necessity of traveling through the kitchen area.

The serving tray slide can be the conventional height of 34".

Should a control railing exist, there should be a 34" space between the rail and the serving tray slide.

Self-service beverage or water faucets should be of the type permitting the glass to rest on the counter while being filled.

Dining tables should have a 30" clearance from the underside of the table top to the floor.

Classrooms

A minimum of 70 footcandles of illumination should be provided, with supplemental task lighting available when required.

F.M. or induction coil loop for the hard of hearing should be provided.

Both audible and visual signals in the rooms should be provided.

Acoustic control by using carpet and/or ceiling tile is essential.

A diagnostic and testing room of approximately 400 square feet should be available in the facility. This space should be acoustically treated and illuminated to 70 footcandles.

Gymnasiums and Physical Education

Spaces should be provided in a gym for modified or adapted physical education activities. These adaptations are mostly of degree of involvement rather than type of activity. Modified equipment will normally be usable in the gymnasium utilizing the existing facilities.

Swimming Pool

A flush-deck pool should be utilized.

Access should be provided to the pool by means of steps with handrails, or a sloping ramp.

The pool deck surface should be of a non-slip material.

The dressing room should have an aisle area a minimum of 60" wide.

Sanitary Facilities (each sex)

At least one toilet stall, lavatory and accessory cluster should meet the requirements previously established for a restroom to accommodate the disabled.

Shower

Every shower room should contain two specially designed shower cubicles. One with a seat on the left cubicle wall, the other with the seat on the right. The seat should be opposite the shower head.

The shower seat height should be equal to the height of the wheelchair seat when the chair is outside of the shower cubicle.

The shower seat should be 14" wide, extend the full 3' wall length of the shower cubicle and turn the corner for at least 8 inches. The seat should be designed to fold back against the wall when not in use.

The cubicle should be 3'0" x 3'0", suitably drained, and have a non-slip floor.

The splash curb at the threshold should not exceed 2" in height.

A horizontal rail or grab bar circling the cubicle and securely attached to the cubicle wall so that it is 33" above the floor is desirable.

Wrist-lever type handles for water control should be used.

Soap tray should be no more than 40" from the floor.

The water temperature must be thermostatically controlled to a temperature at the supply point of 110° to 120°, giving a temperature at the delivery point of approximately 105°. An alternate method of preventing injury would be to install anti-scald valves on these showers.

Laboratories

At least one student station should be designed to accommodate the handicapped. (Assuming 25 stations per lab.)

The underside of the work surface must be clear 30" from the floor and 18" deep, with a width for knee space of 30".

Faucets and outlets at these stations should be side-mounted rather than rear-mounted.

A slightly larger than normal lever-type handle for the water and gas faucets should be provided.

Aisles should be a minimum of 36" wide and clear of obstructions.

Libraries

The aisle between the stacks should be 4' wide.

One percent of the study carrels should be accessible to the handicapped.

Tables and study carrels should have a minimum of 30" clear space between the underside of the work surface and the floor.

Provision should be made for soundproof booths or study carrels where the blind and hard of hearing may use tape recorders, A.V. equipment, etc.

Bookshelves commonly used by the student body must not be higher than 6'0" or lower than 9" above floor level. Preferred levels are not higher than 5'9" or lower than 1'3".

Card catalogues and dictionary stands should be on bases 30" from the floor.

Transportation

Buses

School buses are satisfactory for transporting some ambulatory or semi-ambulatory persons.

Vans and Compact Buses

Appropriately engineered vans and compact buses with open interiors have been found to be an efficient means of facilitating the transporting of those in wheelchairs and those who have difficulty in boarding regular vehicles.

Double doors on the side and rear of the van providing an unobstructed entrance at least 48" wide should be utilized.

The van should be equipped with hydraulic lift having a platform a minimum of 33 x 51 inches, lift capacity of 700 pounds, and having a tapered front edge on the lift platform.

Wheelchair patients should be transported while seated in their chairs. Seating for them should be arranged so that they face the front of the van.

VITA

Emory Childs Harrison, Jr., was born in Richmond, Virginia, on November 9, 1944. After having been graduated from Cumberland High School, Cumberland, Virginia, in 1962, he attended The University of Tennessee in Knoxville, Tennessee; Northeastern Oklahoma A & M, Miami, Oklahoma; and Tennessee Technological University, Cookeville, Tennessee, from which he graduated with a Bachelor of Science degree in 1966 and a Master of Arts degree in 1967.

He taught at Woodward Academy, College Park, Georgia, for three and one-half years and spent two and one-half years at Metairie Park Country Day School, Metairie, Louisiana. He entered the Graduate School at The University of Tennessee in August, 1972, and received the Doctor of Education degree in Educational Administration and Supervision in June, 1974. While at The University of Tennessee, he served on the staff of the School Planning Laboratory as a research associate.

He is a member of the American Association of School Administrators, Phi Delta Kappa, Kappa Delta Pi, and other professional organizations.