

A STUDY OF ARCHITECTURAL BARRIERS FOR WHEELCHAIR  
STUDENTS AT OKLAHOMA STATE UNIVERSITY:  
IDENTIFICATION, EVALUATION AND  
PROPOSED MODIFICATION OF  
BARRIERS WITHIN SELECTED  
CURRICULA

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## PREFACE

The number of physically disabled persons within college age has been steadily increasing along with the importance of a college education. These two factors combine to make the presence of architectural barriers for the disabled on the college campus a problem of much concern to educators and to those concerned with the rehabilitation of the disabled. This study has been conducted to determine the nature, extent, and significance of barriers present on the Oklahoma State University campus, and to suggest modifications for these buildings and grounds to insure accessibility and utilization by students confined to wheelchairs.

The writer wishes to express her sincere appreciation and gratitude to the many individuals, organizations, and institutions whose assistance and encouragement made the study possible.

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## CHAPTER I

### INTRODUCTION

#### Statement of the Problem

The purpose of this study is to identify, evaluate, and suggest modifications of architectural barriers encountered by wheelchair students attending classes and participating in campus activities at Oklahoma State University, Stillwater, Oklahoma.

#### Justification of the Study

Within recent years the term "architectural barriers" has been put before the public with increasing frequency. For some persons this term represents just another vague cause, is little understood and less appreciated. For others, "architectural barriers" has a very real and significant meaning.

An architectural barrier can be a single curb that prevents a wheelchair user from crossing a street, a door too narrow for him to enter, or a monumental flight of steps leading to a "public" library or courthouse. Without assistance, those who use wheelchairs might not be able to perform a task as simple as getting a drink of water from a fountain of "average" height and design, or making a telephone call in a booth too small to accommodate a wheelchair. Architectural barriers

can force the physically disabled<sup>1</sup> to enter a building through unattractive, and often dangerous, back doors and loading areas. These same barriers may prohibit the attainment of a college education for the physically disabled. The presence or absence of architectural barriers can be the difference between a life of isolation and dependence, or one of productivity and independence.

There can be no doubt that barriers do exist. A 1967 state-wide survey conducted by the Oklahoma Vocational Rehabilitation Administration has indicated that 57.8 per cent of the public buildings surveyed are totally inaccessible to disabled citizens, while only 2 per cent were judged fully accessible (e.g. enter all levels). Full utilization (e.g. use of telephones, rest rooms and water fountains) was found in only 7 per cent of the fully accessible buildings and in only 10 per cent of the buildings with limited access (e.g. enter building but not officer or upper level).<sup>2</sup> Thus, it is evident that, due to architectural barriers, the physically disabled citizens of Oklahoma are barred from entering and using many buildings built for "public" use.

Disabled persons constitute 15 per cent to 20 per cent of the population of the United States.<sup>3</sup> The number and percentage of disabled

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<sup>1</sup>Harold E. Yuker, Proceedings of the National Institute on Making Buildings and Facilities Accessible to and Usable by the Physically Handicapped (Chicago, 1965), p. 18: "I prefer the use of the word 'disabled' which describes a physical condition ... the handicap comes through architectural barriers."

<sup>2</sup>Oklahoma Vocational Rehabilitation Administration, "Survey of Oklahoma Buildings for Architectural Barriers," Task Force on Architectural Barriers, Oklahoma City, 1967.

<sup>3</sup>Thomas A. Stein, "A Report of Progress in the Elimination of Architectural Barriers," Rehabilitation Literature, XXV (1964), p. 15.

citizens is acknowledged to be increasing rapidly. Nugent attributes this increase in the number of physically disabled to the following:

1. Increase in the use of motor vehicles resulting in increased accident rates;
2. Increase in leisure time for activities such as water sports, which account for many major accidents;
3. Life saving advancements in science and medical technology that save lives but leave many individuals with permanent handicaps.<sup>4</sup>

Along with the increasing population of physically disabled is an increasing endeavor by these persons to use public facilities. Architectural barriers are tangible evidence of attitudes concerning the disabled. In the past these persons were to be kept out of sight, to be ignored, and, if possible, forgotten. Therefore, architecture made little provision for the special needs of the physically handicapped. Condon credits World War II with bringing about an increased understanding of the disabled and their needs.<sup>5</sup> Emphasis is now being placed on the individual as a person instead of on his disability. With education of the public, more economic and social opportunities are made available and the physically disabled are encouraged to take an active, rather than passive, role in life.<sup>6</sup> Such a change, however

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<sup>4</sup>Timothy J. Nugent, Design of Buildings to Permit Their Use by the Physically Handicapped (Chicago, 1960), pp. 51-52.

<sup>5</sup>Margaret E. Concon, "Facilitation of the Education of the Physically Disabled College Student," Rehabilitation Literature, XXIII (1962), p. 226.

<sup>6</sup>Herbert Rusalem, Guiding the Physically Handicapped College Student (New York, 1962), p. 9.

gradual, would naturally result in the disabled citizens seeking to gain their rightful privileges and responsibilities as members of the community. The architectural environment must be adapted to meet the needs of those it is to serve. It is the responsibility of a community to "meet the deep social need of every man to be free to live, work and play within his own limitations, not those imposed by his environment."<sup>7</sup>

The college and university community, especially, cannot escape that responsibility. A college education is becoming more and more important to youth in our country. Education is very important to the able-bodied, but it is even more important for those who have a physical disability.

It is logical that on competitive jobs they might be passed over unless their training is superior to the able-bodied. This may be true even when the disability would not be an occupational handicap.<sup>8</sup>

Society, also, has an economic need for the education of the physically disabled. Ayers states that "whether these people become a financial liability or an asset to the community may depend upon their opportunity to attend college."<sup>9</sup> Experience has proven that physically disabled persons can make valuable contributions to society when given the opportunity. In a time when there is a shortage of skilled

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<sup>7</sup> Edward H. Noakes, "Making Libraries Usable," Wilson Library Bulletin, XXXX (1966), p. 853.

<sup>8</sup> William V. Tucker, "What Teachers Should Know About Physically Disabled Students," Rehabilitation Literature, XXIV (1963), p. 311.

<sup>9</sup> Robert E. Ayers, "Accommodations for Wheel-Chair Students at Institutions of Higher Learning," Rehabilitation Literature, XXIII (1962), p. 282.

professional personnel, to deny the right of higher education is a waste of human resources that society cannot afford.

Aside from the economic factors involved in the provision of higher education for the physically disabled, the values of our culture demand that such an opportunity be made available. Rusalem expressed this value. "Any individual who meets college standards of intellectual ability, motivation, and personality adjustment has a right to attend an institution of higher learning."<sup>10</sup>

It is generally agreed that the number and percentage of physically disabled youths seeking entrance into college will increase rapidly. A greater number of physically disabled with the desire and need for a college degree help account for this anticipated increase.

College and university administrations may not reject these physically disabled students, but the presence of architectural barriers on the campus may prohibit their attendance. Enrollment has little meaning when the opportunity of attending class and campus activities is denied or is made economically unfeasible, as in cases where an assistant must be employed. This clearly does not fulfill the responsibility of the community to "meet the deep social need of every man to be free to live, work and play within his own limitation, not those imposed by his environment."<sup>11</sup>

For a university to be able to offer full use of campus facilities to all of its present and potential students, architectural barriers must be removed. As yet, there has been no research at Oklahoma State

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<sup>10</sup>Rusalem, p. 11.

<sup>11</sup>Noakes, Wilson Library Bulletin, P. 853.

University to determine what architectural barriers are present on the Stillwater campus and what the significance of these may be to disabled students.

It is the purpose of this study to identify architectural barriers, examine their significance to the disabled student, and suggest modifications of existing facilities to meet the needs of the students. It will be limited to disabilities requiring the use of a wheelchair and to selected campus facilities. Results obtained will have implications for other disabilities and other facilities.

### Objectives

The specific objectives of this study are:

1. To identify architectural barriers for wheelchair students following prescribed curricula and participating in campus activities.
2. To examine the significance of architectural barriers on the campus in relation to the student's pursuit of the curriculum and campus activities.
  - a. the extent and nature of architectural barriers on the campus
    - (1) accessibility and utilization of facilities
    - (2) frequency of occurrence of specific barriers
  - b. the problems architectural barriers present to the student using a wheelchair.
3. To suggest modifications of the examined facilities to meet the needs of wheelchair students.

## Procedure

The procedure used in this study included the following:

1. Review of the literature pertaining to architectural barriers and to wheelchair college students.
2. Observations at selected colleges and rehabilitation centers.
3. Survey of various campus organizations and offices to locate and to determine the approximate number of disabled students on campus.
4. Development of survey form for recording architectural barriers.
5. Pretesting of survey instrument with wheelchair users familiar with the Stillwater campus.
6. Revision of survey form to incorporate suggestions of wheelchair users.
7. Selection of physical facilities (e.g. buildings and campus grounds) to be included in the study.
  - a. relating of curricula to campus facilities
  - b. selection of campus facilities for housing and extra-curricular activities to be included
8. Use of survey instrument to identify and record the nature of barriers wheelchair students encounter in the selected facilities.
9. Analysis of survey data to:
  - a. identify major architectural barriers
  - b. determine extent of architectural barriers
    - (1) accessibility of buildings
    - (2) utilization of facilities
  - c. identify problems that architectural barriers present to wheelchair users

10. Formulation of suggestions for the modification of examined facilities to meet the needs of wheelchair students.

11. Drawing of conclusions and implications regarding the significance of architectural barriers to the completion of the curricula and activities selected.

#### Limitations

1. The study is limited to facilities and curricula at the Oklahoma State University, Stillwater campus during the 1967 fall semester.

2. The schedules followed were arranged according to the fall 1967 requirements and the official Departmental Schedule of Courses for the spring and fall semesters of 1967. Due to schedule or requirement changes, the facilities required for these curricula may vary in the future.

3. The survey was limited to facilities used in only two curricula.

4. The survey was conducted during daylight hours and only "good" weather conditions.

#### Assumptions

1. It is assumed that when necessary the wheelchair student would be placed in laboratory sections where the partner system is used.

2. It is assumed that the student's physical strength would allow him to carry the average class load.

3. It is assumed that instructors would make necessary adjustments to arrangements within the room to accommodate wheelchair students.

## CHAPTER II

### REVIEW OF THE LITERATURE

The first step in the elimination of architectural barriers for the physically disabled is that of education of the public to the importance and scope of the problem which society is facing. Efforts made in this direction have resulted in an abundance of persuasive literature aimed at educators, the general public, and businessmen to enlist their individual as well as collective support and participation in the program.

Relatively little literature is available on the practical aspects of identification and elimination, or prevention of architectural barriers. Even less has been written directly related to the college program. It is this area with which this study is concerned. What has been published can be divided into the following categories: (1) philosophy concerning the physically disabled college student, (2) progress reports and surveys of colleges, and (3) research in the areas of building specifications.

#### Philosophy

With the increase in the number of physically disabled young people, has come a realization of their abilities and their needs. In general, educators have become convinced of their responsibility to provide the necessary educational opportunities for people regardless of their physical abilities or disabilities.

We as educators dare not pass by the possible scientist, teacher, or good citizen simply because he is in a wheelchair or carrying a white cane. History has proven many times that it is a man's ability that counts and not his disability.<sup>1</sup>

Ayers reflects this attitude, reporting that the lack of educational opportunities was due, not to the unwillingness of the administration to accept disabled students, but rather to the inadequacy of the campus facilities to accomodate their special needs.<sup>2</sup>

In the past, education of the disabled student was considered possible only in environments "tailor-made" for their use.<sup>3</sup> This is no longer the prevailing thought, and in most instances is considered harmful.<sup>4</sup> The disabled learn to adapt to their invironment so long as they are given the chance to experience and to use it.<sup>5</sup> Most of the physically disabled neither expect nor desire a "tailor-made" campus - without challenges. It is said "the world we hope for is one which is not necessarily molded for the perfect, but one in which any person despite a physical handicap, can move about with grace and dignity."<sup>6</sup> This

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<sup>1</sup>William V. Tucker, Higher Education and Handicapped Students (Emporia, Kansas, 1964), Foreword.

<sup>2</sup>Robert E. Ayers, "Accommodations for Wheel-Chair Students at Institutions of Higher Learning," Rehabilitation Literature, XXIII (1962), p. 284.

<sup>3</sup>Herbert Rusalem, Guiding the Physically Handicapped College Student (New York, 1962), p. 25.

<sup>4</sup>National Society for Crippled Children and Adults, Proceedings of the National Institute on Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped (Chicago, 1965), p. 22.

<sup>5</sup>Rusalem, p. 26-27.

<sup>6</sup>"Remove Architectural Barriers," Reprint from The Electrical Workers' Journal, p. 4.

position is further emphasized through Tucker's statement that changes "should be held to a minimum and students allowed to manage as many problems as they are capable of handling."<sup>7</sup>

The basic goal is the achievement of an environment in which all students - able-bodied and disabled - may be independent in their pursuit of all aspects of campus life. Students are encouraged to take part in appropriate extra-curricular activities, and to be as independent as possible in all aspects of college life. This philosophy requires the consideration of the entire campus in any modification program undertaken.<sup>8</sup>

Until recently the University of Illinois required that all students be completely independent. This program has recently been expanded to include a limited number of students whose disabilities make it impossible for them to be completely independent.<sup>9</sup>

The first requirement for the program is that the handicapped student must navigate alone. That ability is essential to the program's purpose of integrating the handicapped student into the classes, the dormitories, and all of the life of the campus, without asking or getting special favors.<sup>10</sup>

Other colleges put less emphasis on independence. Some colleges provide centralized living facilities while others strongly discourage

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<sup>7</sup> William V. Tucker, "What Teachers Should Know About Physically Disabled Students," Rehabilitation Literature, XXIV (1963), p. 310.

<sup>8</sup> State University of New York Construction Fund, Making Facilities Accessible to the Physically Handicapped (Albany, 1967), p. 7.

<sup>9</sup> Interview with J. F. Kanitzki, University of Illinois Rehabilitation Center, Champaign, Illinois, July 14, 1967.

<sup>10</sup> Dorothy Rigdon, "Mecca for Disabled Students," Rehabilitation Record, November-December, 1961, p. 13.

any grouping of the disabled in the interest of integration with the larger community of the able-bodied.<sup>11</sup> These examples illustrate differences in philosophies concerning the degree of independence that the student should be forced, or encouraged, to attain. However, it is agreed that integration into the total college program is a goal for which all should strive.<sup>12</sup>

Integration into the college community has many values to the disabled student in addition to the obvious social and educational aspects. The able-bodied also benefits from contact with the disabled member of the society. Yuker has stated that:

There has been study after study which has shown that when people are prejudiced toward a particular group, they usually know very little about that group, and have contact with very few members of that group. So if people are to be less prejudiced toward the disabled, one of the best ways of accomplishing this is to get them to know disabled persons.<sup>13</sup>

Rigdon reports that at the University of Illinois the attitude of the able-bodied students toward the disabled "has become just what rehabilitation experts agree it ought to be, they look upon them as fellow students, period."<sup>14</sup>

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<sup>11</sup>William E. Fife, "Services to Handicapped Students at Southern Illinois University." Rehabilitation Literature, XXI (1960), p. 222.

<sup>12</sup>Ibid.

<sup>13</sup>National Society for Crippled Children and Adults, Proceedings of the National Institute on Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped, p. 22.

<sup>14</sup>Rigdon, Rehabilitation Record, p. 16.

## Progress Reports and College Surveys

Before any problem can be solved there must first be a recognition of its existence. Acceptance of the disabled as worthy members of society is the first step to the elimination of architectural barriers for the physically handicapped. In times past these persons were sacrificed as a means of purification or survival of the race.<sup>15</sup> Later they were allowed to live but were given a lowly place in the social structure. Through the years society has gained in understanding and thus, acceptance of persons with physical disabilities. Rusalem explains this attitude change.

Planned campaigns of community education, the impact of the returning World War II and Korean veterans, and the avoidance of segregation of the handicapped persons academically and socially have contributed to an improved public understanding and acceptance of the individual with a serious physical loss. Slowly, at times imperceptibly, increasingly positive community attitudes toward the handicapped are forming. Perceptions of helplessness, avoidance, and rejection are giving way in some cases to constructive acceptance and realistic appreciation of the individual as a totality, not merely as a handicap.<sup>16</sup>

Various communities throughout the nation have undertaken the project of eliminating barriers, educating the public, and providing services for the severely disabled. From these efforts have come several noteworthy achievements. The New York World's Fair, John F. Kennedy Center for the Performing Arts,<sup>17</sup> and New York's Philharmonic Hall and

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<sup>15</sup>D. G. Pritchard, Education and the Handicapped. (London, 1963), p. 12.

<sup>16</sup>Rusalem, p. 9.

<sup>17</sup>"Remove Architectural Barriers." Reprint from The Electrical Workers' Journal, p. 5.

Lincoln Center for the Performing Arts<sup>18</sup> are a few outstanding examples of buildings where accessibility and utilization by the physically disabled has been considered. Fearn, in 1966, reported that forty communities had completed, and others had started, booklets listing accessible and inaccessible facilities in their areas. There is no doubt that much progress has been made towards accessibility and utilization of buildings in individual communities. However, in comparison to the total picture, this represents a minute, though significant, beginning.<sup>19</sup>

Several surveys of campus facilities have shown an increase in interest and awareness of the problem of architectural barriers. A 1944 survey by Gitnick and a 1952 survey of American colleges and universities by Zundell produced similar findings in that they both reported that the surveyed institutions generally were not equipped to serve the disabled student. In Gitnick's survey only 5 per cent reported adequate elevator service and only 3 per cent had provided ramps.<sup>20</sup> Zundell found that two thirds of the surveyed colleges had buildings without ramps or elevator service.<sup>21</sup> Five years later Condon's survey

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<sup>18</sup>The New York Times, November 19, 1961, p. 61.

<sup>19</sup>National Society for Crippled Children and Adults, Proceedings of the National Institute on Making Buildings and Facilities Assessible to and Usable by the Physically Handicapped, p. 17.

<sup>20</sup>Dorothy Gitnick, The Physically Handicapped Student in American Colleges and Universities, as cited by Herbert Rusalem, Guiding the Physically Handicapped College Student (New York, 1962), p. 16.

<sup>21</sup>Betty Zundell, College Policies for Severely Handicapped Students: A Report of a Survey, as cited by Herbert Rusalem, Guiding the Physically Handicapped College Student (New York, 1962), p. 17.

concluded that only 25 per cent of the institutions surveyed had physical facilities favoring the admission of disabled students.<sup>22</sup> In 1959, Schweikert reported that of the institutions surveyed, 9 per cent offered little or no difficulty for the wheelchair student, 27 per cent were limited to some degree, and 55 per cent were judged inadequate.<sup>23</sup> Ayer's 1962 study of selected mid-west institutions revealed that of the ninety-two responding, only twenty-seven had wheelchair students enrolled. Of these twenty-seven colleges and universities, five had made "sufficient adaptations to allow the wheelchair student to function independently or with minimal assistance."<sup>24</sup>

A general conclusion can be drawn from these surveys that progress is being made, yet a great majority of our college campuses are not now usable by persons in wheelchairs.

The University of Illinois was among the first colleges to emphasize the elimination of architectural barriers from their campus. This program, begun in 1947, has served as an example for educational institutions as well as public and private interests seeking the removal of barriers for the disabled.<sup>25</sup> The University of Missouri is also noted

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<sup>22</sup> Margaret E. Condon, "A Survey of Special Facilities for the Physically Handicapped in the Colleges," Personnel and Guidance Journal, XXXI (1957), p. 279.

<sup>23</sup> Harry A. Schweikert, "PVA Makes Survey of Colleges for Wheelchair Students," Paraplegia News, July, 1959, pp. 14-15, as cited by Herbert Rusalem, Guiding the Physically Handicapped College Student (New York, 1962), p. 19.

<sup>24</sup> Ayers, Rehabilitation Literature, p. 284.

<sup>25</sup> Rigdon, Rehabilitation Record, p. 16.

for its extensive efforts in this area.<sup>26</sup> Southern Illinois University,<sup>27</sup> Wayne State University at Detroit, University of California at Los Angeles, and Kansas State Teachers College at Emporia<sup>28</sup> are other educational institutions that have made substantial contributions toward making higher education available to the physically disabled.

In 1959, the President's Committee on Employment of the Handicapped, the National Society for Crippled Children and Adults, and the American Standards Association, formed an American Standards Association Committee for the purpose of developing a set of standards which became officially known as American Standards Association Project A-117 - "Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped."<sup>29</sup> (see Appendix B). After a two year study, conducted primarily at the University of Illinois, the resulting specifications were approved by the American Standards Association on October 31, 1961.<sup>30</sup>

Upon the introduction of these standards President John F. Kennedy made the following statement:

We must remember that standards remain nothing more than words and phrases, unless they are translated into action...To serve the purpose for which they were created...they must be put

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<sup>26</sup>Robert Dantona and Benjamin Tessler, "Architectural Barriers for the Handicapped: A Survey of the Law in the United States," Rehabilitation Literature XXVII (1967), p. 42.

<sup>27</sup>"Wheelchairs on Campus," Performance, May, 1966, p. 6.

<sup>28</sup>Ibid, p. 8.

<sup>29</sup>Leon Chatelain, "Opening Public Buildings to the Handicapped," Rehabilitation Record, November-December, 1961, p. 10.

<sup>30</sup>Dantona and Tessler, Rehabilitation Literature, p. 36.

into use in designing new public buildings and in remodeling old. The acceptance and adoption of these standards now becomes the business of citizens and governmental authorities everywhere. I am sure they will rise to the challenge.<sup>31</sup>

An administrative decision by the Federal Government has resulted in the accessibility and utilization of many government owned and leased facilities. In over two hundred national parks, facilities are being reconstructed for the use and enjoyment of the disabled. In addition, buildings which involve Federal funds for construction are required to meet the American Standards Association's specifications.<sup>32</sup>

Another Federal action to promote the elimination of Architectural Barriers was the appointment of the National Commission on Architectural Barriers in April, 1966. The purpose of the commission is to determine

...to what extent architectural barriers impede access to or use of facilities in buildings of all types by the handicapped and...to what may be necessary to achieve the goal of ready access to and full use of these buildings.<sup>33</sup>

Dantona and Tessler report that the states have responded in varying degrees to the need for legislation. As of July 1, 1966, only eleven states had made mandatory the standards adopted by the American Standards Association. An additional eight states had passed legislation which was inadequate due to "escape clauses," or had adopted the standards in part only. Other states reported having legislative resolutions or administrative directives which were considered ineffective. At the time of the survey, twelve states had no existing legislation

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<sup>31</sup>"Remove Architectural Barriers," Reprint from The Electrical Worker's Journal, p. 4.

<sup>32</sup>Ibid.

<sup>33</sup>Leon Chatelain, "More Accessibility for Handicapped," Rehabilitation Record, November-December, 1966, p. 13.

concerning architectural barriers, while the status of seven states was unknown.<sup>34</sup>

### Research

Historically, the design module in architecture has been that of the so called "average man." With increased interest in, and understanding of the disabled, a new module of design has begun to emerge. Research has sought to establish the general and specific architectural needs of those persons with severe physical loss. Many of the architectural guidelines thus established have been concerned primarily with the needs defined by the wheelchair and its user. Explanation for this consideration is given by the State University of New York Construction Fund.

The wheelchair with its different mode of movement, requires the most stringent standards with respect to clear spaces, grades, the size of openings, and the accessibility of equipment and conveniences. Therefore, the criteria set forth in this publication are largely devoted to the needs of wheelchair users, not meaning to create an effortless atmosphere for them or for other handicapped but rather to provide environmental assistance.<sup>35</sup>

A basic assumption made in all research is that a standard wheelchair will be used and that the person will be unassisted. The new principles established, therefore, have begun with space requirements defined by the following: (1) the wheelchair, (2) the movement of the wheelchair, and (3) the average dimensions and reach of an individual

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<sup>34</sup> Dantona and Tesser, Rehabilitation Literature, p. 36.

<sup>35</sup> State University Construction Fund, Making Facilities Accessible to the Physically Handicapped, p. 11.

using the chair.<sup>36</sup>

Basic dimensional requirements are given under section three of American Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped (see Appendix B). Goldsmith, in Designing for the Disabled, includes additional dimensional and functional space requirements essential to a deeper understanding of architectural needs (see Appendix C).<sup>37</sup>

"American Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped,"<sup>38</sup> previously mentioned, includes very minimum standards for accessibility and utilization by wheelchair users. Its basic concern is with public buildings; therefore, many aspects, such as living facilities and science laboratories that must be considered in a university program, have not been discussed. A review of the publication reveals that information is lacking as to detailed specifications for such items as public telephones, lavatories, door handles and water fountains. This lack of detailed specifications allows for flexibility and imaginative design; however, it is felt that in order for a deep understanding of the architectural needs of wheelchair users to be obtained, reference must be made to other more specific, or more detailed research publications.

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<sup>36</sup>Tucker, Higher Education, p. 30.

<sup>37</sup>Selwyn Goldsmith, Designing for the Disabled (2nd ed., London, 1967).

<sup>38</sup>American Standards Association, American Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped (Chicago, 1961).

In 1967 Part I of British Standard Code of Practice, "Access for the Disabled to Buildings,"<sup>39</sup> was published. This document states that its basic concern lies in the accessibility of buildings for general public use.<sup>40</sup> As previously stated, this limitation neglects specifications for some aspects of a college program. A comparison of the American Standards specifications and the British code indicates that the later British specifications are more comprehensive and detailed than are the more general American specifications. There is no argument on general principles of design and basic specifications; however, a difference is noted in specifications for specific details. Of these, one of the more significant differences is that of the required clear-opening width of interior and exterior doors. The British Code requires a 31 inch clear-opening<sup>41</sup> while the American minimum requirement is 32 inches clear-opening.<sup>42</sup> Other apparent differences could be attributed to generalizations made in the American Standards specifications.

Designing for the Disabled, by Goldsmith, gives extensive specifications and explanations concerning the prevention of architectural barriers in public and private buildings. The specifications are accompanied by numerous illustrative drawings and charts.

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<sup>39</sup> British Standard Institution, The Council for Codes of Practice, Access for the Disabled to Public Buildings, British Standard Code of Practice CP 96, 1967.

<sup>40</sup> Ibid, p. 6.

<sup>41</sup> Ibid, p. 14.

<sup>42</sup> American Standards Association, American Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped, p. 9.

From a review of these three major research publications, it is concluded that Goldsmith's study is much more comprehensive and detailed than either the American or the British set of standards.

In 1959, Salmon and Salmon published one of the earliest research projects on architectural barriers - Rehabilitation Center Planning: An Architectural Guide.<sup>43</sup> The design principles derived were applied to the design of rehabilitation centers but also apply to other buildings planned for accessibility and utilization.

Making Facilities Accessible to the Physically Handicapped,<sup>44</sup> published in 1967, pertains directly to the problem of accessibility and utilization of the college campus. From a review of the brochure, it can be concluded that the authors concur with the American Standard Association Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped.

Other studies have contributed to a greater understanding of specific architectural needs of those persons using wheelchairs. For example, Hofstra University developed an inexpensive elevator to be attached to the exterior of existing buildings, making upper levels accessible to their disabled students.<sup>45</sup> Another research project, conducted at the Nuffield Orthopaedic Centre, Oxford, England, sought to determine

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<sup>43</sup>Cuthbert F. Salmon and Christine F. Salmon, Rehabilitation Center Planning: An Architectural Guide (University Park, 1959).

<sup>44</sup>State University of New York Construction Fund, Making Facilities Accessible to the Physically Handicapped.

<sup>45</sup>Harold E. Yaker, Alfred Cohn, and Martin A. Feldman, The Development and Effects of an Inexpensive Elevator for Eliminating Architectural Barriers in Public Buildings (Hempstead, New York, 1966).

the relative suitability of different designs of door handles.<sup>46</sup> Twenty-five of the fifty-three participants in the study were confined to wheelchairs.<sup>47</sup> The results of the experiments showed that lever handles were much favored over the conventional door knob.<sup>48</sup> The handle chosen by 81 per cent of the participants was a lever, flattened in the horizontal plane and molded to fit the palm.<sup>49</sup>

The area of homemaking for the disabled received much early attention. A review of the research literature pertaining to the homemaker confined to a wheelchair reveals several outstanding publications relating to specifications for kitchen planning. McCullough and Farnhom have done extensive research on the requirements for wheelchair kitchens. The results were presented in an Illinois Experiment Station Bulletin in 1960<sup>50</sup> and an Experiment Station Circular in 1961.<sup>51</sup> Another extensive study concerning kitchen requirements was conducted at the New York University Medical Center Institute of Physical Medicine

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<sup>46</sup>P. J. R. Nichols, "Doorhandles for the Disabled: An Assessment of Their Suitability," Annals of Physical Medicine, VIII (1966).

<sup>47</sup>Ibid, p. 181.

<sup>48</sup>Ibid, p. 182.

<sup>49</sup>Ibid, p. 183.

<sup>50</sup>Helen E. McCullough and Mary B. Farnhom, Space and Design Requirements for Wheelchair Kitchens (Champaign-Urbana: University of Illinois Agricultural Experiment Station, Bulletin 661, 1960).

<sup>51</sup>Helen E. McCullough and Mary B. Farnhom, Kitchens for Women in Wheelchairs (Champaign-Urbana: University of Illinois College of Agriculture, Extension Service in Agriculture and Home Economics, Circular 841, 1961).

and Rehabilitation and reported by Wheeler.<sup>52</sup>

The Functional Home for Easier Living is another result of research conducted at the Institute of Physical Medicine and Rehabilitation of New York University Medical Center.<sup>53</sup> This publication presents housing specifications with emphasis on the needs of persons using wheelchairs.

Many other significant publications are available concerning the subject of homemaking for the disabled. A brief listing of additional readings in this area can be found in Appendix D.

### Summary

A review of literature reveals that the elimination of architectural barriers is undoubtedly receiving more interest and active concern than at any time past. The public is recognizing physically disabled people as individuals and not as a category. With increased understanding has come awareness and concern about the barriers that exist in today's environment.

The need is not to create an effortless environment, but rather to eliminate the senseless barriers that prohibit the pursuit of independence and productivity. Aside from obvious social and economic advantages, such an environment has many physical benefits for the able-bodied.

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<sup>52</sup>Virginia Hart Wheeler, Planning Kitchens for Handicapped Homemakers (New York: Institute of Physical Medicine and Rehabilitation, New York University Medical Center, Rehabilitation Monograph XXVII).

<sup>53</sup>Howard Rusk et al., The Functional Home for Easier Living (New York: The Institute of Physical Medicine and Rehabilitation, New York University Medical Center).

Experience has proven time and again that designs based on the needs of this group will present those who do possess average characteristics, with an infinitely safer and more convenient environment at little or no additional cost.<sup>54</sup>

The esthetic quality of architecture need not be sacrificed in the interest of accessibility and utilization. Salmon has stated that a "well designed building does not have to look different or unique or bazarre in order to serve the disabled as well as the non-disabled."<sup>55</sup>

Private, local, state, and federal actions have been taken in an effort to create an environment in which physically disabled people can enjoy the rights and responsibilities as members of society. One major contribution towards this end has been the creation of the American Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped. These buildings specifications have become law (in whole or in part) in some states and have been adopted by other state, Federal, and private interests. An increase in educational opportunities is noted. Many college administrations have realized their responsibilities and have begun programs to eliminate architectural barriers on their campuses.

The review of research publications concerning specifications for the prevention of architectural barriers reveals that there is a general consensus as to the basic requirements, but a difference of opinion as to specific details. The principle concern is with the provision of accessibility and utilization as based on the demands of the standard

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<sup>54</sup>Edward H. Noakes, "Making Libraries Usable," Wilson Library Bulletin XXXX (1966), p. 852.

<sup>55</sup>National Society for Crippled Children and Adults, Proceedings of the National Institute on Making Buildings Accessible to, and Usable by, the Physically Handicapped, p. 43.

wheelchair and the person using it.

Unquestionably, much progress has been made in educating the public, establishing standards, and eliminating architectural barriers, yet much more must be done before the desired environment can be realized.

### CHAPTER III

#### STANDARDS

The review of literature revealed an agreement on basic principles, but a difference of opinion as to specific architectural requirements. No one publication gave a complete set of standards against which the facilities found on a college campus could be measured for accessibility and utilization. It was, therefore, necessary for the writer to compile a set of standards by forming a composite of the several standards reviewed that would cover the facilities to be included in the study.

To supplement the review of literature, visits were made to Kansas State Teachers College at Emporia, and the University of Illinois at Champaign-Urbana, to observe campus modifications, barrier-free facilities, and programs designed for the disabled college student. Observations at the Rehabilitation Center, Okmulgee, Oklahoma, and Hot Springs Rehabilitation at Hot Springs, Arkansas, were made to develop an understanding of the abilities, as well as limitations, of disabled persons. The relationship of these abilities and limitations to environmental needs was studied.

In an attempt to organize the findings of the various research studies and personal observations into a set of standards, the writer has selected major categories of concern and stated the basic principles found pertaining to each. To develop this set of standards, each specification was evaluated as it applied to campus facilities. In many

instances, this selection has been stated as a range between minimum and optimum measurements. The resulting set of standards was the basis for the survey instrument (see Appendix A). Where general agreement in the research literature was found, no attempt has been made to give credits to individual sources. However, when the information has come from only one source or when there is a disagreement as to specific details mentioned, footnotes have been used to credit the sources.

### Exterior

✓ Entrances. All buildings used by wheelchair students must have at least one major entrance either at grade level or accessible by means of a ramp. In multi-level buildings this entrance should lead to a floor serviced by an elevator or lift suitable for wheelchair use. Doors at the entrance should conform to standards set for interior and exterior doors.

✓ Ramps. Any ramp to be used by persons in wheelchairs must be of no greater gradation than 8 per cent and have a non-slip surface. Other specifications include handrails and curbs on both sides, sufficient clearance at the top and bottom, and a width adequate for the traffic it is to serve. Appendix E includes an illustration of most of the above specifications with the exception of the 2" by 4" curbs on either side of the ramp.

✓ Curbs. Street intersections must have beveled curbs to provide for wheelchair mobility (see Appendix E).

✓ Walks. Walks must have an even, non-slip surface, and a width of at least 48". The main campus walks must be kept free of ice and snow at all times.

\* Parking Spaces. Reserved parking spaces should be made available close to all major buildings. A 12' wide space should be provided with direct access to walkways.<sup>1</sup>

Bus Service. Where distances and demand warrant, bus service should be provided wheelchair students. Buses, equipped with hydraulic lifts, have been successfully used at several universities.

### Interior

\* Doors. Door openings, design, and closer resistance frequently are definite barriers for wheelchair students. A 32" clear-opening is required for the movement of a wheelchair through a door. In addition to the width of the chair, space must be allotted for the occupant's hands to push the chair through the opening. The clear-opening is approximately the width of the door minus the depth. Thus a 34" door could give a 32" clear-opening. The use of a hospital type hinge can provide a larger clear-opening with the same width door (see Appendix E).

Door handles must be placed about 36" to 39" from the floor.<sup>2</sup> Lever or pull handles are easier to use than are conventional door knobs. Additional horizontal bars on the trailing side of the door aid in closing the door and should be installed where such assistance is needed, as in toilet stalls.<sup>3</sup> The resistance of door closers must not exceed eight to nine pounds. The placement of the doorway is extremely

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<sup>1</sup> Cuthbert F. Salmon and Christine F. Salmon, Sheltered Workshops: An Architectural Guide (Stillwater, Oklahoma, 1966), p. 32.

<sup>2</sup> Selwyn Goldsmith, Designing for the Disabled (2nd ed., London, 1967), p. 80.

<sup>3</sup> Ibid, p. 81.

important. There must always be a minimum of 15" to 24" of unobstructed area next to the handle side of the door. Absence of this space makes it extremely difficult, or impossible, for the door to be opened.

Dining Halls and Laboratories. Items of self-service must be placed within the reach of the wheelchair student (see Appendix B and C). Aisle width must be adequate as defined in American Standard Specifications for Making Buildings Accessible to, and Usable by, the Physically Handicapped. At least 30" of clear distance between floor and the underside of tables and desks must be provided. Other dimensions pertaining to tables and desks are given in Appendix E.

Assembly Areas. An aisle width of 60" should be provided as well as reserved seating sections in a level area accessible from both the entrance and the speaker's platform.

X Libraries. Aisle widths of 48"<sup>4</sup> and desks with sufficient clearance between floor and the underside of the desk (discussed under Dining Halls and Laboratories) must be provided.

X Restrooms. The interior of any restroom should provide for needed circulation as defined in Appendix B. One toilet stall should be provided with sufficient width (minimum 54")<sup>5</sup> to enable a side transfer onto the water closet seat. A minimum width of 36" is required for a stall planned for frontal transfers.<sup>6</sup> The depth of stall must be at

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<sup>4</sup>State University of New York Construction Fund, Making Facilities Accessible to the Physically Handicapped (Albany, 1967), p. 22.

<sup>5</sup>Goldsmith, p. 153.

<sup>6</sup>American Standards Association, American Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped (Chicago, 1961), p. 10.

least a minimum of 56"<sup>7</sup> or a preferable 66".<sup>8</sup> A 32" clear-opening and an outward swinging door are essential as are grab rails--parallel to and 33" from the floor.<sup>9</sup> These rails must extend at least 13" from the front of the water closet.<sup>10</sup> Grab rails should be 1½" in diameter and have a 1½" clearance from the wall.<sup>11</sup> A 19" to 20" high water closet seat is necessary.

Lavatories must provide for a clearance below the apron of 30" by at least 18" deep. Insulated pipes protect against burns to those persons who have lost sensory abilities. Mirrors and other restroom accessories must be placed with the bottom edge at the 40" level. Appendix E includes illustrations of lavatory requirements.

Bathing Facilities. When planning dormitory bathroom facilities for wheelchair students, bathtubs as well as showers should be provided. A 19" high bathtub with an 18" deep platform at the head of the tub enables a transfer to be made from the chair to the tub. Where space is limited a detachable bath bench may be used to provide a platform. The surface of the tub and platform must be non-slip. Support rails are necessary and can be placed as shown in Appendix E. Showers should

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<sup>7</sup>Ibid.

<sup>8</sup>British Standard Institution, The Council for Codes of Practice, Access for the Disabled to Public Buildings, British Standard Code of Practice CP 96, 1967, p. 16.

<sup>9</sup>American Standards Association, American Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped, p. 10.

<sup>10</sup>Goldsmith, p. 153.

<sup>11</sup>American Standards Association, American Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped, p. 10.

be provided with a 3'6" by 4'0" dressing area that is even with and curtained off from the adjacent bathroom area. The major considerations for a shower are the provision of a shower seat approximately the height of the chair seat (19"), diversionary shower spray with a flexible hose, and a threshold curb no higher than 3". The shower cubicle itself should be 3' by 4'9".<sup>12</sup>

Bedrooms. The following are principle considerations for the planning of dormitory rooms: (1) adequate circulation space, especially around the bed, (2) desks with 28" by 30" high chair clearance, (3) closet rods 48" high<sup>13</sup>, and (4) usable storage, dresser, and mirror.

Elevators. Every multi-story building must be equipped with an elevator usable by the wheelchair student. This requires a passenger elevator with 60" by 60" or 63" by 56" interior space. Controls within reach (48")<sup>14</sup> and an eight second clear-opening time are also required.<sup>15</sup>

Telephones. Where public telephones are available, there should be at least one usable by the person in a wheelchair. This utilization involves adequate chair clearance and a receiver no more than four feet from the floor (see Appendix E).

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<sup>12</sup> Goldsmith, p. 131.

<sup>13</sup> Howard Rusk et al, The Functional Home for Easier Living (New York: The Institute of Physical Medicine and Rehabilitation, New York University Medical Center), p. 11.

<sup>14</sup> American Standards Association, American Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped, p. 7.

<sup>15</sup> Goldsmith, p. 94.

Water Fountains. The utilization of water fountains requires a wall mounting with the basin no higher than 36" above the floor and space for the wheelchair foot rest beneath.

## CHAPTER IV

### INTERPRETATION OF DATA

The analysis and summary of the data obtained from this study are presented in this chapter. The first section pertains to the identification and the extent of architectural barriers on the campus. Problems that the barriers create for the student using a wheelchair will be discussed in the second section of the chapter.

The campus facilities were chosen to include those used in the pursuit of two selected four year curricula and those used in extra-curricular activities. Curricula schedules used in the study were derived from eight semesters of work followed by a student in each of the curricula.

#### The Identification and Extent of Barriers

The data concerning architectural barriers have been divided into the following three categories: (1) campus grounds, (2) building access, and (3) building interiors. The findings relating to the first category, campus grounds, are discussed as a whole without regard to different curricula use. In this section the data includes the barriers found and the degree of accessibility or utilization of these facilities. The degrees of accessibility or utilization are defined below.

#### Definition of Terms

In the analysis of the data the following terms have been assigned

to describe various degrees of accessibility and utilization.

Accessible -- facilities to which a wheelchair user can gain independent entrance to the main area without difficulty or danger.

Limited Access -- facilities to which a wheelchair user can gain independent entrance to the main area with minimum difficulty and/or danger.

Minimum Access -- facilities to which a wheelchair user cannot gain independent entrance to the main area without difficulty and/or danger.

Non-accessible -- facilities to which a wheelchair user can not gain entrance to the main area without dependence on the able-bodied.

Full Utilization -- conditions allowing wheelchair users independent use of facilities without difficulty or danger.

Limited Utilization -- conditions allowing wheelchair users only limited independent use of facilities, or use with difficulty and/or danger.

Lack of Utilization -- conditions prohibiting wheelchair users independent use of facilities.

### Campus Grounds

The first area of study is that of architectural barriers that impede mobility on the campus grounds. The barriers recorded in this category have been identified on the campus map in Appendix F. Of these barriers the most serious and obvious ones recorded are the curbs at major pedestrian crosswalks. It was noted that no curbs are beveled to meet the needs of the wheelchair user. Curbs were also recorded surrounding parking lots, thus obstructing the direct path from a parked car to the major sidewalk or building. A lack of sufficient

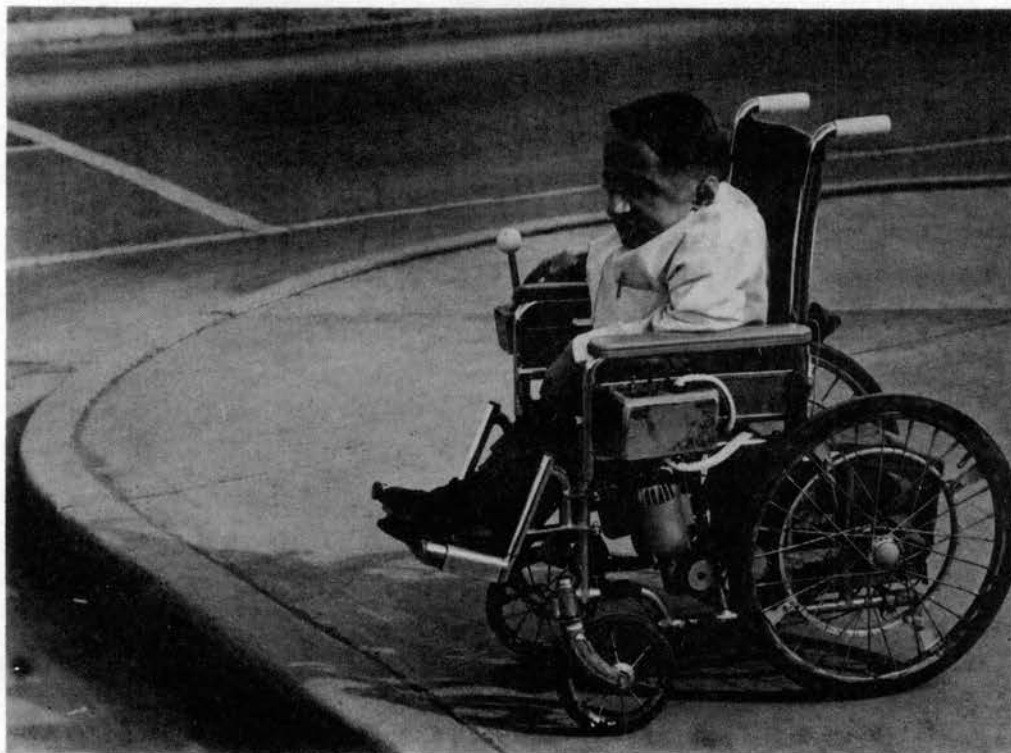


Figure 1. Curbs at Major Crossing



Figure 2. Exterior Steps Hamper Mobility on Campus

width of parking spaces and the absence of reserved spaces in areas of greatest safety are concluded to be major hazards to the disabled student.

The most frequently recorded barrier on the campus grounds was that of surface irregularities in the walks. Abrupt changes in level were present at the intersections of walks and in older walks where portions of the concrete had settled. These surface irregularities present hazards to the able-bodied as well as the disabled. (As the researcher was recording one such barrier, two able-bodied students, in their hurry to class, stumbled over the one inch difference in the level in the walk.) Serious cracks and graveled areas were recorded, as well as areas where the walk surface was slippery. Steps in the walkway are obvious obstructions to wheelchair mobility.

Any tabulation to determine the degree of utilization for the campus grounds would be invalid due to the lack of information concerning the exact use of each section of the grounds. However, from a review of the map in Appendix F it can be concluded that the campus grounds could be considered to have no more than limited utilization.

### Building Access

Architectural barriers that obstruct independent access to buildings constitutes the second area of study. All entrances to the buildings included in the study were examined, the barriers recorded, and the buildings classified according to the degree of accessibility of the most accessible entrance. The classification of the individual buildings included in the study is as follows:

Accessible -- Kerr and Drummond Residence Halls.

Limited Access -- Classroom Building, North Engineering, Library, Student Union, and Business Building.

Minimum Access -- Whitehurst, Home Economics East, and South Engineering.

Non-accessible -- Monroe Home Management House, Child Development Laboratory, Bennett Chapel, University Auditorium, Gundersen, Field House, Morrill, Life Science, Physical Science, and Home Economics West.

The frequency of occurrence of specific barriers at the selected entrances has been tabulated according to the classification of the buildings as given above. Data given in Table I indicate, in addition to the frequency of occurrence, the relative significance of barriers in determining the degree of accessibility of the entrance. The overall frequency of occurrence of the barriers in all of the buildings included in the survey has also been given in this Table.

The most obvious and serious barrier to independent access to campus buildings is the presence of exterior and/or interior steps at the entrances. The second most formidable barrier found at entrances is the lack of sufficient clear-opening of the exterior doorways. This obstruction is noted in older buildings where the entrances have not been remodeled recently. These entrances are equipped with double doors having center posts, thus making the clear-opening extremely narrow. Entrances that have been recently remodeled often provide sufficient clear-opening but have employed glass doors that present hazards to many persons using wheelchairs. Dimensions shown in Appendix C indicate that a distance of over nine inches from the floor to the glass should be provided to prevent the danger of the glass being broken from contact with the foot rest of the wheelchair. It was noted that seven

TABLE I

## BARRIERS FOUND AT ENTRANCES OF VARIOUS DEGREES OF ACCESSIBILITY

	<u>Accessible</u>		<u>Limited Access</u>		<u>Minimum Access</u>		<u>Non-Accessible</u>		<u>Total Surveyed</u>	
	Number N=2	%	Number N=5	%	Number N=3	%	Number N=10	%	Number N=20	%
I. <u>Approach</u>										
Step or Steps	--	--	--	--	--	--	6	60	6	30
Incline	--	--	--	--	1	33	--	--	1	5
II. <u>Platform</u>										
Depth	--	--	--	--	--	--	1	10	1	5
Step at door	--	--	--	--	1	33	4	40	5	25
Surface	--	--	1	20	--	--	1	10	2	10
III. <u>Door</u>										
Closer resistance	--	--	3	60	2	66	8	80	13	65
Handle height	--	--	1	20	1	33	2	20	4	20
Handle design	--	--	--	--	1	33	2	20	3	15
Clearance to glass	--	--	4	80	--	--	2	20	6	30
Clear-opening	--	--	--	--	1	33	3	30	4	20
Threshold	--	--	2	40	1	33	1	10	4	20
Inside clearance	--	--	--	--	--	--	1	10	1	5
Interior steps	--	--	--	--	--	--	2	20	2	10

inches from floor to glass was the greatest allowance made in the newly installed doors. Door handle design and height are other barriers found in the older entrances. The resistance of door closers, making the door seem extremely heavy, is another factor contributing to inaccessibility of buildings.

The significance of architectural barriers at the entrances to the buildings included in the study can best be realized through an analysis of the degree of accessibility of these buildings in relationship to the overall sample and to the individual curriculum. The data presented in Table II show that of the twenty buildings surveyed, half were judged totally inaccessible. The two accessible buildings recorded owe their accessibility to the common entrance of the two dormitories included in the study; therefore one entrance, serving two buildings, is represented.

TABLE II  
ACCESSIBILITY OF BUILDINGS SURVEYED

	Number N=20	Percent
Accessible	2	10
Limited Access	5	25
Minimum Access	3	15
Non-accessible	10	50

Buildings entered strictly for extra-curricular activities have been separated from those entered for class activities. The

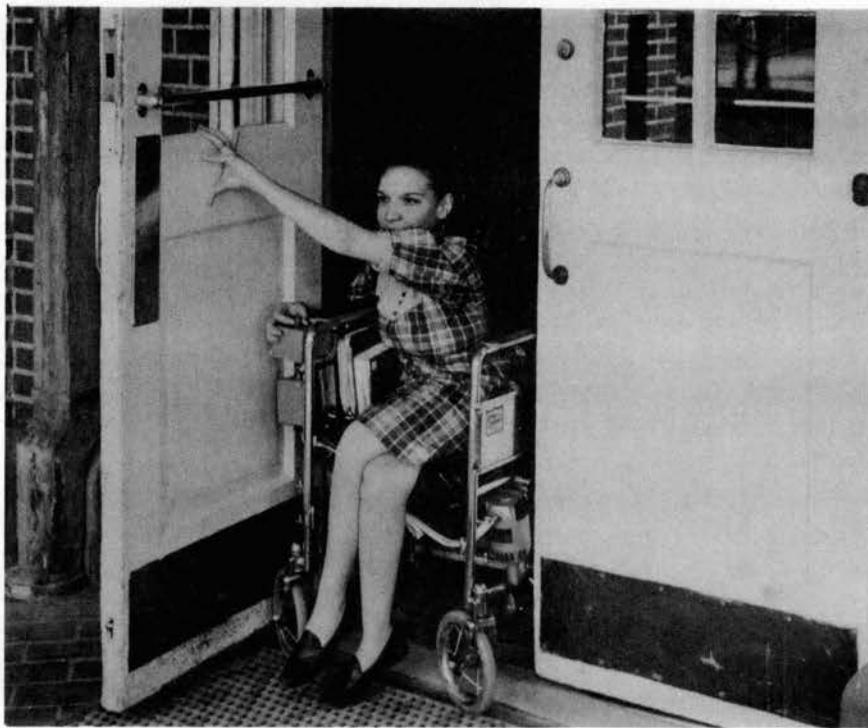


Figure 3. Double Doors Lack Needed Clear-Opening



Figure 4. Present Water Fountains are Barriers

accessibility of these buildings is presented in Table III. The two living facilities represent the two accessible buildings while the Student Union has been classified as accessible with minimum difficulty and the Chapel has been classified as totally inaccessible.

TABLE III  
ACCESSIBILITY OF BUILDINGS ENTERED FOR  
EXTRA-CURRICULAR ACTIVITIES

	Number N=16	Percent
Accessible	2	50%
Limited Access	1	25%
Minimum Access		
Non-accessible	1	25%

Buildings entered for class activities include several also used for extra-curricular activities, the University Auditorium, the Field House, and the Monroe Management House, which is used as a living facility. The fact that entrance to each of these buildings is required for class activity places them in the category of a classroom building. The accessibility of those buildings entered for class activities is shown in Table IV. It is noted that the majority of these buildings were non-accessible, although one-fourth were accessible with minimum difficulty and/or danger.

The degree of accessibility of those buildings entered for class activity in each curriculum is presented in Table V. These data vary only slightly from that given in the preceding Table IV concerning the

total of all classroom buildings included in the study.

TABLE IV  
ACCESSIBILITY OF BUILDINGS ENTERED FOR CLASS MEETINGS

	Number N=16	Percent
Accessible	--	--
Limited Access	4	25
Minimum Access	3	19
Non-accessible	9	56

TABLE V  
ACCESSIBILITY OF BUILDINGS ENTERED FOR CLASS MEETINGS  
IN EACH CURRICULUM

	H.E.E.D.		Economics	
	Number N=15	Percent	Number N=9	Percent
Accessible	--	--	--	--
Limited Access	4	17	6	67
Minimum Access	2	13	1	11
Non-accessible	9	60	2	22

The frequency of entering buildings of various degrees of accessibility is perhaps the greatest indication of the significance of barriers encountered by wheelchair users. Data concerning frequency of entrance have been organized according to each curriculum and for the combination of the two curricula. Table VI presents this information

for the two different curricula while the data concerning the combination of curricula are shown in Table VII. The variance in the data is primarily due to the accessibility of the major buildings in each curriculum.

TABLE VI  
FREQUENCY OF BUILDING ENTERED FOR CLASS MEETINGS  
IN EACH CURRICULUM

	H.E.E.D.		Economics	
	Number N=226	Percent	Number N=224	Percent
Accessible	--	--	--	--
Limited Access	52	23	180	80
Minimum Access	22	10	2	1
Non-accessible	122	67	42	19

TABLE VII  
FREQUENCY OF BUILDING ENTERED FOR CLASS MEETINGS  
IN COMBINATION OF CURRICULA

	Number N=450	Percent
Accessible	--	--
Limited Access	232	52
Minimum Access	24	5
Non-accessible	194	43

It should be remembered that these data represent the accessibility of the main area of the building and not that of the class meeting area.

Therefore, although a building entrance may provide minimum accessibility, the class meeting areas may actually be more accessible than similar areas in buildings of less entrance accessibility. This factor will be discussed in more detail later.

### Building Interiors

The third area of concern is that of architectural barriers that interfere with the full and independent use of buildings and the facilities contained within the buildings. Use of the interior of buildings has been sub-divided into the following four general categories: (1) interior circulation, (2) class, living, and activity areas, (3) restrooms, and (4) water fountains and telephones.

Corridors, elevators and doors are included in the first category of interior circulation. In most buildings corridors were found to meet the needs of the disabled. Exceptions to this statement were: (1) obstructions (e.g. display cases, coat racks, tables, etc.) that hamper swift movement of traffic, (2) slippery floors in the Student Union, parts of the dormitories and the chemistry laboratories, and (3) partitions installed in the first and third floor corridors of Home Economics West. The Student Union presents several major corridor barriers for the disabled. Aside from the obstructions and slippery surfaces cited above, steps connecting different levels of the second, third and fourth floors prohibit access to the Student Union Theater, the third floor lounges, and all major activity areas on the fourth floor.

The absence of elevators and the design of existing ones create the most serious and prevalent interior circulation obstacle for persons

in wheelchairs. Data in Table VIII indicate the lack of elevator service in almost half of the buildings where access might be needed to upper levels. In one building this service was available in one part of the building but lacking in another. The building was therefore recorded as lacking the availability of elevator service to all floors of the building.

TABLE VIII  
AVAILABILITY OF ELEVATORS IN BUILDINGS  
WHERE NEEDED

	Number N=16	Percent
Available	9	56
Not available	7	44

In Table IX it is noted that the elevator service available is usable only with difficulty and/or danger. In no instance were controls placed within the reach of a person sitting in a wheelchair. However, it was noted that only one elevator did not provide the necessary interior space.

Availability of elevator service in buildings used for class activities has been tabulated in Table X. The data shown reveal that in more than half of the classroom buildings where access is needed to upper levels this service is not available. When consideration is given to the different needs of the two curricula studied it is noted

that in both instances elevator service was absent in half of the classroom buildings where access to the upper levels was needed.

TABLE IX  
UTILIZATION OF AVAILABLE ELEVATORS

	Height of Controls		Sufficient Space	
	Number N=9	Percent	Number N=9	Space
Full utilization	0	0	8	89%
Lack of utilization	9	100	1	11%

TABLE X  
AVAILABILITY OF ELEVATORS IN CLASS MEETING  
BUILDINGS WHERE NEEDED

	H.E.E.D.		Economics		Combination of Curricula	
	Number N=12	Percent	Number N=8	Percent	Number N=13	Percent
Elevators available	6	50%	4	50	6	46%
Elevators not available	6	50%	4	50	7	54%

As previously stated, the significance of barriers can only be realized when frequency of use is considered. When related to the availability of elevator service, this means the comparison of the frequency of need for such service and the frequency with which this need

is, to some degree, met. Data concerning the frequency with which elevator service is needed in each curriculum and in the combination of the curriculum is given in Table XI. A review of this data clearly shows that the accessibility of 68 per cent of the class meetings depends upon this service. Data also reveal that this service (with limited utilization) is available 59 per cent of the times needed. It is also noted that there is little difference in frequency of need between the two curriculum.

TABLE XI  
FREQUENCY OF NEED FOR ELEVATOR SERVICE

	H. E. E. D.		Economics		Combination of Curricula	
	Number N=230	Percent	Number N=231	Percent	Number N=461	Percent
Elevators needed	158	68	155	67	313	68
Elevators not needed	72	32	76	33	148	32

The above data established the need for elevator service in both curriculum studied. The availability of this service when needed is presented in Table XII and Table XIII. A significant difference in the availability of elevator service in the two curriculum is noted. In the Economics curriculum there is a lack of service in a little over one-half of the instances in which it is needed. This lack is noted in over one-fourth of the instances in which the Home Economics Education

curriculum requires the elevator service. This comparison is interesting when the data concerning the degree of accessibility of entrances required in each curriculum is remembered. It may be noted here that while the Economics curriculum offered the greater accessibility to buildings, the accessibility of its class meeting areas is considerably less than that offered in Home Economics Education.

TABLE XII

FREQUENCY WITH WHICH THE NEED FOR ELEVATOR SERVICE IS MET

	H.E.E.D.		Economics		Combination of Curricula	
	Number N=158	Percent	Number N=155	Percent	Number N=313	Percent
Available	111	71	75	48	186	59
Not available	47	29	80	52	127	41

TABLE XIII

FREQUENCY WITH WHICH ELEVATOR SERVICE IS PROVIDED

	H.E.E.D.		Economics		Combination of Curricula	
	Number N=230	Percent	Number N=231	Percent	Number N=461	Percent
Available when needed	111	49	75	32	186	40
Not available when needed	47	20	80	35	127	28
Not needed	72	31	76	33	148	32

The only buildings classified as extra-curricular that required elevator service were the residence halls. Both of these buildings were equipped with elevators; however, as in all other cases they had only limited utilization due to the high placement of the controls.

Doors are another prevalent barrier for wheelchair users. Interior doors were identified as barriers in all buildings surveyed (see Table XIV). Of the sixty-eight classroom doors included in the survey, none met the standards that indicate full utilization. In classroom buildings it was observed that single doors usually had the necessary clear-opening width but had knob handles instead of the desired pull or lever designs. Double doors had the desired handles but lacked the necessary clear-opening width. The lack of sufficient unobstructed area (15 inches) adjacent to the handle on the opening side of the door was another commonly found barrier.

TABLE XIV  
DEGREE OF UTILIZATION OF CLASSROOM DOORS SURVEYED

	H.E.E.D.		Economics		Combination of Curricula	
	Number N=48	Percent	Number N=32	Percent	Number N=68	Percent
Full utilization	--	--	--	--	--	--
Limited utilization	26	56	22	69	39	57
Lack of utilization	22	44	10	31	29	43

Utilization of class, living, and activity areas was found to vary considerably. Classrooms present relatively few barriers for the

wheelchair student (see Table XV). Lecture rooms usually have flexible seating arrangements and the large auditoriums have space available that can be used for wheelchairs. Amphitheater arrangements found in the Business Building and in Old Physical Science are exceptions in that the level differences prohibit safe and convenient arrangements for the wheelchair. Access to the speakers' platform is a common although a less significant barrier than the lack of space. Laboratories, however, present many barriers. There is an almost total lack of utilization in science laboratories due to the height of benches and the placement of supplies and controls. Food, clothing construction, and art laboratories lack utilization due to the lack of circulation space, chair space under tables, access to equipment, and use of various facilities within the room.

TABLE XV  
DEGREE OF UTILIZATION OF CLASSROOMS SURVEYED

	H.E.E.D.		Economics		Combination of Curricula	
	Number N=48	Percent	Number N=32	Percent	Number N=68	Percent
Full utilization	20	42	15	47	31	46
Limited utilization	15	31	16	50	24	35
Lack of utilization	13	27	1	3	13	19

It was concluded that living facilities surveyed have limited utilization. Circulation space was available, but requirements for

desk, dressers, mirrors, and closet rods were not met and thus represent barriers. Activity areas within the dormitories surveyed also lacked full utilization, in that the Kerr-Drummond Complex lounge was accessible only with difficulty and considerable inconvenience.

Cafeterias in the dormitories and in the Student Union present barriers that make independent utilization impossible. Self-service items are placed past the reach limitations, some aisles are generally wide enough for straight travel but not for turns, and the space between the floor and table does not allow the needed 30 inch clearance. It is therefore concluded that those dining facilities examined offered limited utilization.

Other activity areas include the University Auditorium (included in the discussion of class areas), the first floor of the Field House, and Bennett Chapel. The width of the ticket lines at the entrances of the Field House presents difficulty in entering the main area. For most activities, seating space can be arranged without difficulty; however, access to the speaker's platform is not available. The main part of Bennett Chapel would be usable except for a difference in level of the entrance and the assembly area.

The survey included at least one restroom in every building. As might be expected, the findings indicated uniformity in the placement of fixtures. Therefore, similar barriers were found in all restrooms. Lavatories were discovered to lack the necessary chair clearance. Data in Table XVI indicate that this barrier is caused by absence of height but not depth. Chair clearance is a requirement for full or limited utilization; therefore, placement of the lavatory was recorded as an architectural barrier in all of the restrooms included in the study.

For many wheelchair users a serious barrier is the height of the water closet. It was found that in all instances this height was lower than the required 19-20 inches. The mounting of the water closet was of less significance in that 54 per cent were wall mounted and thus allowed the necessary space for the footrest. The remaining 46 per cent, however, would present difficulties in frontal transfer attempts (see Table XVII).

TABLE XVI  
CAUSES FOR DEGREE OF UTILIZATION OF  
CHAIR CLEARANCE AT LAVATORIES

	Height		Depth	
	Number N=26	Percent	Number N=26	Percent
Full utilization	--	--	19	73
Limited utilization	--	--	3	12
Lack of utilization	26	100	4	15

TABLE XVII  
CAUSES FOR DEGREE OF UTILIZATION OF WATER CLOSET

	Height		Mounting	
	Number N=26	Percent	Number N=26	Percent
Full utilization	--	--	14	54
Lack of utilization	26	100	12	46

Width and depth of toilet stalls are also important factors. It was found that the depth was adequate in the majority of instances, but that the width of the stall was a significant barrier. Data in Table XVIII disclose that in addition to these barriers there was a complete absence of grab bars in the stalls inspected. The interior of the stalls would therefore have to be concluded as having a lack of utilization.

TABLE XVIII  
CAUSES FOR DEGREE OF UTILIZATION OF TOILET STALLS

	Depth		Width		Presence of Grab Bars	
	Number N=24	Percent	Number N=24	Percent	Number N=24	Percent
Full utilization	14	58	4	17	--	--
Limited utilization	2	8	9	38	--	--
Lack of utilization	8	34	11	45	24	100

Another serious barrier found in all restrooms is that of inaccessible toilet stalls. For a stall to be accessible it must have a clear-opening width of 32 inches and an outward swinging door. As indicated in Table XIX, this combination of requirements was not found in any of the restrooms. There were two instances in which there was no stall for the water closet. However, data in Table XIX reveal that in neither of these cases was circulation space adequate to enable access to the water closet. It is therefore evident that, although circulation space

was not a significant barrier in most cases, the combination of total space and stall barriers make all water closets included in the study inaccessible.

The two living facilities included in the study were identical in all respects. It was found that the bathrooms in these facilities provided showers but that there were no bathtubs available for student use. The showers did not meet the specifications that insure independent use and are usable only with extreme difficulty and danger by most persons in wheelchairs. It is therefore concluded that all of the restrooms surveyed could be considered to offer a complete lack of utilization as previously defined.

Water fountains and telephones are facilities often lacking in utilization. Data in Table XX indicate the major reason for this lack of utilization in water fountains is the height of the basin from the floor.

TABLE XIX  
CAUSES OF ACCESSIBILITY OF WATER CLOSET

	Clear-Opening		Swing		Circulation Space		Grab Bars	
	Number	%	Number	%	Number	%	Number	%
	N=24		N=24		N=2		N=2	
Full utilization	1	4	--	--	--	--	--	--
Lack of utilization	23	96	24	100	2	100	2	100

TABLE XX  
CAUSES FOR DEGREE OF UTILIZATION OF WATER FOUNTAINS

	Basin		Controls		Mounting		Approach	
	Number	%	Number	%	Number	%	Number	%
	N=16		N=16		N=16		N=16	
Full utilization	1	6	15	94	15	94	11	69
Lack of utilization	15	94	1	6	1	6	5	31



Figure 5. Existing Telephones Cannot be Used From a Wheelchair

Only five buildings were found to offer any public telephone service. Since it is impossible to use a booth from a wheelchair, only wall mounted telephones were included in the study. Of the telephones examined none was found usable. Data concerning this lack of utilization is found in Table XXI. It is noted that height is again the principle barrier prohibiting use of the facility.

TABLE XXI  
CAUSES FOR DEGREE OF UTILIZATION OF PUBLIC TELEPHONES

	Height of Receiver		Sufficient Chair Clearance	
	Number N=4	Percent	Number N=1	Percent
Full utilization	0	--	1	100
Lack of utilization	4	100	--	--

#### The Problems Created by Barriers

This section of Chapter IV will be concerned with problems created by the presence of architectural barriers on the campus. It is obvious from the previous discussion that architectural barriers do exist and are present in great numbers on the campus. It is also obvious that their presence would create many problems for students using wheelchairs. A review of the map in Appendix F clearly reveals the limited utilization of the campus grounds. Assistance is needed in crossing all streets. The alternative to this is the use of streets and

driveways. The heavy campus traffic makes this extremely hazardous. A wheelchair is relatively small, can be easily hidden behind cars, and is therefore in danger of being hit in traffic areas.

Aside from danger and the loss of independence, a definite time factor is involved in traveling across campus. In order to avoid curbs, unlevel sidewalks, and steps, many devious and time and energy consuming "detours" must be made to get to a building perhaps only a few feet away. Appendix F includes a sample of one of the routes a student must take to class to avoid architectural barriers compared with the route an able-bodied person might take to the same building. It is a common practice to schedule an hour between classes to enable the student to get to class on time. An effect on the number of hours a student could carry and the time and energy remaining for study is unavoidable.

Data in Table II reveal that wheelchair students would have to be completely dependent on able-bodied "friends" for access to half of the buildings they must use. There are no classroom buildings completely accessible although one-fourth are accessible with minimum difficulty and/or danger (see Table IV). However, for an average of 43 per cent of the class meetings attended, considerable assistance would be needed to enter the buildings since more than one-half of the class meeting buildings are totally inaccessible (see Tables IV and VII). The only buildings to which there is complete and independent access are the residence halls included in the study. It is interesting that even in these buildings a wheelchair student must depend upon others for some degree of assistance in operating elevators, using restroom facilities, making a telephone call, and using the cafeteria services.

During the fall semester of 1967 a student in a wheelchair would have found it impossible (without complete dependence on the able-bodied) to attend any of the twenty-eight "extra-curricular" cultural events in the University Auditorium, the Student Union Theater, the Field House, and the Prairie Playhouse as listed in the College of Arts and Sciences "Arts Calendar." The above buildings or areas were all totally inaccessible for attendance at these events, many of which could have been required for class activity.

Table XIII noted that 28 per cent of the class meetings were inaccessible due to the lack of elevator service. Therefore, students in wheelchairs would be faced with having to ask others to carry them up at least one flight of steps to an average of 28 per cent of the class meetings. For 40 per cent of the class meetings assistance would be needed in using the elevator. The design of science laboratories prohibits students from independent work; thus, the knowledge and understanding for which the laboratory exercises are designed may not be gained.

There is no doubt that architectural barriers create many significant economic, academic, and social problems for the student in a wheelchair. For some students the difficulty may require the employment of an assistant or an extra semester or year to complete requirements. Some curricula might prove impractical for students to enter although employment following graduation would be available. Grades could suffer due to unnecessary time and energy spent getting around campus. The inaccessibility of cultural events would also affect the academic advancement of the student. Although not measurable and not actually included in the study, social problems created by these

physical barriers must also be realized.

During the spring of 1967 a campus wide survey of offices, and fifty-seven living groups revealed that only five students, or .03 per cent of the student population of 14,676 were using wheelchairs. Information concerning the percentage of the college age group using wheelchairs is not available. However, it is estimated that one in seven Americans are affected by architectural barriers. It would then seem that a much larger percentage of the student population would be wheelchair users. When consideration is given to the extent of architectural barriers and the problems they create for students on the campus it can be concluded that these barriers could easily prohibit or discourage potential students from attending Oklahoma State University at Stillwater, Oklahoma.

## CHAPTER V

### RECOMMENDATIONS AND CONCLUSION

The study indicated that certain modifications would be required to facilitate wheelchair students on the Oklahoma State University's campus in Stillwater. Recommendations for these modifications have been formulated and presented here. Illustrations, in the form of maps and drawings, supplementing this discussion, can be found in Appendixes F and G.

#### Campus Grounds

As previously stated, wheelchair users have only limited utilization of the campus grounds. The map in Appendix F has been marked to include most of the following recommendations. Of major importance is the construction of curb inclines at principal crosswalks on campus to insure independent and safe circulation. Ideally these inclines should not protrude into the street and should not have a gradation over 10 per cent. Due to heating systems installed under the walks on campus, there are many places where any incline made must protrude into the street and therefore have a shorter and steeper slope than desired.

The construction of inclined walks to avert or remove steps in the major walkways, and repair and evening of existing walks are other important modifications that must be made to the campus grounds. Initiation of maintenance policies to keep major walks clear of sleet and

snow is essential. In addition, the provision of 12' wide parking spaces in all lots adjacent to major buildings must be made as the demand warrants. These spaces should be located in areas of greatest safety, close to a curb incline.

### Exterior of Buildings

Modifications recommended for the exterior of the buildings primarily pertains to (1) the extension of entrance platforms, (2) the construction of ramps, and (3) the provision of suitable doors and doorways. The survey disclosed that only two buildings were classified as being accessible. It is, therefore, evident that some degree of modification would be needed at entrances to all other buildings. These remaining buildings are listed according to degree of accessibility and a brief summary of the modifications recommended for each follows (see Appendix G):

#### Home Economics West (non-accessible)

1. Construct a new entrance on the east side of the north wing of the central buildings that would conform to entrance standards for accessibility.
2. Construct a permanent ramp leading to the above mentioned entrance.

#### Physical Science (non-accessible)

1. Add 16' kickplates to the inside of the existing doors at the north entrance.
2. Build a permanent ramp leading to the north entrance of Physical Science.
3. Construct a walkway from the above mentioned ramp to

the walk on the west side of the building.

Gundersen (non-accessible)

1. Eliminate the step in the approach to the north entrance by constructing an inclined walk.

2. Install a 16' kickplate on the inside of the door to protect the glass from accidental breakage.

3. Reduce door resistance caused by the door closer to meet the needs of the wheelchair student.

Bennett Chapel (non-accessible)

1. Construct an incline or ramp to meet the threshold level of the east entrance.

2. Replace the double doors with a single door supplying the clear-opening, handle, and door closer requirements.

University Auditorium (non-accessible)

1. Include an accessible entrance in the future remodeling of the buildings. The Auditorium, as it now exists, is accessible only by a long flight of steps. The present doors do not fulfill the requirements for accessibility. This detail must also be considered in the remodeling of the building.

Life Science (non-accessible)

1. Extend the exterior platform at the southwest entrance to allow for a ramp along the south side of the building. Such a ramp would not interfere with cross traffic on the walk.

2. Build the above mentioned ramp and construct a walk connecting the ramp with the walk on the south side of the building.

Morrill Hall (non-accessible)

1. Extend the exterior platform at the west entrance and build an incline to eliminate the step at the doorway.
2. Reduce the resistance caused by the door closer to no more than eight pounds of pressure.

Field House (non-accessible)

1. Extend the platform at the center east entrance to allow for the construction of a permanent ramp to that entrance.
2. Replace the double door with a single door that meets the requirements for accessibility.

Monroe Home Management House (non-accessible)

1. Extend the exterior platform to make a ramp possible to the front entrance.
2. Construct the ramp to the front entrance.

Whitehurst (accessible with difficulty and/or danger)

1. Replace the double doors at the southwest entrance with a single door giving the required clear-opening width.

Home Economics East (accessible with difficulty and/or danger)

1. Remove the screen doors at the east entrance.
2. Adjust the door closer to the required eight pounds pressure.

South Engineering (accessible with difficulty and/or danger)

1. Reconstruct the ramp at the northwest entrance to the building to provide a slope no greater than 8 percent and to meet other requirements set for ramps.

Business Building (accessible with minimum difficulty and/or danger)

1. Add 16" kickplates to the inside of the doors at the east entrance to protect the glass from breakage.

2. Reduce the resistance of the door closer at the east entrance to enable those with loss of strength to enter.

Classroom Building (accessible with minimum difficulty and/or danger)

1. Adjust the door closers to permit ease of opening the door.

2. Replace present threshold with one with a gradual incline and a height no greater than three-fourths of an inch.

Student Union (accessible with minimum difficulty and/or danger)

1. Add 16" kickplates on the inside of all doors at the northwest entrance.

Library (accessible with minimum difficulty and/or danger)

1. Reduce the resistance of the door closers at the north entrance and add 16" kickplates to the inside of these doors.

North Engineering (accessible with minimum difficulty and/or danger)

1. Add 16" kickplates to the inside of the west doors.

### Interior of Buildings

Architectural barriers were found in all of the buildings surveyed. Many of these barriers were found so often that general recommendations for their elimination can be made. These recommendations apply to almost all buildings. Corridors in most of the buildings have obstructions such as tables, display cases, coat racks, and doors that swing into the corridor; these could either be removed from the hallway or placed in recessed or other protected areas. However, in many

instances, water fountains are necessary corridor obstructions. Since most recessed water fountains do not provide the necessary space for a wheelchair approach, they are not usable. It is recommended that existing water fountains be lowered or that additional ones be installed at the level of 36" from floor to basin. In cases where this is not feasible, paper cup dispensers no higher than 40" from the floor should be provided. Telephones are other items not usable by the disabled. In all instances where a need for public telephones is recognized, one telephone should be available for use from a wheelchair. Specifications for such telephones are shown in Appendix E.

Door, doorways, and hardware properly chosen and installed can eliminate many interior barriers. When necessary, doorways should be modified to provide for a 32" clear-opening. Only one side of double doors can be operated from a wheelchair; therefore, a 32" clear-opening must be provided for each side. The installation of hospital type hinges can usually provide an additional 2" clear-opening; however, in some instances the doorway may need to be widened. Door closers should be adjusted to require no more than 8 pounds pressure. Conventional door knobs should be replaced by lever or pull hardware and all handles placed within the range of 36" to 39" from the floor.

All restrooms should provide facilities for wheelchair students. This, many times, can be accomplished through the combination of two stalls to provide one of suitable width. Grab bars, wide doors with outward swing, and water closets of suitable design and mounting should be installed. At least one lavatory in each restroom should be raised to provide 30" clearance from floor to apron. Towel dispensers, mirrors, and shelves should be lowered to heights no greater than 40" (see

Appendix E).

Classrooms generally offer few barriers. However, ramps should be provided to make speaker's platforms in auditoriums and large classrooms accessible to those in wheelchairs. Such platforms are found in Home Economics West, North Engineering, South Engineering, Physical Science, Classroom Building and Bennett Chapel.

Elevators should be modified to insure independent use. Full utilization requires the lowering of interior and exterior controls to within the reach limitations of wheelchair users (48") and the timing of elevator doors to provide an 8 second clear-opening. It is recommended that two sets of interior controls, one at the present height and another at the lower height for wheelchair users, be provided.

The previous discussion has been concerned with general modifications recommended for all of the buildings surveyed. Many barriers found were unique to the particular building and, therefore, must be given individual attention. The following is a list of buildings and modifications recommended to achieve utilization in the facilities examined.

#### Home Economics West

1. Remove the partitions and doors that block the corridor on the south end of the first floor and the south end of the third floor. If some partition is necessary for air conditioning, a series of doors meeting the requirements should be provided with a minimum of solid wall to obstruct traffic.
2. Modify laboratory and seminar tables to allow the necessary 30" clearance between the floor and apron.
3. Equip the clothing construction laboratories with storage

and equipment accessible and usable by students confined to wheelchairs. A basic consideration would be the availability of clearance for the arms of the wheelchair under the tables, desks, sewing machines, ironing boards, and sinks.

4. Remodel the demonstration kitchen in 106 to provide an example of a flexible kitchen arrangement for disabled homemakers. This would also allow students confined to wheelchairs to use this area for required demonstrations.

5. Widen the aisle and doorway between equipment laboratories 002 and 001, and choose equipment in these two rooms to provide at least one area suitable for use from a wheelchair. At present no area is usable from a wheelchair.

6. Reconstruct the entrance to the first floor lounge to provide needed inside clearance (see Appendix G).

#### Life Science

1. Replace the existing freight elevator with a passenger elevator meeting the requirements for wheelchairs. Access to the upper levels is now available only by means of the stairway.

2. Modify the tables in the biology laboratory room inspected to provide clearance for the arms of the wheelchair underneath at least one table.

#### Business Building

1. Install an exterior elevator to make the north section of the building accessible. At the present time this section of the building is accessible only by means of a full flight of steps. The area contains several large and important lecture areas.

2. Remove selected stationary chairs and baskets under the desks in the large lecture rooms to enable use of the desks by wheelchair students.

#### Physical Science

1. Provide a desk-type bench and equipment within reach in all chemistry laboratories used by wheelchair students. All benches in the chemistry laboratories surveyed were completely unusable by the wheelchair student. The new desks could be used for other work when not in use by a disabled student.

2. Provide access to the front of room 101 through the adjoining supply room. This large and important lecture room is now completely inaccessible due to the door and the seating arrangement.

#### Home Economics East

1. Arrange one area in each food preparation laboratory to serve both the disabled and the able-bodied. This would involve the selection and arrangement of equipment, storage, and work space. Neither of the food preparation laboratories are now usable from a wheelchair.

2. Install an exterior elevator to make the upper levels accessible. If this is not justified by use, the classes taught on these upper levels should be made available elsewhere in accessible areas.

#### Student Union

1. Widen the check-out line in the bookstore by simply moving the railing.

2. Remodel or rearrange the cafeteria to provide

accessibility of self-service items.

3. Eliminate the series of steps in the corridors, if at all structurally feasible, to allow access to important areas in the Student Union. At the present time, the Union Theater, and the third and fourth floors are not accessible due to these corridor steps.

#### Monroe Home Management House

1. Modify the kitchen to provide for utilization by wheelchair students. Such an area could be designed for the disabled and the able-bodied and could serve as a demonstration kitchen for the Home Management Department.

2. Remodel the present bathroom to include the unused back porch. This larger area could be arranged according to wheelchair requirements since the existing bathroom is entirely too small for a wheelchair to enter.

#### Bennett Chapel

1. Provide small ramps to eliminate the steps in the front area.

#### Dormitories (Kerr-Drummond Complex)

1. Provide selected rooms with desks having the required chair clearance, closet rods that can be lowered when necessary, and mirrors no higher than 40".

2. Provide for utilization of restrooms by wheelchair students on floors where rooms have been adapted. In addition to the restroom requirements already stated, there should be provided a shower or bathtub suitable for use by the disabled. This could be done by closing an entrance and using the space for an inclined

approach to the shower or for a bathtub. Grab bars should be provided for both bathtubs and showers.

3. Rearrange or remodel cafeteria to provide accessibility of self-service items, needed circulation space, and chair clearance under the table.

In an attempt to develop a plan for the elimination of architectural barriers on the campus, a priority listing of modifications recommended has been compiled. This proposed plan includes recommendations to be carried out in a three-stage program. A brief outline of this program can be found in Appendix H. Such a plan, tempered with flexibility and an acute awareness of the situation should eventually result in a fully accessible and usable campus for wheelchair students.

There can be no doubt that architectural barriers exist and present significant difficulties and dangers to wheelchair students on the Oklahoma State University campus in Stillwater. The scope of the study included only those facilities used in two curricula; however, it is felt that major campus buildings were included to some degree. The frequency and uniformity of the barriers found strongly suggest that there would be little variance between the nature and frequency of the barriers in other campus facilities not studied, and those recorded. Therefore, it can be concluded that the general findings and the recommendations stated could be extended to include those facilities not covered in the survey.

The findings of the study indicate that there existed an almost total lack of accessibility and utilization of campus grounds and buildings at Oklahoma State University during the fall semester of 1967. It is concluded that the presence of architectural barriers on the campus

makes it extremely difficult, if not impossible, for many potential students confined to wheelchairs to live in the dormitories and attend classes on the campus. The degree of independence achieved by a wheelchair student would vary considerably depending upon the disability and the individual. However, the necessity for extensive assistance is in direct proportion to unavoidable steps and narrow doorways. The inevitable result is the barring of potential good students from the campus. This denial of an opportunity for a college education has already been defined as a waste of human resources that cannot be socially or economically justified.

It is felt that the extent of uniformity of architectural barriers found suggests that the general findings concerning the nature and significance of barriers are indicative of other campus and other public facilities of similar age and design. It would follow that the recommendations formulated here for specific facilities could easily be applied for the elimination of barriers in other related facilities. Therefore, though the study was designed for a particular location, the findings and recommendations are not restricted but have implications for other institutions of higher learning.

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## APPENDIX A

### SURVEY INSTRUMENT

## SURVEY INSTRUMENT

The survey instrument is divided into the following six parts:

- I. Campus Grounds, II. Parking Lots, III. Entrances and Exits, IV. Interior and Exterior Doors and Doorways, V. General Building Interiors, and VI. Areas.

### I. Campus Grounds.

On the attached map, locate by letter, any of the following barriers:

- A. Surface irregularity
- B. Incline
- C. Abrupt change in level
- D. Walk width (4')
- E. General safety
- F. Other

Note: In the following tables " \* " signifies spaces for needed measurements while " \*\* " signifies spaces for the degree of accessibility or utilization. (X = Full; 1 = Limited; 0 = Lack of; and - = Does not apply)

### II. Parking Lots

- A. Proximity to facilities
- B. Width of space
- C. Identification
- D. Abrupt change in level
- E. Circulation within lot
- F. Incline (5%)
- G. Surface irregularity
- H. Egress
- I. Other

*	**	*	**	*	**





VI. Areas (Continued)

	*	**	*	**	*	**
7. Use of desk and/or equipment						
8. Access to stage and dressing area						
9. Other						
B. Eating Areas						
1. Serving aisle width						
2. Serving line height						
3. Accessibility of self-service items						
4. Table height						
5. Table width						
6. Chair clearance						
7. Floor surface						
8. Aisle width						
9. Tray return						
10. Other						
C. Dormitory Rooms						
1. Floor surface						
2. Floor space						
3. Use of dresser						
4. Use of mirror (40" height)						
5. Use of desk (24" x 30" chair-clearance)						
6. Use of closet rod (48" height)						
7. Other						
D. Restrooms						
1. General						
a. floor surface						
b. circulation space						
2. Lavatory						
a. height to apron (30")						
b. total height (32")						
c. knee clearance height (26")						
d. knee clearance depth (10")						
e. insulated pipes						
f. depth of chair clearance (18")						
g. other						
3. Mirror, Shelf and Accessories						



APPENDIX B

AMERICAN STANDARD SPECIFICATIONS FOR MAKING BUILDINGS  
AND FACILITIES ACCESSIBLE TO, AND USABLE BY,  
THE PHYSICALLY HANDICAPPED

# American Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped

## 1. Scope and Purpose

### 1.1 Scope

**1.1.1** This standard applies to all buildings and facilities used by the public. It applies to temporary or emergency conditions as well as permanent conditions. It does not apply to private residences.

**1.1.2** This standard is concerned with non-ambulatory disabilities, semi-ambulatory disabilities, sight disabilities, hearing disabilities, disabilities of incoordination, and aging.<sup>1</sup>

**1.2 Purpose.** This standard is intended to make all buildings and facilities used by the public accessible to, and functional for, the physically handicapped, to, through, and within their doors, without loss of function, space, or facility where the general public is concerned. It supplements existing American Standards, and reflects great concern for safety of life and limb. In cases of practical difficulty, unnecessary hardship, or extreme differences, administrative authorities may grant exceptions from the literal requirements of this standard or permit the use of other methods or materials, but only when it is clearly evident that equivalent facilitation and protection are thereby secured.

## 2. Definitions

**2.1 Non-ambulatory Disabilities.** Impairments that, regardless of cause or manifestation, for all practical purposes, confine individuals to wheelchairs.

**2.2 Semi-ambulatory Disabilities.** Impairments that cause individuals to walk with difficulty or insecurity. Individuals using braces or crutches, amputees, arthritics, spastics, and those with pulmonary and cardiac ills may be semi-ambulatory.

**2.3 Sight Disabilities.** Total blindness or impairments affecting sight to the extent that the individual functioning in public areas is insecure or exposed to danger.

**2.4 Hearing Disabilities.** Deafness or hearing handicaps that might make an individual insecure in public areas because he is unable to communicate or hear warning signals.

**2.5 Disabilities of Incoordination.** Faulty coordination or palsy from brain, spinal, or peripheral nerve injury.

**2.6 Aging.** Those manifestations of the aging processes that significantly reduce mobility, flexibility, coordination, and perceptiveness but are not accounted for in the aforementioned categories.

**2.7 Standard.** When this term appears in small letters and is not preceded by the word "American," it is descriptive and does not refer to an American Standard approved by ASA; for example, a "standard" wheelchair is one characterized as standard by the manufacturers.

**2.8 Fixed Turning Radius, Wheel to Wheel.** The tracking of the caster wheels and large wheels of a wheelchair when pivoting on a spot.

**2.9 Fixed Turning Radius, Front Structure to Rear Structure.** The turning radius of a wheelchair, left front-foot platform to right rear wheel, or right front-foot platform to left rear wheel, when pivoting on a spot.

**2.10 Involved (Involvement).** A portion or portions of the human anatomy or physiology, or both, that have a loss or impairment of normal function as a result of genesis, trauma, disease, inflammation, or degeneration.

**2.11 Ramps, Ramps with Gradients.** Because the term "ramp" has a multitude of meanings and uses, its use in this text is clearly defined as ramps with gradients (or ramps with slopes) that deviate from what would otherwise be considered the normal level. An exterior ramp, as distinguished from a "walk," would be considered an appendage to a building leading to a level above or below existing ground level. As such, a ramp shall meet certain requirements similar to those imposed upon stairs.

**2.12 Walk, Walks.** Because the terms "walk" and "walks" have a multitude of meanings and uses, their use in this text is clearly defined as a predetermined, prepared-surface, exterior pathway leading to or from a building or facility, or from one exterior area to another, placed on the existing ground level

<sup>1</sup> See definitions in Section 2.

and not deviating from the level of the existing ground immediately adjacent.

**2.13 Appropriate Number.** As used in this text, appropriate number means the number of a specific item that would be necessary, in accord with the purpose and function of a building or facility, to accommodate individuals with specific disabilities in proportion to the anticipated number of individuals with disabilities who would use a particular building or facility.

**EXAMPLE:** Although these specifications shall apply to all buildings and facilities used by the public, the numerical need for a specific item would differ, for example, between a major transportation terminal, where many individuals with diverse disabilities would be continually coming and going, an office building or factory, where varying numbers of individuals with disabilities of varying manifestations (in many instances, very large numbers) might be employed or have reason for frequent visits, a school or church, where the number of individuals may be fixed and activities more definitive, and the many other buildings and facilities dedicated to specific functions and purposes.

**NOTE:** Disabilities are specific and where the individual has been properly evaluated and properly oriented and where architectural barriers have been eliminated, a specific disability does not constitute a handicap. It should be emphasized that more and more of those physically disabled are becoming *participants*, rather than spectators, in the fullest meaning of the word.

### 3. General Principles and Considerations

**3.1 Wheelchair Specifications.** The collapsible-model wheelchair of tubular metal construction with plastic upholstery for back and seat is most commonly used. The standard model of all manufacturers falls within the following limits, which were used as the basis of consideration:

- (1) Length: 42 inches
- (2) Width, when open: 25 inches
- (3) Height of seat from floor: 19½ inches
- (4) Height of armrest from floor: 29 inches
- (5) Height of pusher handles (rear) from floor: 36 inches
- (6) Width, when collapsed: 11 inches

#### 3.2 The Functioning of a Wheelchair

**3.2.1** The fixed turning radius of a standard wheelchair, wheel to wheel, is 18 inches. The fixed turning radius, front structure to rear structure, is 31.5 inches.

**3.2.2** The average turning space required (180 and 360 degrees) is 60 x 60 inches.

**NOTE:** Actually, a turning space that is longer than it is

wide, specifically, 63 x 56 inches, is more workable and desirable. In an area with two open ends, such as might be the case in a corridor, a minimum of 54 inches between two walls would permit a 360-degree turn.

**3.2.3** A minimum width of 60 inches is required for two individuals in wheelchairs to pass each other.

#### 3.3 The Adult Individual Functioning in a Wheelchair<sup>2</sup>

**3.3.1** The average unilateral vertical reach is 60 inches and ranges from 54 inches to 78 inches.

**3.3.2** The average horizontal working (table) reach is 30.8 inches and ranges from 28.5 inches to 33.2 inches.

**3.3.3** The bilateral horizontal reach, both arms extended to each side, shoulder high, ranges from 54 inches to 71 inches and averages 64.5 inches.

**3.3.4** An individual reaching diagonally, as would be required in using a wall-mounted dial telephone or towel dispenser, would make the average reach (on the wall) 48 inches from the floor.

#### 3.4 The Individual Functioning on Crutches<sup>3</sup>

**3.4.1** On the average, individuals 5 feet 6 inches tall require an average of 31 inches between crutch tips in the normally accepted gaits.<sup>4</sup>

**3.4.2** On the average, individuals 6 feet 0 inches tall require an average of 32.5 inches between crutch tips in the normally accepted gaits.<sup>4</sup>

### 4. Site Development<sup>5</sup>

**4.1 Grading.** The grading of ground, even contrary to existing topography, so that it attains a level with a normal entrance will make a facility accessible to individuals with physical disabilities.

<sup>2</sup>Extremely small, large, strong, or weak and involved individuals could fall outside the ranges in 3.3.1, 3.3.2, 3.3.3, and their reach could differ from the figure given in 3.3.4. However, these reaches were determined using a large number of individuals who were functionally trained, with a wide range in individual size and involvement.

<sup>3</sup>Most individuals ambulating on braces or crutches, or both, or on canes are able to manipulate within the specifications prescribed for wheelchairs, although doors present quite a problem at times. However, attention is called to the fact that a crutch tip extending laterally from an individual is not obvious or protective as a wheelchair and is, therefore, a source of vulnerability.

<sup>4</sup>Some cerebral palsied individuals, and some severe arthritics, would be extreme exceptions to 3.4.1 and 3.4.2.

<sup>5</sup>Site development is the most effective means to resolve the problems created by topography, definitive architectural designs or concepts, water table, existing streets, and atypical problems, singularly or collectively, so that ingress, egress to buildings by physically disabled can be facilitated while preserving the desired design and effect of the architecture.

## 4.2 Walks

**4.2.1** Public walks should be at least 48 inches wide and should have a gradient not greater than 5 percent.<sup>6</sup>

**4.2.2** Such walks shall be of a continuing common surface, not interrupted by steps or abrupt changes in level.

**4.2.3** Wherever walks cross other walks, drive-ways, or parking lots they should blend to a common level.<sup>7</sup>

NOTE: 4.1 and 4.2, separately or collectively, are greatly aided by terracing, retaining walls, and winding walks allowing for more gradual incline, thereby making almost any building accessible to individuals with permanent physical disabilities, while contributing to its esthetic qualities.

**4.2.4** A walk shall have a level platform at the top which is at least 5 feet by 5 feet, if a door swings out onto the platform or toward the walk. This platform shall extend at least 1 foot beyond each side of the doorway.

**4.2.5** A walk shall have a level platform at least 3 feet deep and 5 feet wide, if the door does not swing onto the platform or toward the walk. This platform shall extend at least 1 foot beyond each side of the doorway.

## 4.3 Parking Lots

**4.3.1** Spaces that are accessible and approximate to the facility should be set aside and identified for use by individuals with physical disabilities.

**4.3.2** A parking space open on one side, allowing room for individuals in wheelchairs or individuals on braces and crutches to get in and out of an automobile onto a level surface, suitable for wheeling and walking, is adequate.

**4.3.3** Parking spaces for individuals with physical disabilities when placed between two conventional

<sup>6</sup>It is essential that the gradient of walks and driveways be less than that prescribed for ramps, since walks would be void of handrails and curbs and would be considerably longer and more vulnerable to the elements. Walks of near maximum grade and considerable length should have level areas at intervals for purposes of rest and safety. Walks or driveways should have a nonslip surface.

<sup>7</sup>This specification does not require the elimination of curbs, which, particularly if they occur at regular intersections, are a distinct safety feature for all of the handicapped, particularly the blind. The preferred method of meeting the specification is to have the walk incline to the level of the street. However, at principal intersections, it is vitally important that the curb run parallel to the street, up to the point where the walk is inclined, at which point the curb would turn in and gradually meet the level of the walk at its highest point. A less preferred method would be to gradually bring the surface of the driveway or street to the level of the walk. The disadvantage of this method is that a blind person would not know when he has left the protection of a walk and entered the hazards of a street or driveway.

diagonal or head-on parking spaces should be 12 feet wide.

**4.3.4** Care in planning should be exercised so that individuals in wheelchairs and individuals using braces and crutches are not compelled to wheel or walk behind parked cars.

**4.3.5** Consideration should be given the distribution of spaces for use by the disabled in accordance with the frequency and persistency of parking needs.

**4.3.6** Walks shall be in conformity with 4.2.

## 5. Buildings

**5.1 Ramps with Gradients.** Where ramps with gradients are necessary or desired, they shall conform to the following specifications:

**5.1.1** A ramp shall not have a slope greater than 1 foot rise in 12 feet, or 8.33 percent, or 4 degrees 50 minutes.

**5.1.2** A ramp shall have handrails on at least one side, and preferably two sides, that are 32 inches in height, measured from the surface of the ramp, that are smooth, that extend 1 foot beyond the top and bottom of the ramp, and that otherwise conform with American Standard Safety Code for Floor and Wall Openings, Railings, and Toe Boards, A12-1932.

NOTE 1: Where codes specify handrails to be of heights other than 32 inches, it is recommended that two sets of handrails be installed to serve all people. Where major traffic is predominantly children, particularly physically disabled children, extra care should be exercised in the placement of handrails, in accordance with the nature of the facility and the age group or groups being serviced.

NOTE 2: Care should be taken that the extension of the handrail is not in itself a hazard. The extension may be made on the side of a continuing wall.

**5.1.3** A ramp shall have a surface that is non-slip.

**5.1.4** A ramp shall have a level platform at the top which is at least 5 feet by 5 feet, if a door swings out onto the platform or toward the ramp. This platform shall extend at least 1 foot beyond each side of the doorway.

**5.1.5** A ramp shall have a level platform at least 3 feet deep and 5 feet wide, if the door does not swing onto the platform or toward the ramp. This platform shall extend at least 1 foot beyond each side of the doorway.

**5.1.6** Each ramp shall have at least 6 feet of straight clearance at the bottom.

**5.1.7** Ramps shall have level platforms at 30-foot intervals for purposes of rest and safety and shall have level platforms wherever they turn.

## 5.2 Entrances

**5.2.1** At least one primary entrance to each building shall be usable by individuals in wheelchairs.

NOTE: Because entrances also serve as exits, some being particularly important in case of an emergency, and because the proximity of such exits to all parts of buildings and facilities, in accordance with their design and function, is essential (see 112 and 2000 through 2031 of American Standard Building Exits Code, A9.1-1953) it is preferable that all or most entrances (exits) should be accessible to, and usable by, individuals in wheelchairs and individuals with other forms of physical disability herein applicable.

**5.2.2** At least one entrance usable by individuals in wheelchairs shall be on a level that would make the elevators accessible.

## 5.3 Doors and Doorways

**5.3.1** Doors shall have a clear opening of no less than 32 inches when open and shall be operable by a single effort.

NOTE 1: Two-leaf doors are not usable by those with disabilities defined in 2.1, 2.2, and 2.5 unless they operate by a single effort, or unless one of the two leaves meets the requirement of 5.3.1.

NOTE 2: It is recommended that all doors have kick plates extending from the bottom of the door to at least 16 inches from the floor, or be made of a material and finish that would safely withstand the abuse they might receive from canes, crutches, wheelchair foot-platforms, or wheelchair wheels.

**5.3.2** The floor on the inside and outside of each doorway shall be level for a distance of 5 feet from the door in the direction the door swings and shall extend 1 foot beyond each side of the door.

**5.3.3** Sharp inclines and abrupt changes in level shall be avoided at doorsills. As much as possible, thresholds shall be flush with the floor.

NOTE 1: Care should be taken in the selection, placement, and setting of door closers so that they do not prevent the use of doors by the physically disabled. Time-delay door closers are recommended.

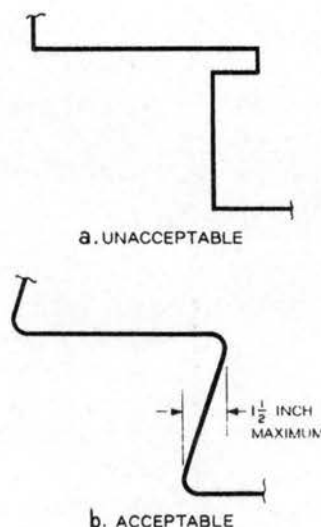
NOTE 2: Automatic doors that otherwise conform to 5.3.1, 5.3.2, and 5.3.3 are very satisfactory.

NOTE 3: These specifications apply both to exterior and interior doors and doorways.

**5.4 Stairs.** Stairs shall conform to American Standard A9.1-1953, with the following additional considerations:

**5.4.1** Steps in stairs that might require use by those with disabilities defined in 2.2 and 2.5 or by the aged shall not have abrupt (square) nosing. (See Fig. 1.)

NOTE: Individuals with restrictions in the knee, ankle, or hip, with artificial legs, long leg braces, or comparable conditions cannot, without great difficulty and hazard, use steps with nosing as illustrated in Fig. 1a, but can safely and with minimum difficulty use steps with nosing as illustrated in Fig. 1b.



**Fig. 1**  
**Steps**

**5.4.2** Stairs shall have handrails 32 inches high as measured from the tread at the face of the riser.

NOTE: Where codes specify handrails to be at heights other than 32 inches, it is recommended that two sets of handrails be installed to serve all people. Where traffic is predominantly children, particularly physically disabled children, extra care should be exercised in the placement of handrails in accordance with the nature of the facility and the age group or groups being serviced. Dual handrails may be necessary.

**5.4.3** Stairs shall have at least one handrail that extends at least 18 inches beyond the top step and beyond the bottom step.

NOTE: Care should be taken that the extension of the handrails is not in itself a hazard. The extension may be made on the side of a continuing wall.

**5.4.4** Steps should, wherever possible, and in conformation with existing step formulas, have risers that do not exceed 7 inches.

## 5.5 Floors

**5.5.1** Floors shall have a surface that is nonslip.

**5.5.2** Floors on a given story shall be of a common level throughout or be connected by a ramp in accord with 5.1.1 through 5.1.6, inclusive.

EXAMPLE 1: There shall not be a difference between the level of the floor of a corridor and the level of the floor of the toilet rooms.

EXAMPLE 2: There should not be a difference between the level of the floor of a corridor and the level of a meeting room, dining room, or any other room, unless proper ramps are provided.

**5.6 Toilet Rooms.** It is essential that an appropriate number<sup>8</sup> of toilet rooms, in accordance with the nature and use of a specific building or facility, be made accessible to, and usable by, the physically handicapped.

**5.6.1** Toilet rooms shall have space to allow traffic of individuals in wheelchairs, in accordance with 3.1, 3.2, and 3.3.

**5.6.2** Toilet rooms shall have at least one toilet stall that—

- (1) Is 3 feet wide
- (2) Is at least 4 feet 8 inches, preferably 5 feet, deep
- (3) Has a door (where doors are used) that is 32 inches wide and swings out
- (4) Has handrails on each side, 33 inches high and parallel to the floor, 1½ inches in outside diameter, with 1½ inches clearance between rail and wall, and fastened securely at ends and center
- (5) Has a water closet with the seat 20 inches from the floor

**NOTE:** The design and mounting of the water closet is of considerable importance. A wall-mounted water closet with a narrow understructure that recedes sharply is most desirable. If a floor-mounted water closet must be used, it should not have a front that is wide and perpendicular to the floor at the front of the seat. The bowl should be shallow at the front of the seat and turn backward more than downward to allow the individual in a wheelchair to get close to the water closet with the seat of the wheelchair.

**5.6.3** Toilet rooms shall have lavatories with narrow aprons, which when mounted at standard height are usable by individuals in wheelchairs; or shall have lavatories mounted higher, when particular designs demand, so that they are usable by individuals in wheelchairs.

**NOTE:** It is important that drain pipes and hot-water pipes under a lavatory be covered or insulated so that a wheelchair individual without sensation will not burn himself.

**5.6.4** Some mirrors and shelves shall be provided above lavatories at a height as low as possible and no higher than 40 inches above the floor, measured from the top of the shelf and the bottom of the mirror.

**5.6.5** Toilet rooms for men shall have wall-mounted urinals with the opening of the basin 19 inches from the floor, or shall have floor-mounted urinals that are on level with the main floor of the toilet room.

**5.6.6** Toilet rooms shall have an appropriate number<sup>8</sup> of towel racks, towel dispensers, and other dispensers and disposal units mounted no higher than 40 inches from the floor.

**5.7 Water Fountains.** An appropriate number<sup>8</sup> of water fountains or other water-dispensing means shall be accessible to, and usable by, the physically disabled.

**5.7.1** Water fountains or coolers shall have up-front spouts and controls.

**5.7.2** Water fountains or coolers shall be hand-operated or hand- and foot-operated. (See also American Standard Specifications for Drinking Fountains, Z4.2-1942.)

**NOTE 1:** Conventional floor-mounted water coolers can be serviceable to individuals in wheelchairs if a small fountain is mounted on the side of the cooler 30 inches above the floor.

**NOTE 2:** Wall-mounted, hand-operated coolers of the latest design, manufactured by many companies, can serve the able-bodied and the physically disabled equally well when the cooler is mounted with the basin 36 inches from the floor.

**NOTE 3:** Fully recessed water fountains are not recommended.

**NOTE 4:** Water fountains should not be set into an alcove unless the alcove is wider than a wheelchair. (See 3.1.)

**5.8 Public Telephones.** An appropriate number<sup>8</sup> of public telephones should be made accessible to, and usable by, the physically disabled.

**NOTE:** The conventional public telephone booth is not usable by most physically disabled individuals. There are many ways in which public telephones can be made accessible and usable. It is recommended that architects and builders confer with the telephone company in the planning of the building or facility.

**5.8.1** Such telephones should be placed so that the dial and the handset can be reached by individuals in wheelchairs, in accordance with 3.3.

**5.8.2** An appropriate number<sup>8</sup> of public telephones should be equipped for those with hearing disabilities and so identified with instructions for use.

**NOTE:** Such telephones can be used by everyone.

**5.9 Elevators.** In a multiple-story building, elevators are essential to the successful functioning of physically disabled individuals. They shall conform to the following requirements:

**5.9.1** Elevators shall be accessible to, and usable by, the physically disabled on the level that they use to enter the building, and at all levels normally used by the general public.

**5.9.2** Elevators shall allow for traffic by wheelchairs, in accordance with 3.1, 3.2, 3.3 and 5.3.

**5.10 Controls.** Switches and controls for light, heat, ventilation, windows, draperies, fire alarms, and all similar controls of frequent or essential use, shall be placed within the reach of individuals in wheelchairs. (See 3.3.)

<sup>8</sup> See 2.13.

**5.11 Identification.** Appropriate identification of specific facilities within a building used by the public is particularly essential to the blind.

**5.11.1** Raised letters or numbers shall be used to identify rooms or offices.

**5.11.2** Such identification should be placed on the wall, to the right or left of the door, at a height between 4 feet 6 inches and 5 feet 6 inches, measured from the floor, and preferably at 5 feet.

**5.11.3** Doors that are not intended for normal use, and that might prove dangerous if a blind person were to exit or enter by them, should be made quickly identifiable to the touch by knurling the door handle or knob. (See Fig. 2.)

EXAMPLE: Such doors might lead to loading platforms, boiler rooms, stages, fire escapes, etc.

## 5.12 Warning Signals

**5.12.1** Audible warning signals shall be accompanied by simultaneous visual signals for the benefit of those with hearing disabilities.

**5.12.2** Visual signals shall be accompanied by simultaneous audible signals for the benefit of the blind.

**5.13 Hazards.** Every effort shall be exercised to obviate hazards to individuals with physical disabilities.

**5.13.1** Access panels or manholes in floors, walks, and walls can be extremely hazardous, particularly when in use, and should be avoided.

**5.13.2** When manholes or access panels are open and in use, or when an open excavation exists on a site, particularly when it is approximate to normal pedestrian traffic, barricades shall be placed on all open sides, at least 8 feet from the hazard, and warning devices shall be installed in accord with 5.12.2.

**5.13.3** Low-hanging door closers that remain within the opening of a doorway when the door is open, or that protrude hazardously into regular corridors or traffic ways when the door is closed, shall be avoided.

**5.13.4** Low-hanging signs, ceiling lights, and similar objects or signs and fixtures that protrude into regular corridors or traffic ways shall be avoided. A minimum height of 7 feet, measured from the floor, is recommended.

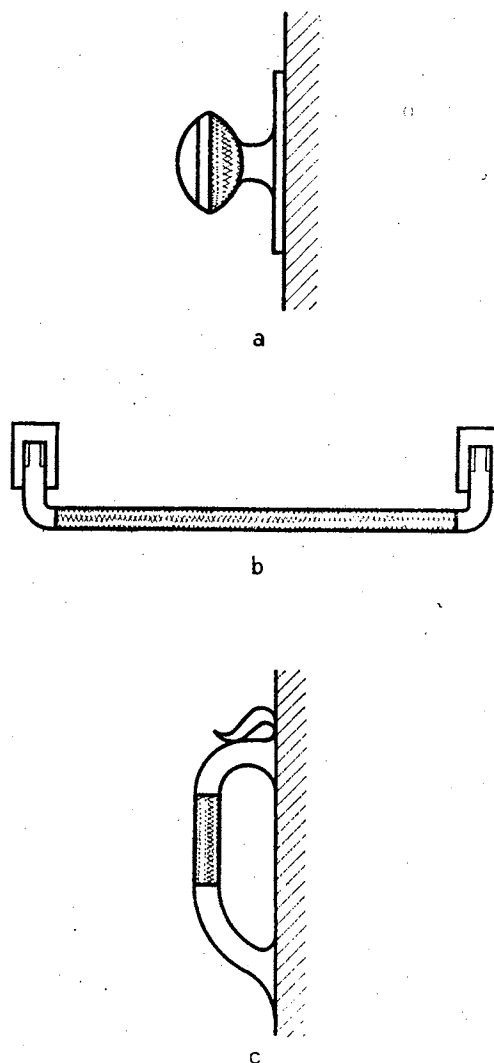


Fig. 2

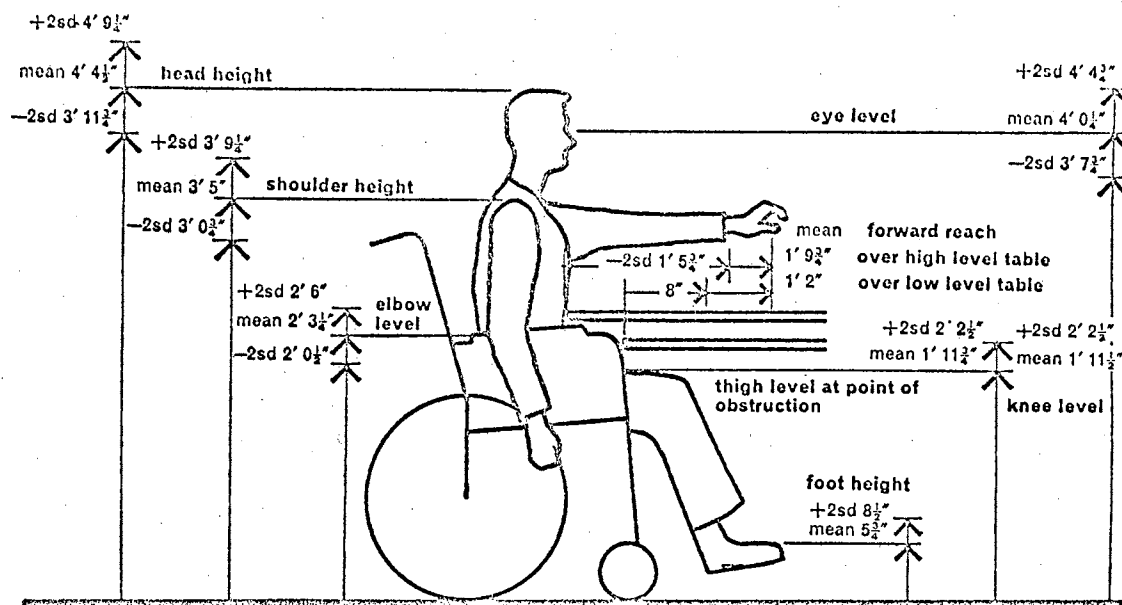
## Knurled Door Handles and Knobs

**5.13.5** Lighting on ramps shall be in accord with 1201, 1202, 1203, and 1204 of American Standard A9.1-1953.

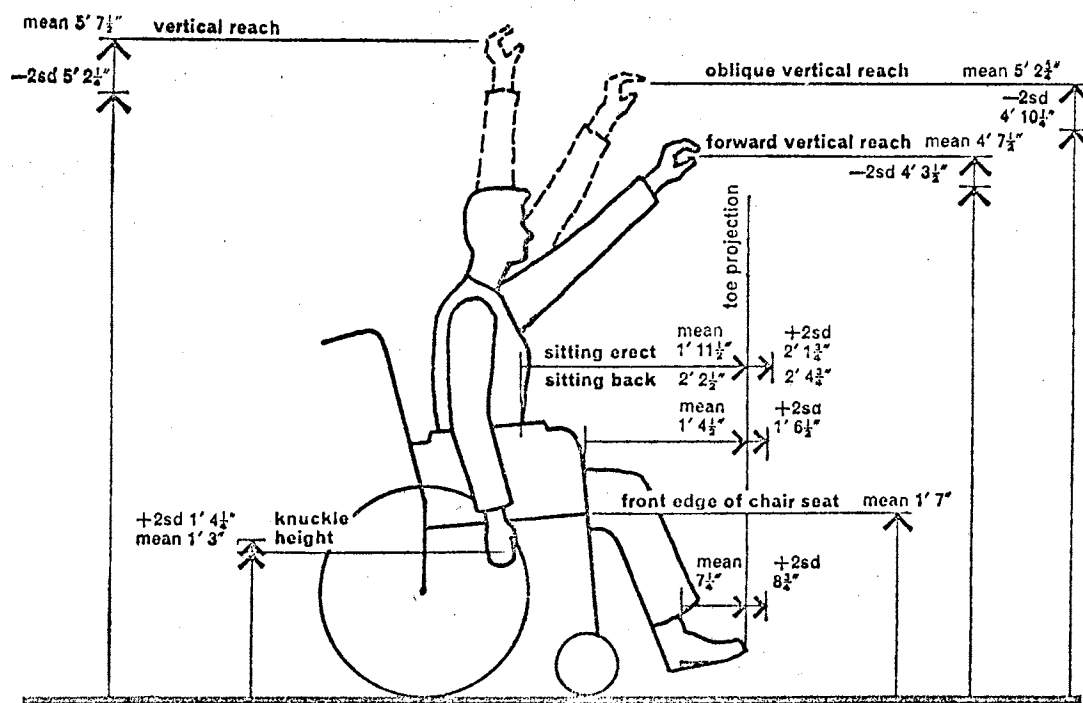
**5.13.6** Exit signs shall be in accord with 1205 of American Standard A9.1-1953, except as modified by 5.11 of this standard.

American Standards Association, American Standard Specifications for Making Buildings and Facilities Accessible to, and Usable By, the Physically Handicapped (Chicago, 1961).

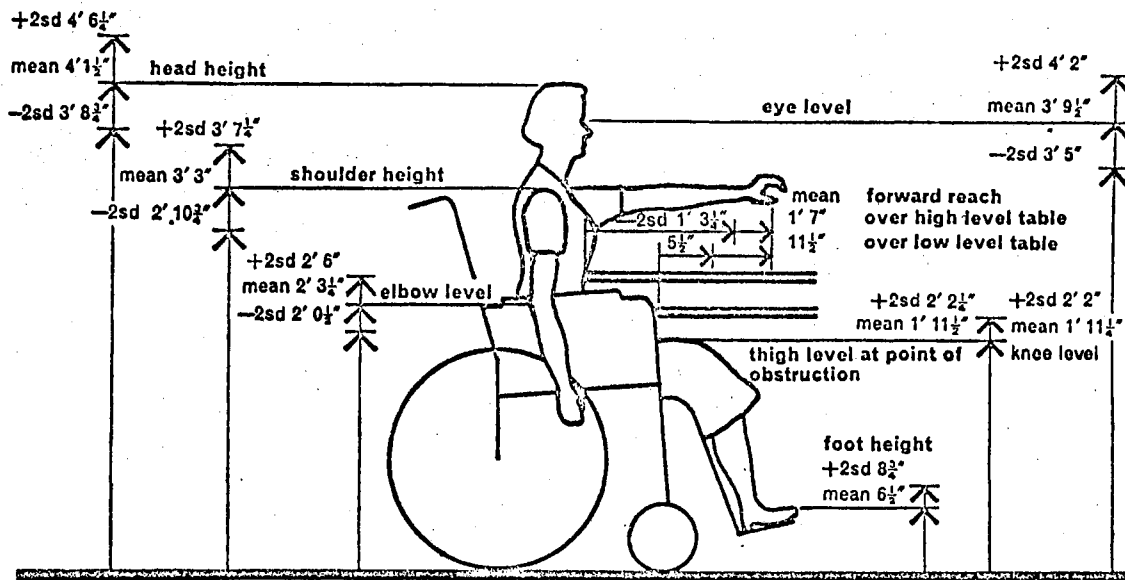
APPENDIX C  
DIMENSIONAL REQUIREMENTS



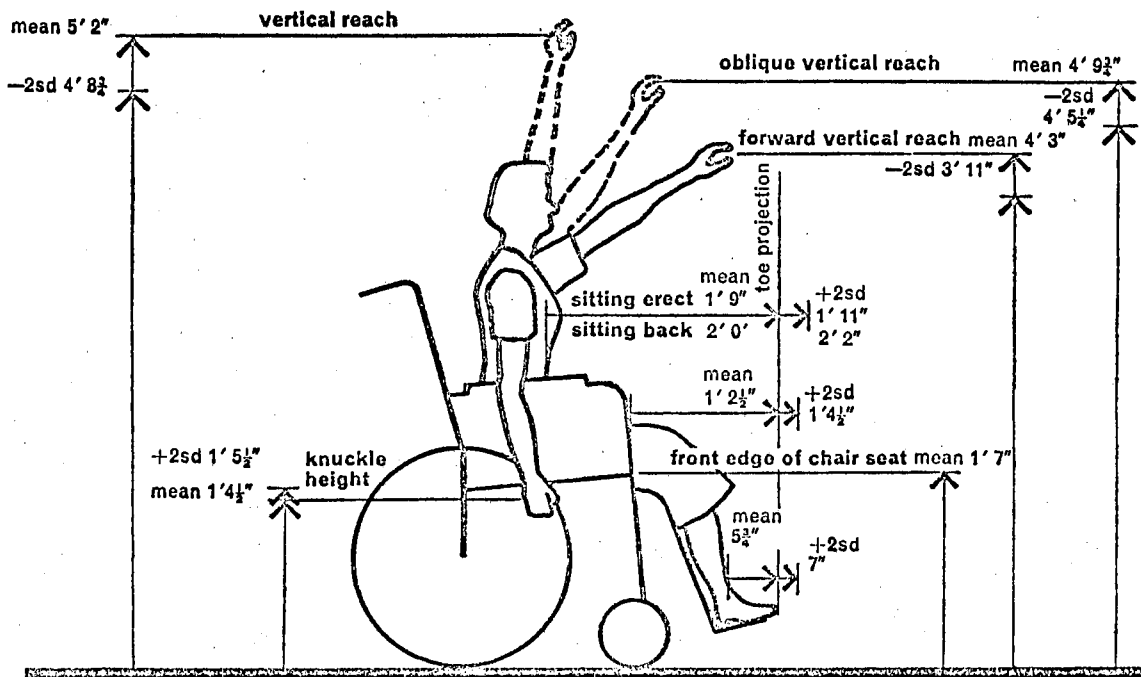
Anthropometrics: chairbound men



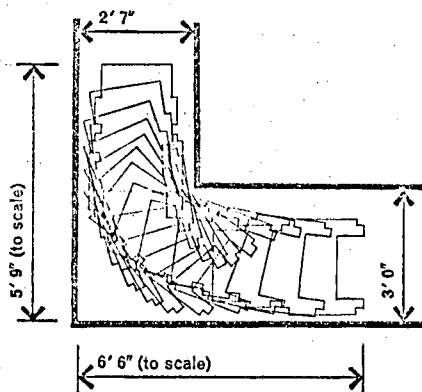
Anthropometrics: chairbound men



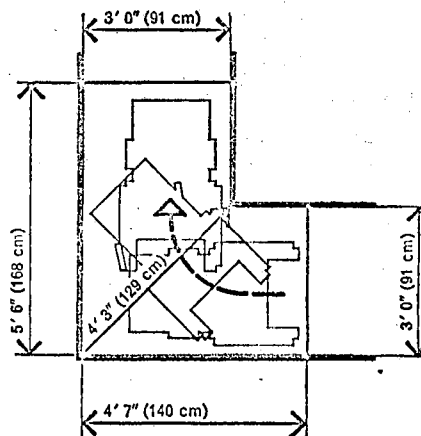
Anthropometrics: chairbound women



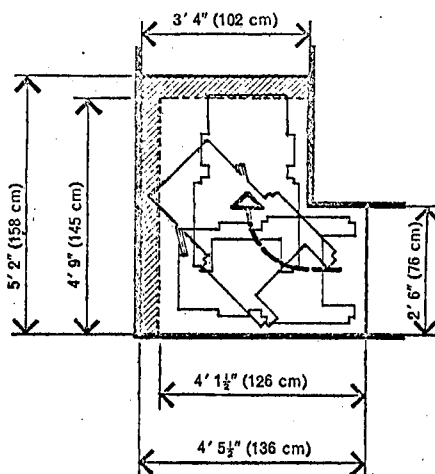
Anthropometrics: chairbound women



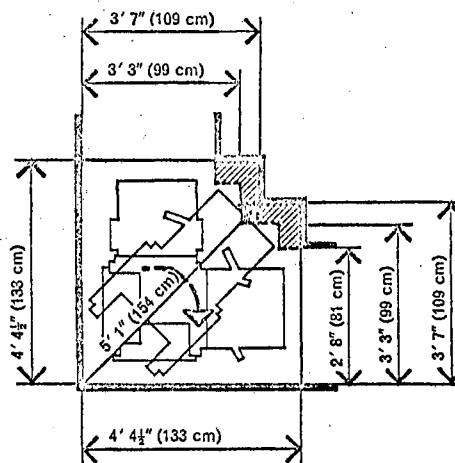
Small wheelchairs, forward turn through 90°



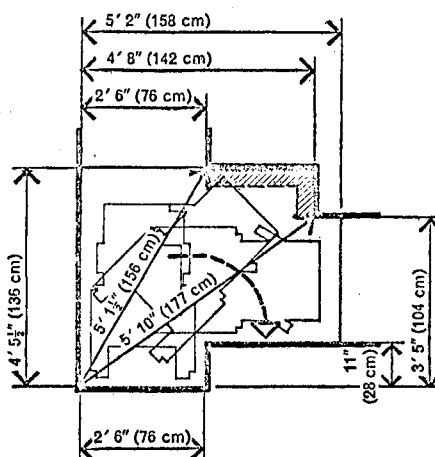
Small wheelchairs, forward turn through 90°, preferred minimum space



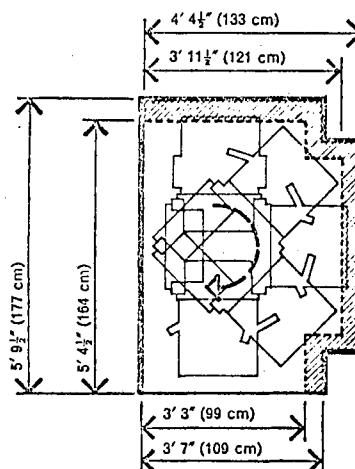
Small wheelchairs, forward turn through 90°, alternative preferred minimum space



Small wheelchairs, reverse turn through 90°



Small wheelchairs, hemiplegics etc., reverse turn through 90°



Small wheelchairs, turn through 180°

APPENDIX D

A SELECTED BIBLIOGRAPHY ON HOUSING  
FOR THE DISABLED

# A SELECTED BIBLIOGRAPHY ON HOUSING FOR THE DISABLED

- Burton, Alice M., and Virginia Y. Trotter. "The Bathroom Made Safe and Usable." University of Nebraska College of Agriculture and Home Economics, Extension Service in Agriculture and Home Economics, Circular EC 66-2206.
- Burton, Alice M., and Virginia Y. Trotter. "Cleaning Supplies--Keep Them Handy." University of Nebraska College of Agriculture and Home Economics, Extension Service in Agriculture and Home Economics, Circular EC 66-2207.
- Burton, Alice M., and Virginia Y. Trotter. "Easy-to-Use Cooking and Serving Center." University of Nebraska College of Agriculture and Home Economics, Extension Service in Agriculture and Home Economics, Circular EC 66-2203.
- Burton, Alice M., and Virginia Y. Trotter. "Easy-to-Use Kitchens." University of Nebraska College of Agriculture and Home Economics, Extension Service in Agriculture and Home Economics, Circular EC 66-2200.
- Burton, Alice M., and Virginia Y. Trotter. "Easy-to-Use Mixing Center." University of Nebraska College of Agriculture and Home Economics, Extension Service in Agriculture and Home Economics, Circular EC 66-2204.
- Burton, Alice M., and Virginia Y. Trotter. "Easy-to-Use Sink Center." University of Nebraska College of Agriculture and Home Economics, Extension Service in Agriculture and Home Economics, Extension Service in Agriculture and Home Economics, Circular EC 66-2202.
- Burton, Alice M., and Virginia Y. Trotter. "No Stoop; No Stretch; Kitchen Storage." University of Nebraska College of Agriculture and Home Economics, Extension Service in Agriculture and Home Economics, Circular EC 66-2201.
- Institute of Rehabilitation Medicine, New York University Medical Center, "A Severely Handicapped Homemaker Goes Back to Work in Her Own Kitchen." New York: Institute of Rehabilitation Medicine, New York University Medical Center.
- International Society for Rehabilitation of the Disabled Conferences. The Physically Disabled and Their Environment, A report of the proceedings. Stockholm, 1961.

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- May, Elizabeth Eckhardt, Neva R. Waggoner, and Eleanor M. Boettke, Homemaking for the Handicapped. New York: Dodd, Mead, and Company, 1966.
- McCullough, Helen E., and Mary B. Farnhom. Kitchens for Women in Wheelchairs. University of Illinois College of Agriculture, Extension Service in Agriculture and Home Economics, Circular 841, 1961.
- McCullough, Helen E., and Mary B. Farnhom. Space and Design Requirements for Wheelchair Kitchens. University of Illinois Agricultural Experiment Station, Bulletin 661, 1960.
- Rusk, Howard, et al. The Functional Home for Easier Living. New York: The Institute of Physical Medicine and Rehabilitation, New York University Medical Center.
- Rusk, Howard, and Eugene J. Taylor. Living with a Disability. New York: Blakiston Company, Inc., 1953.
- Trotter, Virginia Y., and Lois O. Schwab. "Homemaking Unlimited: Nebraska's Rehabilitation Unit on Wheels," Journal of Home Economics, LIX (June, 1967), 438-439.
- U. S. Department of Agriculture. "Home and Garden Bulletin No. 60," Beltsville Kitchen Workroom. Washington, D. C.: U. S. Government Printing Office, 1962.
- U. S. Department of Agriculture. "Energy-Saving Kitchen." Leaflet no. 518. Washington, D. C.: U. S. Government Printing Office, 1963.
- Wheeler, Virginia Hart. Planning Kitchens for Handicapped Homemakers. New York: Institute of Physical Medicine and Rehabilitation, New York University Medical Center. (Monograph XXVII).
- Zimmerman, Muriel E. "Model Home for the Disabled," Rehabilitation Record, II (November-December, 1961), 17-20.

APPENDIX E  
SELECTED DETAILS

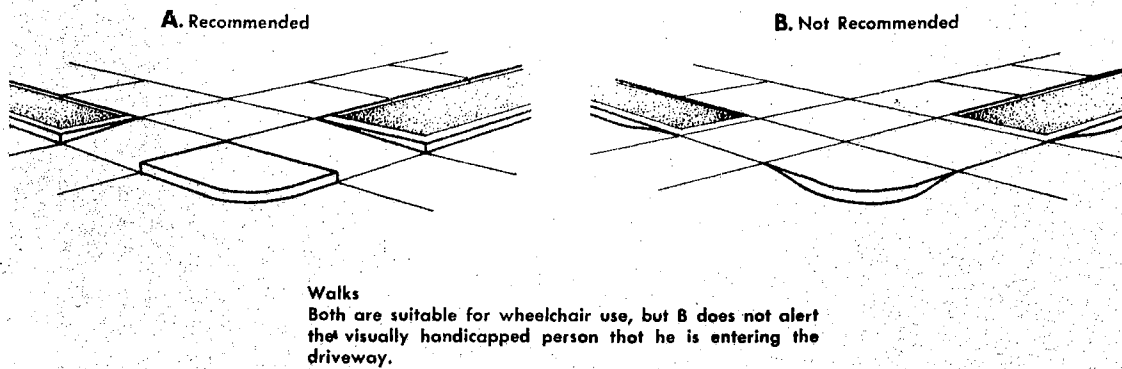


Figure 6. Recommended Modification of Curbs

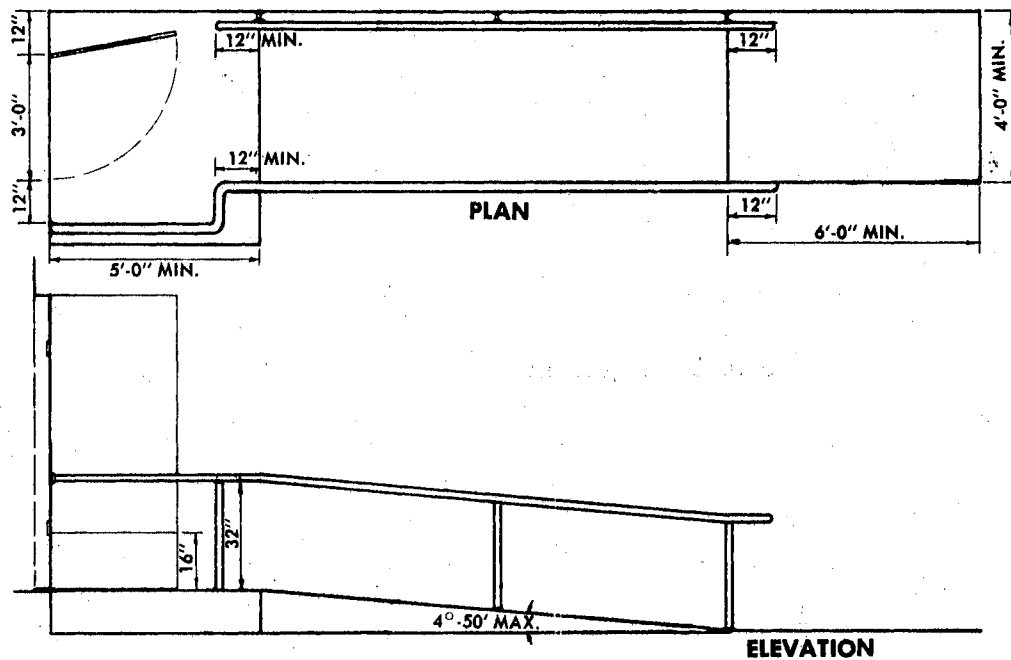


Figure 7. Recommended Ramp Specifications

Cuthbert F. Salmon and Christine F. Salmon, Sheltered Workshops: An Architectural Guide (Stillwater, Oklahoma, 1966), pp. 130, 131.

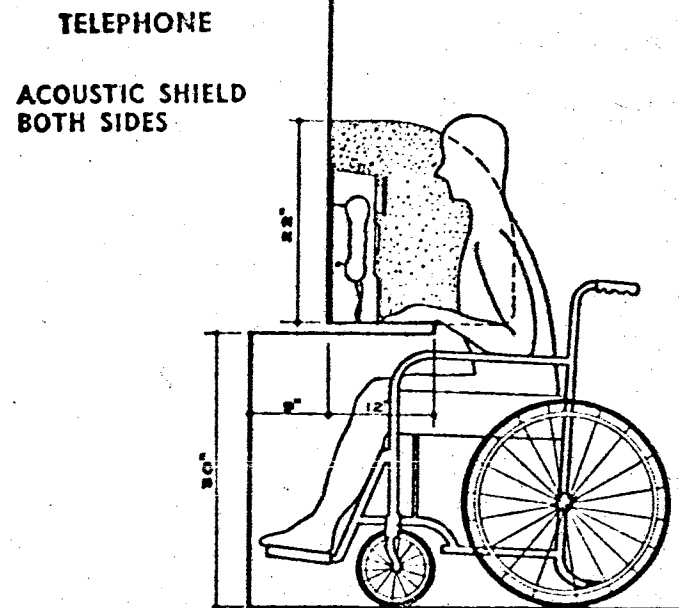


Figure 8. Suggested Design for Usable Public Telephones

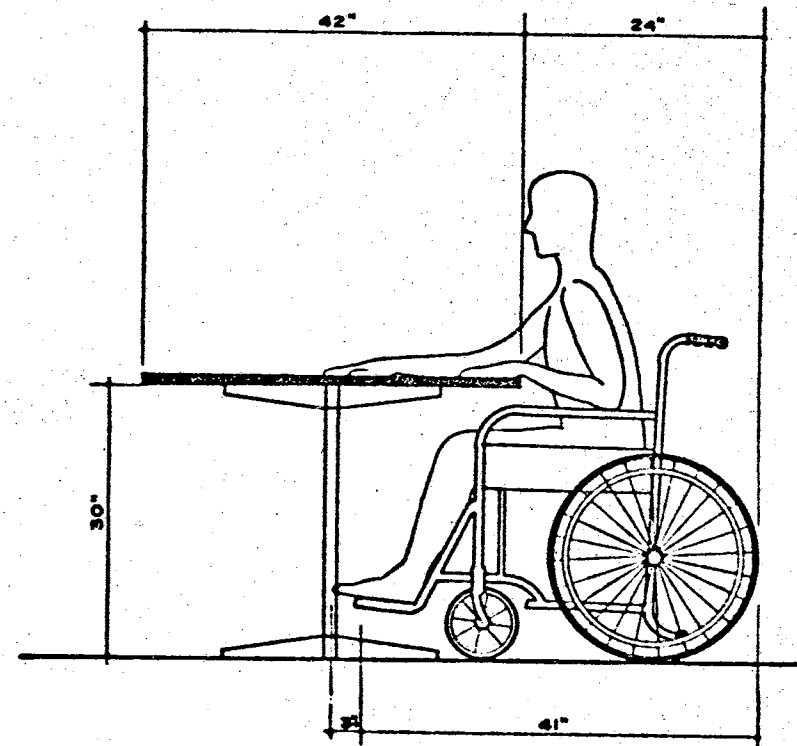


Figure 9. Suggested Dimensions For Usable Tables and Desks

Cuthbert F. Salmon and Christine F. Salmon, Rehabilitation Center Planning: An Architectural Guide (University Park, 1959), p. 23.

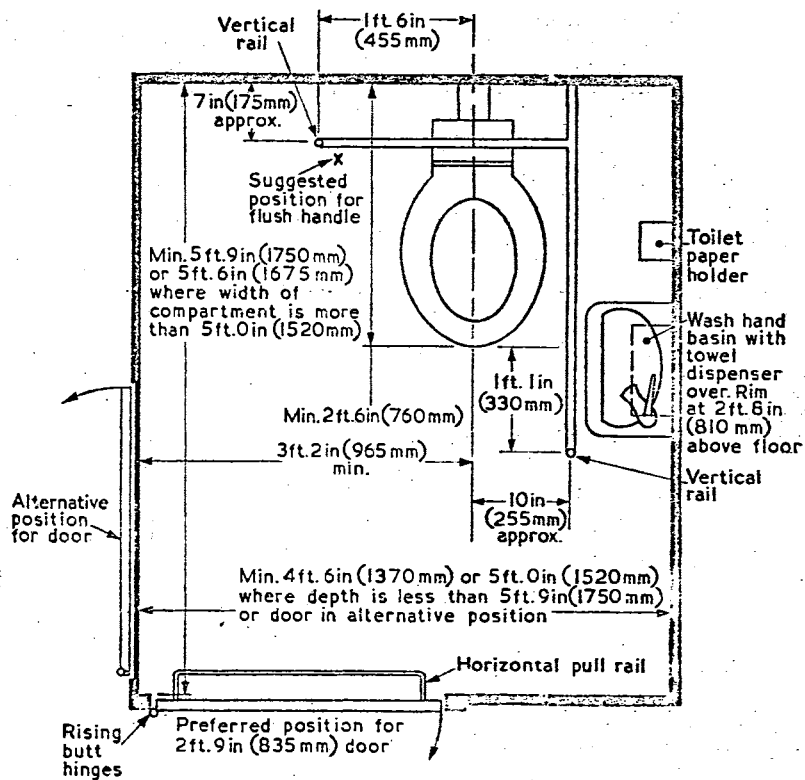


Figure 10. Recommended Toilet Stall for Side Transfers

British Standard Institution, The Council for Codes of Practice, Access for the Disabled to Public Buildings, British Standard Code of Practice CP 96, 1967, p. 27.

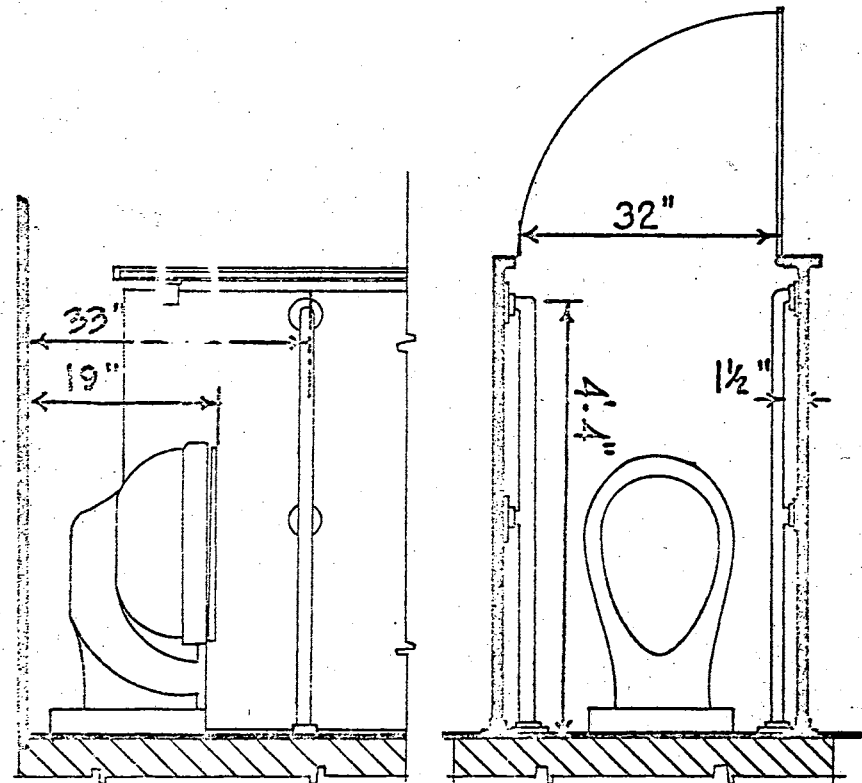


Figure 11. Recommended Toilet Stall for Frontal Transfers

State University of New York Construction Fund, Making Facilities Accessible to the Physically Handicapped (Albany, 1967), p. 23.

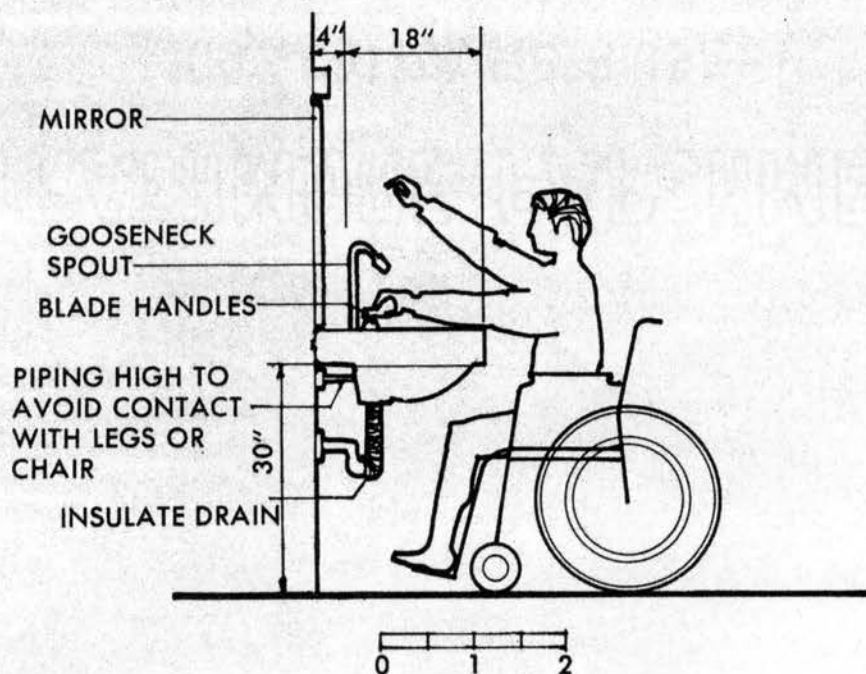
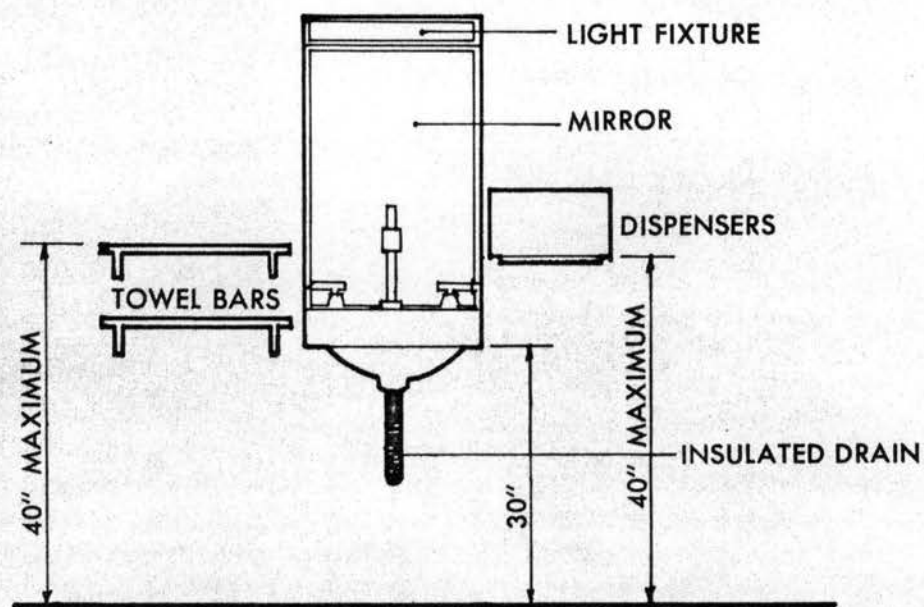


Figure 12, Recommended Lavatory for Wheelchair Users

Cuthbert F. Salmon and Christine F. Salmon, Sheltered Workshops: An Architectural Guide (Stillwater, Oklahoma, 1966), p. 34.

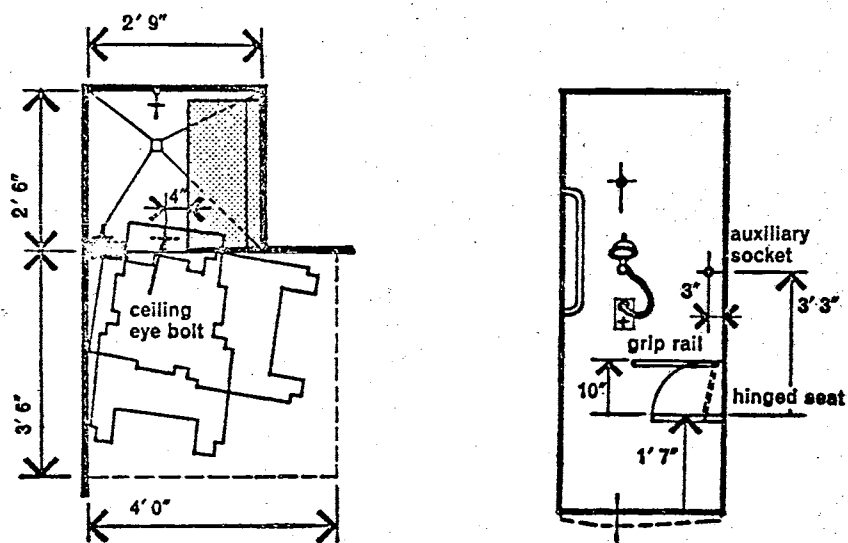


Figure 13. Plan for Small Shower Suitable for Wheelchair Users

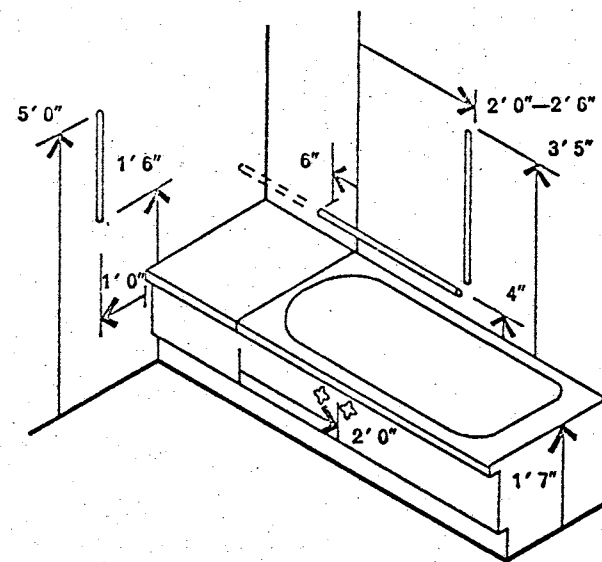
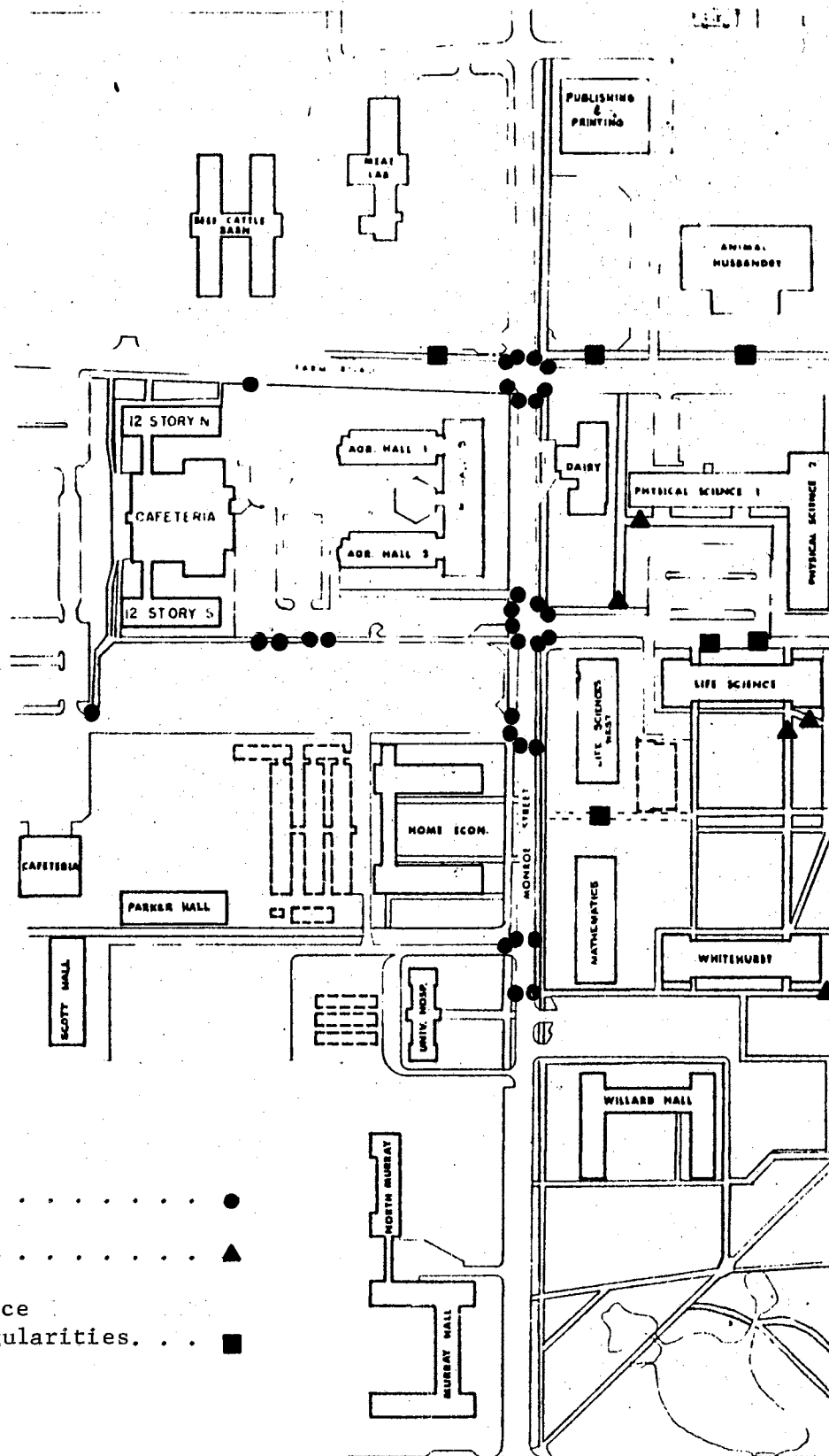


Figure 14. Suggested Bathtub Arrangement

Selwyn Goldsmith, Designing for the Disabled (2nd ed., London, 1967), pp. 129, 132.

APPENDIX F  
CAMPUS MAPS



Curbs . . . . . ●

Steps . . . . . ▲

Surface Irregularities. . . ■

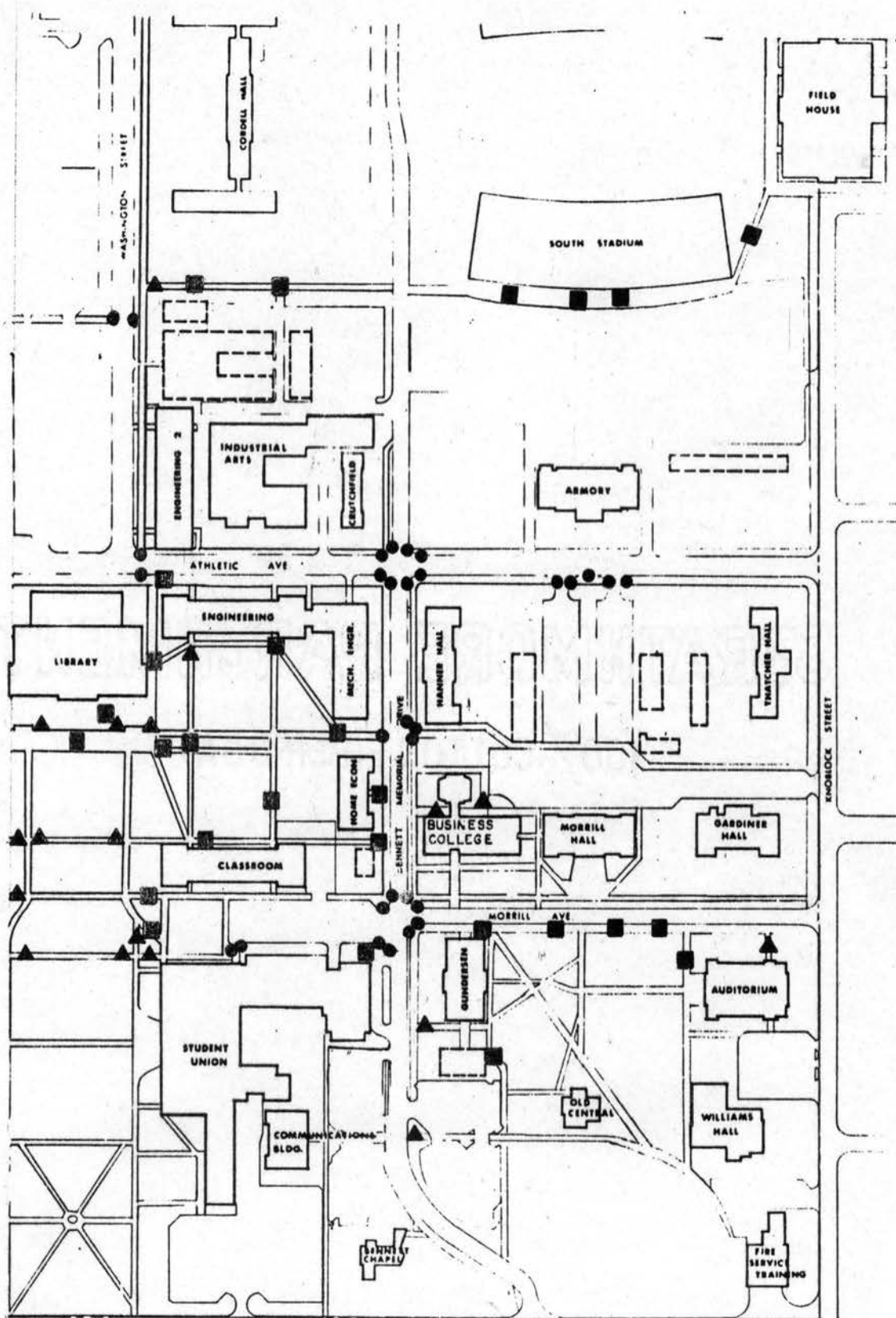



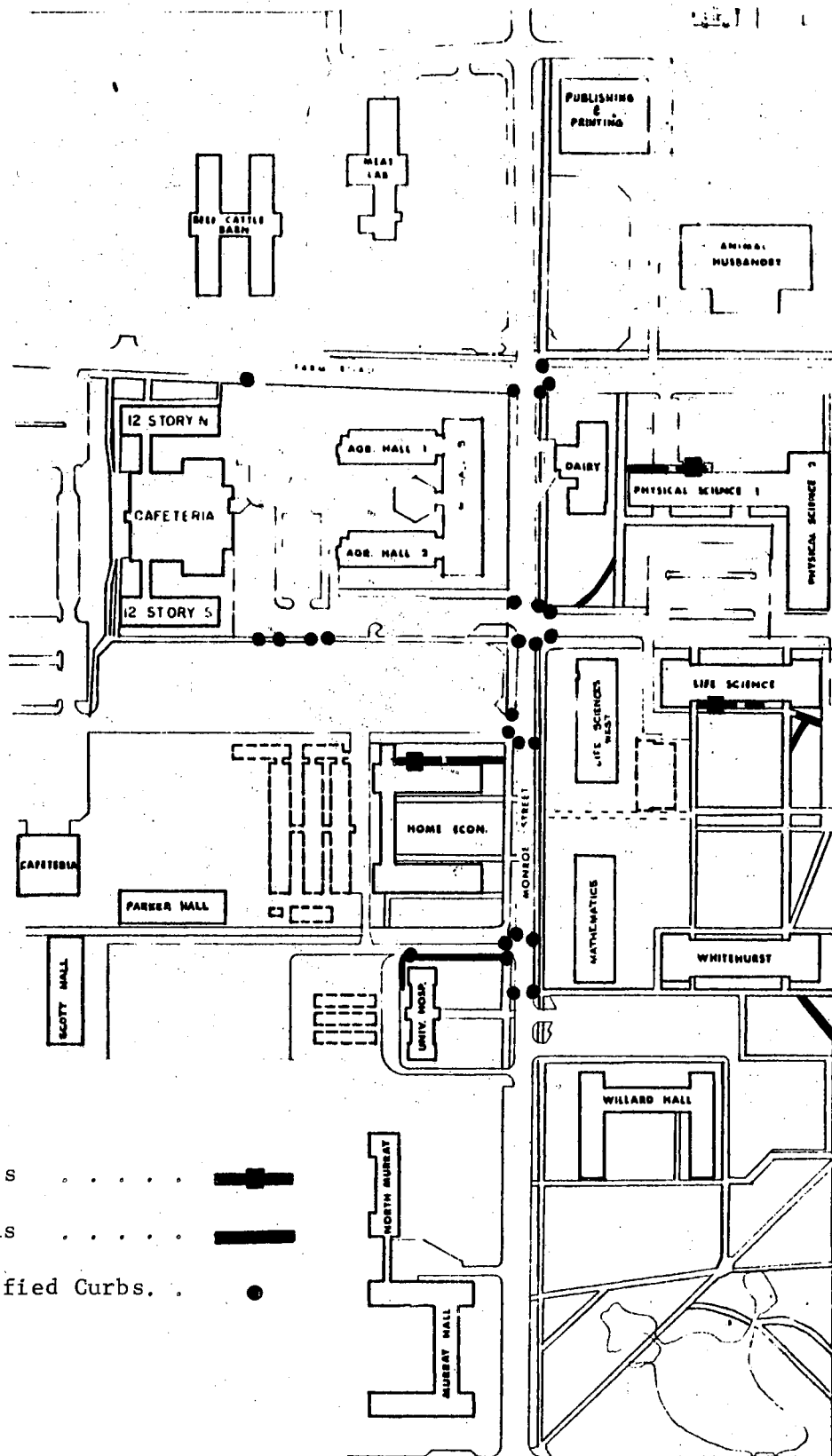


Figure 15. Barriers Identified on the Campus Grounds

Ramps . . . . . 

Walks . . . . . 

Modified Curbs. . . 



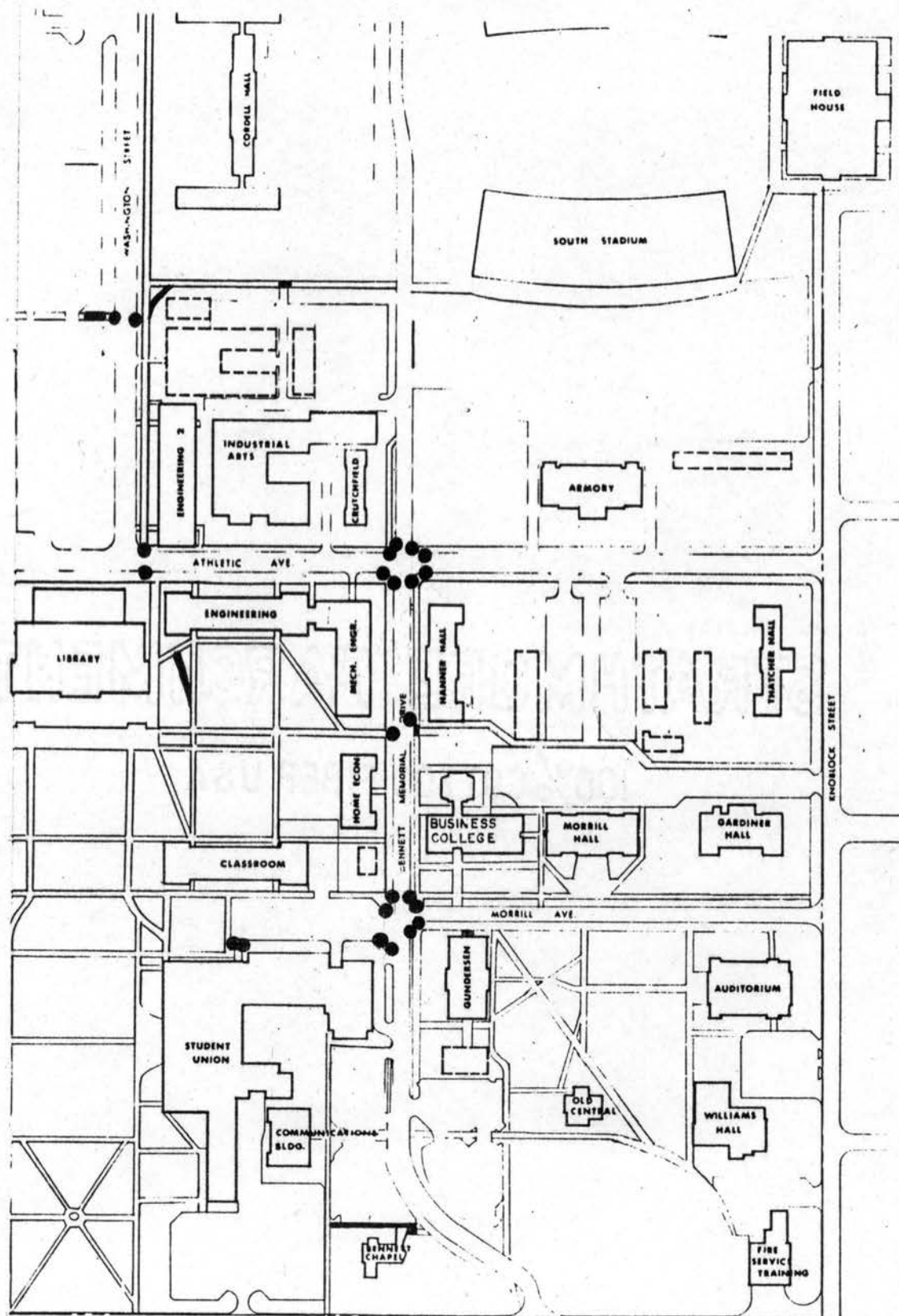
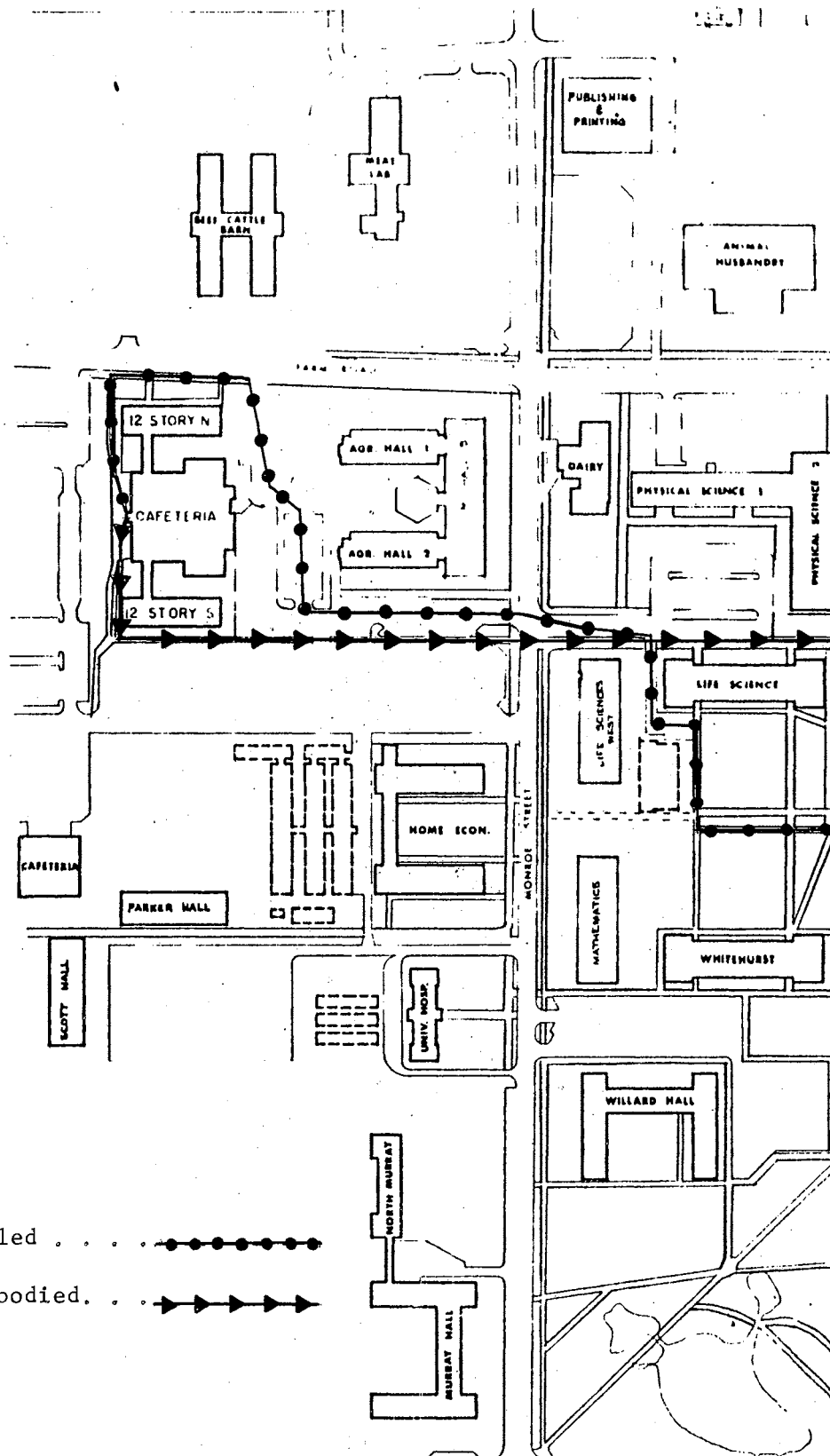


Figure 16. Modifications Recommended for Utilization of Grounds and Entrances



Disabled . . . . .

Able-bodied. . . . .

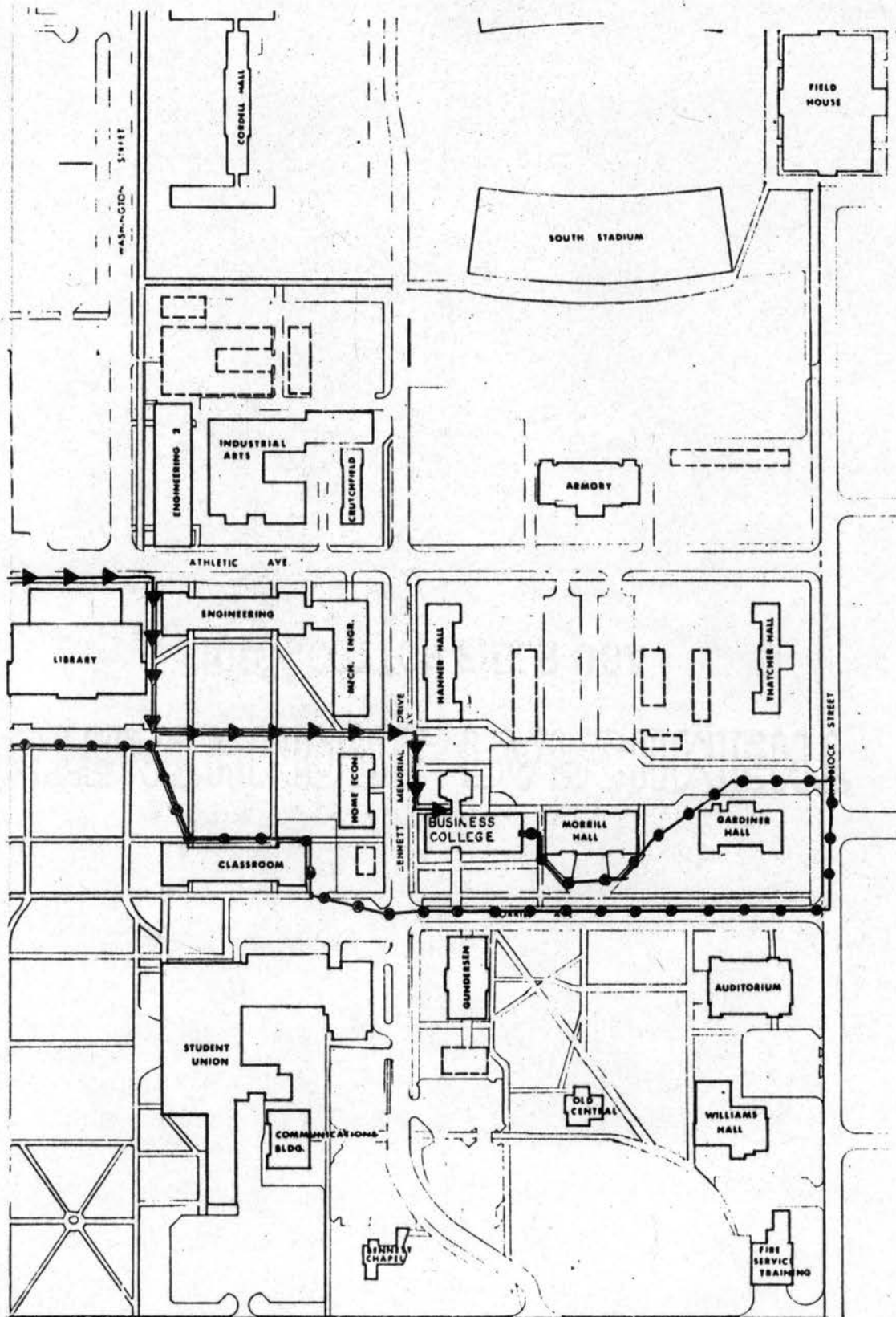


Figure 17. Routes of Able-bodied and Wheelchair Students

APPENDIX G  
RECOMMENDED MODIFICATIONS OF SELECTED DETAILS

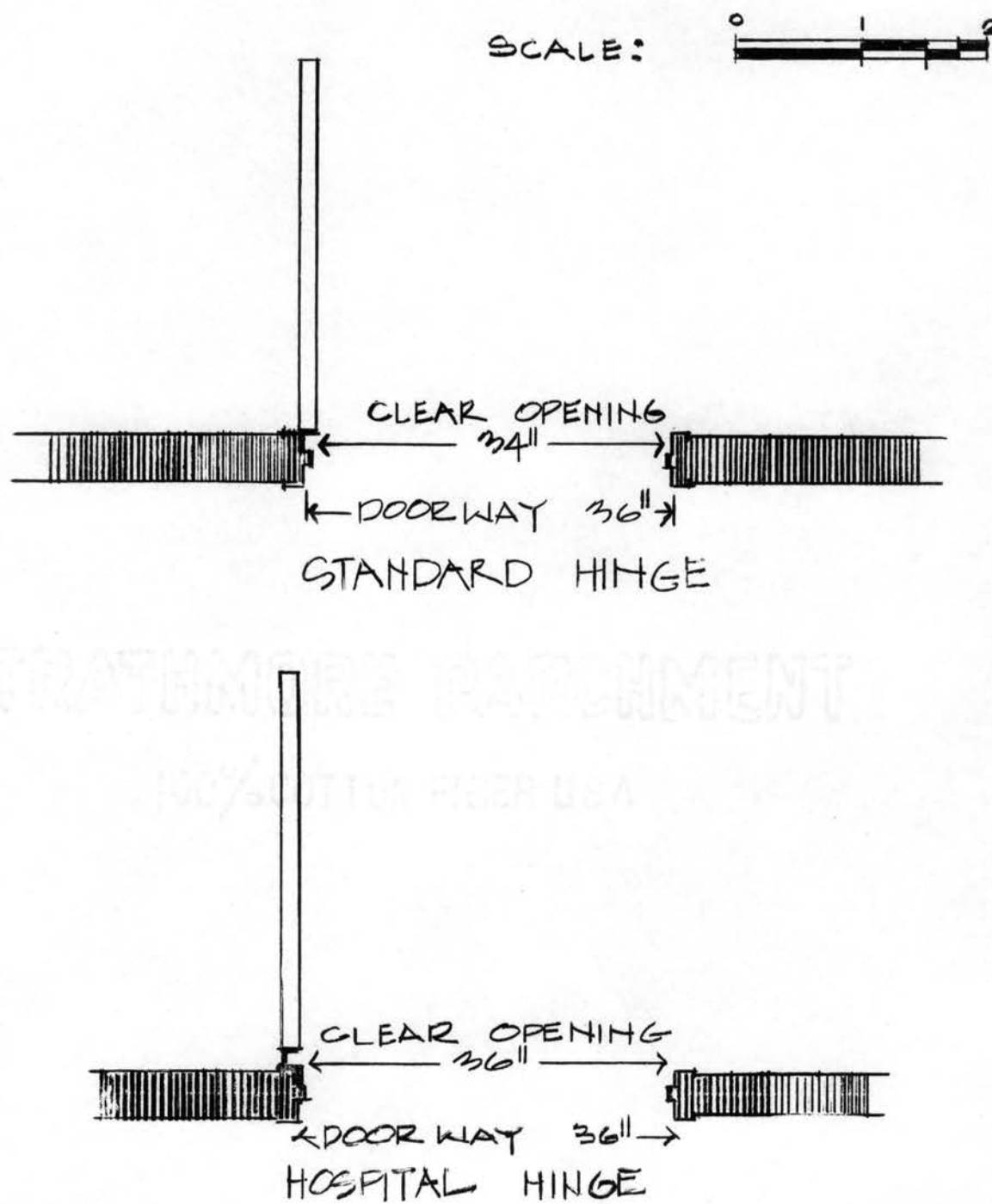


Figure 18. Door Clear-Opening in Relation to Door Hinge

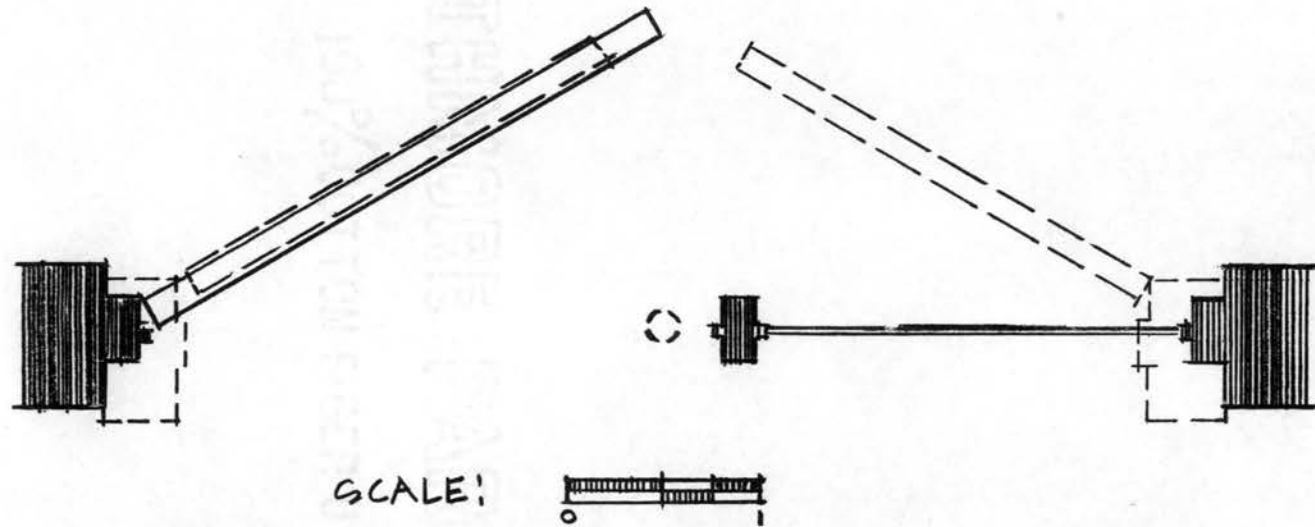
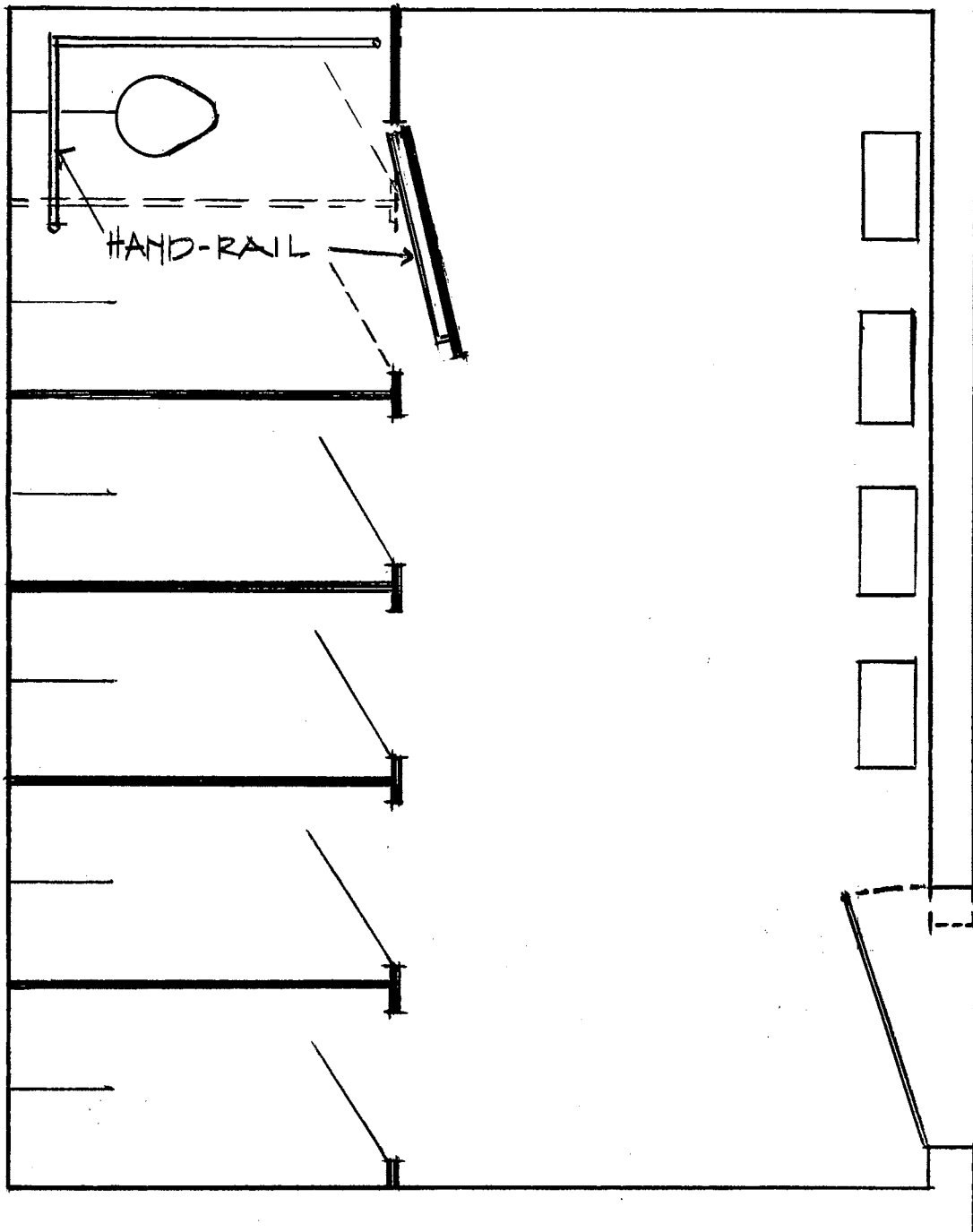


Figure 19. Modification of Double Door Entrance to Provide Sufficient Clear-Opening - Whitehurst Southwest Entrance



SCALE: 0 1 2 3

Figure 20. Proposed Modification of Restroom - Third Floor Home Economics West

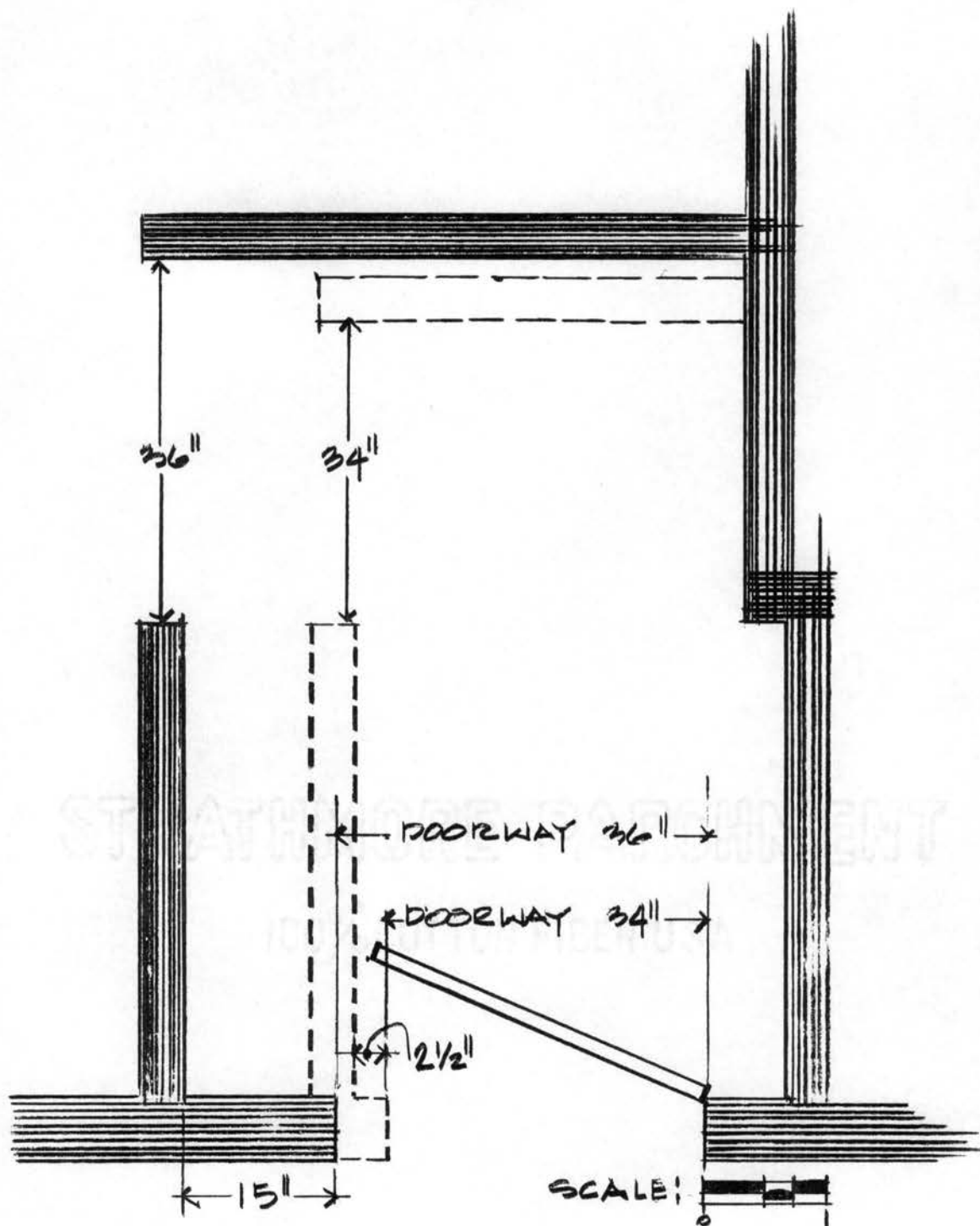


Figure 21. Proposed Modification of Interior Entrance -  
First Floor Lounge, Home Economics West

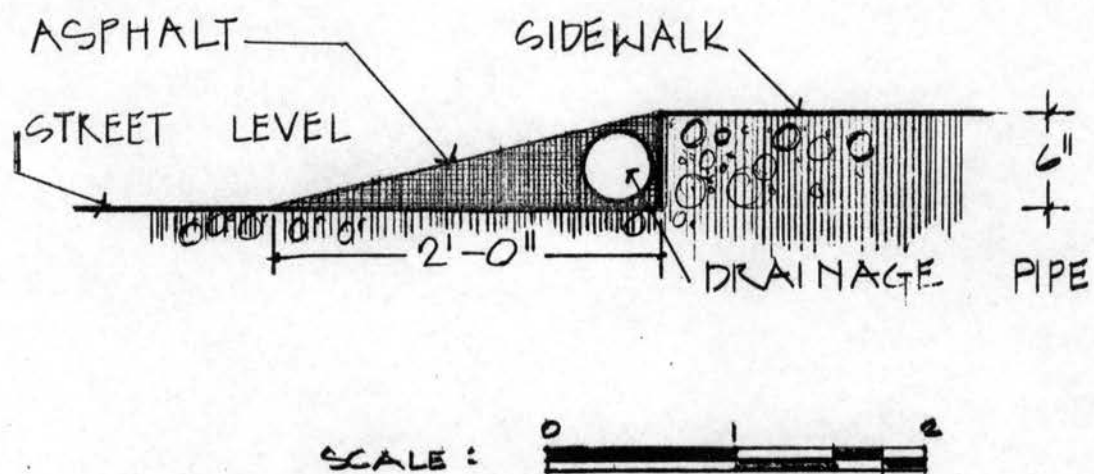


Figure 22. Alternate Modification for Curbs

APPENDIX H

PRIORITY LISTING OF MODIFICATIONS TO INSURE THE

CAMPUS GROUNDS AND BUILDINGS USABLE

BY PERSONS IN WHEELCHAIRS

## FIRST PRIORITY

## Accessibility

Limited AccessibilityFull Accessibility

Awareness - Education Program to widespread understanding of the problems involved - resulting, in part, in accessibility of new buildings.

Access to "Most Frequently Used Buildings" - Library, Classroom Building, Student Union, Field House, University Auditorium, Whitehurst, Hospital, and Dormitories.

Access to "Frequently Used Buildings" - Life Science, Morrill, Physical Science, Business, and Gunderson.

## Utilization

Limited UtilizationFull Utilization

Beveling of curbs at major crosswalks.

Construction of walks to avert steps and repair of existing walks.

Limited utilization of "Most Frequently Used Buildings."\*

Limited utilization of "Frequently Used Buildings."\*

Awareness - Educational program to gain widespread understanding of the problems involved - resulting in part, in awareness, elimination, and prevention of barriers whenever the opportunity arises.

---

\* Previously listed.

## SECOND PRIORITY

## Accessibility

Limited AccessibilityFull Accessibility

Awareness.

Access to "Most Frequently Used Buildings."\*

Access to "Frequently Used Buildings."\*

Access to "Special Studies Buildings." - Home Economics West, Engineering North, Agriculture Halls, and Engineering South

## Utilization

Limited UtilizationFull Utilization

Beveling of curbs.

Awareness.

Construction and repair of walks.

Full utilization of "Most Frequently Used Buildings."\*

Provision of parking spaces.

Full utilization of "Frequently Used Buildings."\*

---

\*Previously listed.

## THIRD PRIORITY

## Accessibility

Limited AccessibilityFull Accessibility

Awareness.

Access to "Most Frequently Used Buildings."\*

Access to "Frequently Used Buildings."\*

Access to "Special Studies Buildings."\*

Access to remaining campus buildings in order of their use.

## Utilization

Limited UtilizationFull Utilization

Awareness.

Beveling of all curbs at crosswalks.

Construction and repair of walks.

Provision of parking spaces.

Full utilization of "Most Frequently Used Buildings."\*

Full utilization of "Frequently Used Buildings."\*

Full utilization of "Special Studies Buildings."\*

Full utilization of remaining campus buildings in order of their use.

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\* Previously listed.

VITA

Mary Dale McGregor

Candidate for the Degree of

Master of Science

Thesis: A STUDY OF ARCHITECTURAL BARRIERS FOR WHEELCHAIR STUDENTS AT  
OKLAHOMA STATE UNIVERSITY: IDENTIFICATION, EVALUATION AND  
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