DOCUMENT RESUME

ED 123 855 EC 090 223

AUTHOR	Steinfeld, Edward
TITLE	Barrier Free Access to the Man-Made Environment - A Review of Current Literature. Interim Report.
INSTITUTION	Syracuse Univ., N.Y. School of Architecture.
SPONS AGENCY	Department of Housing and Urban Development, Washington, D.C. Office of Policy Development and Research.
PUB DATE	Oct 75
CONTRACT	H-2200R
NOTE	45p.
EDRS PRICE	MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS	*Architectural Barriers; Building Design; Demography; *Design Needs; Exceptional Child Research; *Handicapped Children; *Research Reviews (Publications); Spatial Relationship; Standards

ABSTRACT

Reviewed in the interim report on revision of the existing American National Standards Institute provision is current literature on barrier free design for disabled individuals. The report addresses the following topics: the history of access as a civil right; demographic aspects (including information on task dysfunctions of disabled persons related to architectural building elements); standards and building codes review (including tables on scope of state and federal regulations); review of human factors research on functional anthropometry, biomechanics, information display and specific task environments; spatial behavior of disabled persons; analysis of building products (including a suggested matrix for use in evaluating such products as plumbing fixtures, telephone booths, and refrigerators); and recommendations on design features. (CL)

INTERIM REPORT:

BARRIER-FREE ACCESS TO THE MAN-MADE ENVIRONMENT -A REVIEW OF CURRENT LITERATURE

October 9, 1975

by:

Edward Steinfeld
Project Director-
School of Architecture
Syracuse University
Syracuse, NY

Research Associates-
Marilyn Bishop
Rolf Faste
Steven Schroeder

Research Assistants-
Richard Buchanan
Craig Fisher
Paul Cardell
Harold Sommers
James Duncan

Performed under Contract N. H-2200R

for:

Community Design Research
Office of Policy Development and Research
U.S. Department of Housing and Urban Development

Introduction

This report is a synopsis of the first major product of a two-year research contract entitled, "A New ANSI Standard for the Physically Handicapped." The purpose of the project is to identify the necessary revisions and additions to improve the existing American National Standards Institute ANSI A117.1 standard, "Making Buildings Accessible and Useable by the Physically Handicapped."

This report presents, in condensed form, current knowledge regarding barrier-free design, or the process of making the built environment accessible to people with disabilities. Specifically, the report describes:

1. The history and trends in efforts to achieve a barrier-free environment;
2. The extent of the problem, i.e. whom it affects;
3. Existing federal, state and municipal legislation and regulations regarding barrier-free design;
4. Research findings that could be applied to the design of barrier-free environment;
5. Knowledge about the effects of barriers on the life patterns of people and how those effects could be mitigated;
6. Available building products and their suitability for use by people with disabilities; and,
7. A collection and comparison of all available design criteria for barrier-free design.

Building on this initial data and knowledge base, the next stage of the project will focus on: 1) identifying particularly difficult design problems and solutions to them; and 2) laboratory testing to resolve conflicts and inadequacies in existing design criteria. A third phase of the project will be the development of proposed standards, both content and format, that receive a consensus approval from representatives of consumers, designers, the building industry and regulatory agencies. These standards will be submitted by HUD to ANSI for approval. Other products of the third phase will be a cost-benefit study on barrier-free design, and development of model legislation.

1. ACCESS AS A CIVIL RIGHT

The civil rights of disabled people are slowly but surely being guaranteed through legislation and court action. Although people with disabilities are not yet included in civil rights legislation, there is a trend in other legislation to mandate antidiscriminatory guarantees similar to those that racial minorities, women and the aged have received regarding employment, use of places of public accommodation, housing, etc. The right of access to the built environment is firmly established in existing civil rights legislation, although it is not specifically directed to access by disabled people. Specific policies need to be created that implement total accessibility for disabled people to all community support systems. This will insure that one group of people is not unwillingly segregated from full participation in normal community life.

The above paragraph summarizes the main theme of the section, "Access as a Civil Right." The following is an outline of the contents:

1. A brief history of the barrier-free design movement
2. Legislation specifically regarding b arrier-free design:
   PL 90-333 Vocational Rehabilitation Act of 1964;
   PL 90-480 Architectural Barrier Act of 1968;
   PL 91-205 Amendment to PL 90-480;
   PL 93-112 Rehabilitation Act of 1973;
   PL 93-518 Rehabilitation Act of 1974.
3. Legislation regarding civil rights of minorities:
   PL 85-315 Civil Rights Act of 1957;
   PL 88-352 Civil Rights Act of 1964;
   PL 92-496 Act to Extend Life of Civil Rights Commission;
   Equal Rights Amendment of 1972.
4. Parallels drawn between the physically disabled minority group and other groups disadvantaged in civil rights, e.g. women and the aged.
5. Normalization approaches taken by Denmark, Sweden and Holland.
6. Conclusions and predictions for future concepts of barrier-free design as a civil right of the handicapped.

2. DEMOGRAPHY OF DISABLED PEOPLE

In order to justify the creation of a barrier-free environment we must demonstrate that a significant percentage of the population requires such an environment in order to enjoy the full rights of citizenship. This section of the report demonstrates through the use of statistics that the need is sufficiently great to require it. The population that would benefit is comprised of individuals with physical disability, learning disability, and also the elderly in general.

Of the 199,843,000 people in the U.S. in 1970, a total of 23,630,000 had limitations of activity (NCHS, 1970). This figure includes those people with activity limitations who are 65 years of age and over. According to the 1970 census, there were 20,049,592 individuals 65 years of age and over (USDHEW-SRS, 1970). The percentage with activity limitations greatly increases with age. In addition, the degree of activity limitation and the incidence of multiple chronic conditions increases with age. Since disability is highly related to age, it is difficult to omit any older person from the total figure. They are all likely to suffer a disability; thus, when considering the target population for barrier-free design, the entire elderly population plus the younger disabled population can be added together. This results in a total of 32,030,000 people or 16 percent of the U.S. population (the SRS figure was adjusted to subtract that 42 percent of the elderly population already included in the NCHS number).

The National League of Cities conducted a study using both existing and hypothetical buildings to determine costs for making buildings barrier-free. The construction cost for total accessibility of three new existing structures was estimated to be less than 1/10 of 1 percent. Construction costs for six of the seven hypothetical buildings studied for barrier-free design could have been less than 1/2 of 1 percent (National League of Cities, 1974).

A barrier-free environment means total independence to many disabled or elderly people who would otherwise need to be dependent upon an institution, a family or an aide. The latter course of action is very costly indeed, particularly if the service were needed over an extended period of time, which is often the case.

To use paralysis as one example of an impairment, studies show that among persons 45 years and over, the rate of cases of paralysis decreased steadily with increasing income. The rate of 25.4 cases per 1,000 population among older persons, with a family income of less than $3,000, was about three times as high as the rate among older persons (8.4/1,000), with an income of $10,000 or more (NCHS, 1963-65). Obviously, this shows that the group who would have the greatest need for an aide or need to remodel would be the least financially able to do so. Furthermore, the independence gained by having a barrier-free environment would give a psychological boost to a population that often suffers from chronic depression.

By gathering statistics on various disability concerns and then more precisely on specific chronic conditions, the real need for eliminating architectural barriers can be demonstrated. Proceeding in this manner, we can them determine which disabilities should be considered as priorities when developing standards to make buildings accessible for all.

In order to decide which disability concerns to use as guidelines for collecting data, as well as to describe the relationship of the disability to task dysfunctions in the environment, we took into consideration which groups of disabilities would be most likely to create difficulties with activity and mobility in the environment. The six definitions used by ANSI A117.1 (1961) were considered, but we felt that they were not inclusive enough to include all of the problems or "task dysfunctions" that the disabled and elderly might encounter. By limiting ourselves to these six definitions, we felt that it would be more difficult to resolve the priorities for design solutions. We developed disability concerns that reflect such task dysfunctions. The disability concerns used for our analysis are:

A. Difficulty in Interpreting Information: individuals who have impaired abilities to read or reason and would have difficulty with electrical controls as well as directional or functional ones.

B1. Severe Los of Sight: individuals who cannot read ordinary newspaper print with eye glasses, are legally blind (20/200), or have vision field defect of 10 percent or less.

B2. Totally Blind.

C. Severe Loss of Hearing: individuals who cannot understand useable speech with or without amplification.

D. Prevalence of Fainting, Dizziness or Poor Balance: individuals with Meniere's disease, hemiplegia, etc., and some pregnant women.

E. Incoordination: individuals who have difficulty in controlling and placing or directing their extremities, e.g. those with crebral palsy or other neurological disorders.

F. Limitations of Stamina: individuals who become short of breath and/or experience an abnormal elevation in blood pressure from walking long distances or climbing stairs, e.g. those with cardiopulmonary disorders or severe hypertension.

G. Difficulty in Moving Ahead: individuals limited in looking up and down or side to side.

H. Difficulty in Lifting and Reaching with Arms: individuals with decreased mobility and range of motion of upper extremities as well as those confined to wheelchairs.

I. Difficulty in Handling or Fingering: individuals who have difficulty performing functional activities with hands, e.g. one who has severe arthritis or fixed contractures from an injury such as a third degree burn.

J. Inability to Perform Upper Extremity Skills: individuals with complete paralysis, lack of coordination or absence of upper extremities.

K. Difficulty in Bending, Turning, Sitting or Kneeling: individuals with severe arthritis of the spine or those in back braces and plaster body casts.

L. Reliance on Walking Aids: individuals who use leg braces or artificial legs and those who need crutches, canes or walkers.

M. Inability to Use Lower Extremities: individuals who are unable to move about except by use of a wheelchair.

N. Extremes of Size and Weight: individuals who are extremely tall, extremely short or extremely overweight.

Individuals who comprise the various groups of disability concerns have certain task dysfunctions or difficulties in relation to architectural building elements. By determining the task dysfunctions for each disability concern and comparing them with the population data for these fourteen categories, the priorities for design solutions may be resolved. Unfortunately, there is little comprehensive data available that relates to degree of task dysfucntion for each disability concern. For example, statistics are available to tell us the number injured by burns (NCHS, 1960-62). However, there is no further breakdown to indicate what degree of task dysfunction there may be for burn cases in relation to lifting and reaching, grasping and pinching or bending, turning, sitting and kneeling. Likewise, the same is true for data on arthritis. The National Center for Health Statistics has statistics for the population with arthritis in hands, feet and hands, and feet (NCHS, 1960-62). However, the degrees (mild, moderate, severe) are not listed separately. Since moderate and severe listings are combined, one is not able to determine specific task dysfunctions for these individuals.

Figure 1 presents data for the U.S. population with actual and potential disability concerns. For some disability concerns, such as severe difficulty in lifting and reaching with arms, an estimate is available. However, data for other disability concerns as a total are unavailable. When considering limitations of stamina, for example, a figure for actual limitations could not be obtained, but data for nearly all chronic conditions in that category were obtained.

It would seem that we could simply add the total of all chronic conditions related to stamina to obtain a total figure for that disability concern. The problem with that approach is that statistics may be available for the population with heart disease or emphysema, but present statistics do not show what percentage of those people actually do have limitations of stamina. Nevertheless, the total can be utilized as a "potential" figure rather than actual, as long as the distinction is made clear. Figure 2 shows that although some concerns have an estimate of incidence available, when the number of people who may have that disability is reviewed in terms of chronic conditions and impairments, the potential can be much higher than the estimate.

Aside from general lack of data on task dysfunctions, there are many other problems and questions that arise. One is the variance of definitions between statistical sources. The inconsistency in definitions causes inaccuracy and uncertainty in data collecting. Also the area of temporary disabilities could give rise to question. We feel that temporary disabilities need to be included, since at any given period of time there is a substantial number who will temporarily encounter mobility problems in the environment. Another problem is the chronic condition, or disease that is progressive in nature or that is not consistent in respect to the area of the body affected, such as multiple sclerosis or rheumatoid arthritis. We know that some afflicted individuals have a multitude of task dysfunctions, but on the other hand some may function very well in their environment with relatively few task dysfunctions.

Still another problem is the area of multiple disabilities. But statistical sources do not take into consideration specific conditions such as an individual who has heart disease, emphysema and is also an above-knee amputee. From experience, a physical therapist knows that these individuals are encountered frequently and there are certainly many other combinations of chronic conditions which in the end lead to even more complex task dysfunctions.

The major source for health statistics in the U.S. is The Vital and Health Statistics Series from the National Center for Health Statistics. Through correspondence with health organizations in requests for statistics, replies most often were directed to, or taken from, The Vital Health Statistics Series. The Social Security Administration and the United States Census Bureau also have some useful data available. The present data does little to assist designers in determining task dysfunctions as guides for design criteria. It would be more effective to conduct a survey of functional abilities among specifically diagnosed individuals, and create a proper data base for this work.

However, the existing information system was not designed to provide precisely the kinds of data needed for this study. Such a method would produce a more accurate account of actual task dysfunctions. Within this approach, a rating system could be developed to take into account those with temporary disabilities, those with diseases which are progressive in nature, and those with multiple disabilities.

3. STANDARDS AND CODES REVIEW

A review of all state and federal legislation and standards addressed to barrier-free design, all model building codes, several municipal codes and some international standards revealed the following:

1. The original ANSI A117.1 Standard has been either adopted or used as a model by all 50 states.

2. Many states have deleted sections of ANSI A117.1; others have added to it.

3. Model codes have differed from ANSI A117.1 in some important areas

4. Standards issued as regulations of Federal agencies have used ANSI A117.1 as a model, with some agencies making many changes to it.

5. The variances from ANSI A117.1 made by states, model codes and agencies generally apply to areas that were inadequately treated or to the form of the requirements; there has been a trend toward quantitative criteria rather than qualitative criteria.

6. There is a lack of uniformity and proliferation of differences in the variances.

7. There has not been a conclusive, explicit policy regarding the target user population for standards.

8. Ambiguous wording in standards is a continuing problem.

9. The style of presentation of material is often not amenable to use by architects and builders.

10. There has been little or no attention to buildings other than publicly used buildings.

11. There is an inadequate base of information regarding the use and design of building products.

Recent efforts by state governments and the federal government have sought to resolve some of the problems associated with design standards. Many states have extended the scope of barrier-free legislation to include privately funded, publicly used buildings and facilities.

Findings of the review are presented by comparing ANSI requirements with the various standards and with an exhaustive list of items culled from the review. Examples of the various materials in this review are displayed in Figure 3 through 7.

Work is still under way gathering international materials. Standards have been obtained from Engleand, Sweden, Denmark, New Zealand, Australia, Netherlands, West Germany, France, Canada, Israel, Japan, and Norway.

4. REVIEW OF HUMAN FACTORS RESEARCH

Human factors research has focused on the fit between human performance and physical environment. A review of this area produced a unifying concept for barrier-free design: buildings conception puts accessibility concerns into an exhaustible framework of human performance. It allowed the generation of an exhaustible list of information needs for design (Figure 8). Empirical research findings were reviewed to idnetify how these information needs are presently being met. Methodological limitations of human factors research have also been noted. The review highlighted many areas in human factors work on other task environments that provide knowledge and principles directly transferrable to designing buildings for access.

Human factors research on functional anthropometry, biomechanics, information display and specific task environments was reviewed to assess the scope of existing empirically based principles that are useful for design. Fromthis review, the following broad conclusions can be drawn:

1. Functional Anthropometry
   A. The principles of applying anthropometric data to design are well established;

   B. There is a need for better data on vulnerable populations;

   C. The most useful kinds of data to obtain would be dynamic and situation based.

2. Biomechanics
   A. There is a need for comprehensive presentation of information on range of movement for disabled people;

   B. Basic, but crude principles for considering range of movement and accuracy in design are evident;

   C. General principles for considering speed of performance are well established;

   D. There is a need for data on strength in situations typical of building use;

   E. There is a need for general data on strength of vulnerable populations;

   F. Some data on endurance and comfort is available, yet there is a complete lack of data for some important design concerns regarding vulnerable groups.

3. Information Display
   A. Principles of coding and organization of information are well established;

B. There is a great deal of general design data available, much of which can be applied to vulnerable users;

C. Information is needed about the perceptual process of vulnerable groups.

4. Specific Task Environments
   A. Research on specific task environments can provide important data on relationships between elements in a setting;

   B. There has been little empirical research on kitchens and bathrooms for vulnerable groups;

   C. Some existing research areas require further attention.

5. Research Methods
   A. Research methods in human factors concerning access should strive to simulate field conditions more closely;

   B. Methods with less reactivity and bias should be developed;

   C. Subject selection and description should strive to improve the scope of generalization from the sample population.

On the whole, existing human factors knowledge includes a great deal of design information pertaining to access. There are also some important information gaps. Figure 9 shows part of a graphic analysis of the information available.

5. SPATIAL BEHAVIOR OF DISABLED PEOPLE

The built environment communicates to those who use it. It speaks a kind of "silent language" (Hall, 1959) that transmits messages about appropriate behavior and meanings. These messages also can have an effective component that reflects back to the user. Individuals who, because of disabilities, are "illiterate" in the language of environment, or who interpret messages through a physiological screen, may not receive important information or may interpret messages differently than the ablebodied. Illiteracy and interpretation problems can result in inappropriate behavior, confusion, or negative feelings of self-worth.

The way one organizes space as a mental image is based on how one experiences it. Although further research is needed in environmental cognition, it appears that people with disabilities may image space differently than ablebodied people, since they have different kinds of experiences. Differences in experience lead to differences in the valued parts of the environment and in systems of orientation.

Territorial behavior is closely associated with social dominance. Exclusion through environmental barriers can be viewed as a form of territorial behavior whereby the ablebodied claim the best space. The disabled act out their low position in the dominance hierarchy by being forced to occupy stigmatized insititutional space.

The development of competence-building settings can aid the adaptive capacity of disabled people. We view the relationship between these two as a set of interlocking careers: the adaptation career of the individual and the adaptation career of the environment. They are interlocked because if the environment is modified to meet the needs of a person then one has in effect increased his competence and therefore made him adapt to the circumstances. Environments must be designed so that they can adapt to match the physiological career of the individual.

Although we have identified several discrete psychosocial implications of inaccessibility, they do not act independently to affect a person's behavior. The entire social and physical world impacts on a person. Individual forces in that life space cannot be added together as simple sums; rather, the forces in the life space work as a whole and as a function of the individual as well. For example, all disabled people probably do not experience the negative effects of territorial exclusion as social dominance. Moreover, attitudes and actions of other people that send positive messages to the disabled person may counteract negative messages from an inaccessible building.

It is important to remember that a society may act supportingly in many ways through interpersonal actions of its members but social actions in shaping the physical environment may be unsupportive--not because of attitudes, but because of traditional ways of building and lack of alternatives. If our society should change its attitudes toward disabled people, without corresponding changes in the built environment, a truly responsive life space will not exist.

The task which faces us is to design truly responsive environments wherein all people have opportunities to develop competence as being a quality which lies exclusively within individuals. Rather, it is a relationship between oneself and the object that one is attempting to manipulate. Environments are constructed to meet the physiological norms of normal people, to allow the average person to display an average amount of environment competence. If the deisgn of the environment gets out of line with the physiological norms of people, then they of course become less competent. The term often applied to an environment where such a discrepancy exists is nonfunctional, i.e. one cannot function (be competent) within it. When such a condition exists, the blame for the misfit is placed upon the environment and it is subsequently changed. Since the disabled person has different physiological norms it is only natural that his reltionship to the environment is different from that of the able bodied.

Fortunately, environments do not have to be designed for the exclusive use of any one group. For a relatively low cost existing enviornments can be modified to allow people with disabilities to interact competently in them. The cost of designing new environments that take into account the perspective of the disabled is even less. Environmental modification should not, of course, be looked upon as a panacea to stigma. It will not eliminate the stigma of disability. It will, however, decrease that stigma to the degree that it increases the person's environmental competence. We. therefore, have it in our hands to substantially increase the quality of life of a section of society that has needlessly suffered for too long. It is of course extremely difficult to change the minds of people. One cannot simple legislate away stigma because such stigma arises out of interaction between people. We can, however, legislate the design of the physical environment and by changing the conditions under which people interact eventually change the very quality of that interaction. Hopefully, this will bring closer the day when a person with a crutch is no longer considered first and foremost a "cripple" but as someone who is essentially a human being with the good and bad qualities that make up that identity.

The individual can make adaptations to a poorly fitting environment but successful adaptations can often be made more appropriately and effectively through design. Developing responsive environments requires a focus on the role of the physical environment and the many effects it can have on human behavior. Particularly in respect to mobility, designers and planners must give attention to the specific parts of the environment that should be changed. For example, should public interurvan transit systems be made more accessible or should the need for them, through land planning and pedestrian planning be reduced? It appears that responsive environments should begin in the home and extend throughout the community. Their development concerns policy and planning issues as well as building design.

6. BUILDING PRODUCTS REVIEW

One important area in design of buildings that has received little attention with respect to barrier-free design is the selection of building products--those manufactured products that are permanently attached or installed in buildings, plumbing fixtures. A method was developed to analyze products to identify those features that are hindrances to use by disabled people. The central element in this method is the "enabler," an ideogram that represents abilities as a basis for design. Analysis matrices were developed to use in evaluating any building product (see Figure 10). Twelve complex products, such as telephone booths, stoves and refrigerators, were also analyzed and recommendations made for selections (see Figure 11). There is much room for improvement in design of these products. Although many products are made with easily used features, the most useable features are often not found together or are not widely available. The major problem area is height of controls and compartments for kitchen and laundry appliances.

7. PERFORMANCE CRITERIA

The final section of the report catalogs recommendations on design features, i.e, width of doorways, height of toilets, etc. All available recommendations for specific features have been listed with their sources so that comparisons can be made. The listing has been used to identify those areas where consensus is available and those where recommendations vary widely. It has also been compared to information needs generated in the human factors review to highlight those design concerns that have received inadequate treatment in guidebooks and other literature. Areas of conflicting recommendations and inadequate knowledge have been selected for laboratory testing which have already begun. Figure 12-15 show examples of the recommendations we have assembled. From reviewing these examples it is clear that there is a great deal of ambiguity in available recommendations. This is due to the many recommendations that are not based on empirical research and the lack of a major source of recommendations for areas not covered comprehensively in ANSI A117.1 (1961).

FIGURE-2S: Example Data for a Disability Concern

H

Difficulty in Lifting and Reaching with Arms | 11.978 mil.[1]

chronic condition/ impairments	criterion for condition	population affected (millions)		source - page	
		date of survey	extrap. to 1974	primary	secondary
1. Arthritis		3.400 (1969)	3.570	17/-	1/38
2. Dislocations					
3. Bursitis					
4. Tendonitis					
5. Heart Disease	Definite heart disease	14.622 (1960-62)	16.962	2/8	-
6. Burns with Fixed Contractures	Burn admissions affecting arms	2.233 (1966) 38%	.918	6/14-13/1[2]	-
7 Dwarfism					
8. Obesity		.99[4] (1971)	1.019	20/-	-
9. Shoulder-Hand Syndrome					
10. Quadriplegia	Three or more major members	.035 (1963-65)	.039	7/13	-
11. Hemiplegia	One side of body, one upper and one lower, same side	.147 (1963-65)	.163	7/13	-
12. Cerebral Palsy	Partial paralysis, arm(s)/fingers	.149 (1963-65)	.164	7/13	-
13. Mastectomy	Absence of breast	.661	.680	19/-	-
14. Upper Extremity Neurologic Disorder					
15. Bilateral Phocomelia					

notes:
1 lifting, carrying weights, and reaching (Haber, 1966, extrapolated from 11.07 million)
2 multiplier
3 probably the Social Security Survey
4 non institutionalized population
5 ages 18-64
6 no date provided

FIGURE-1S:

Population Affected by Disability Concerns

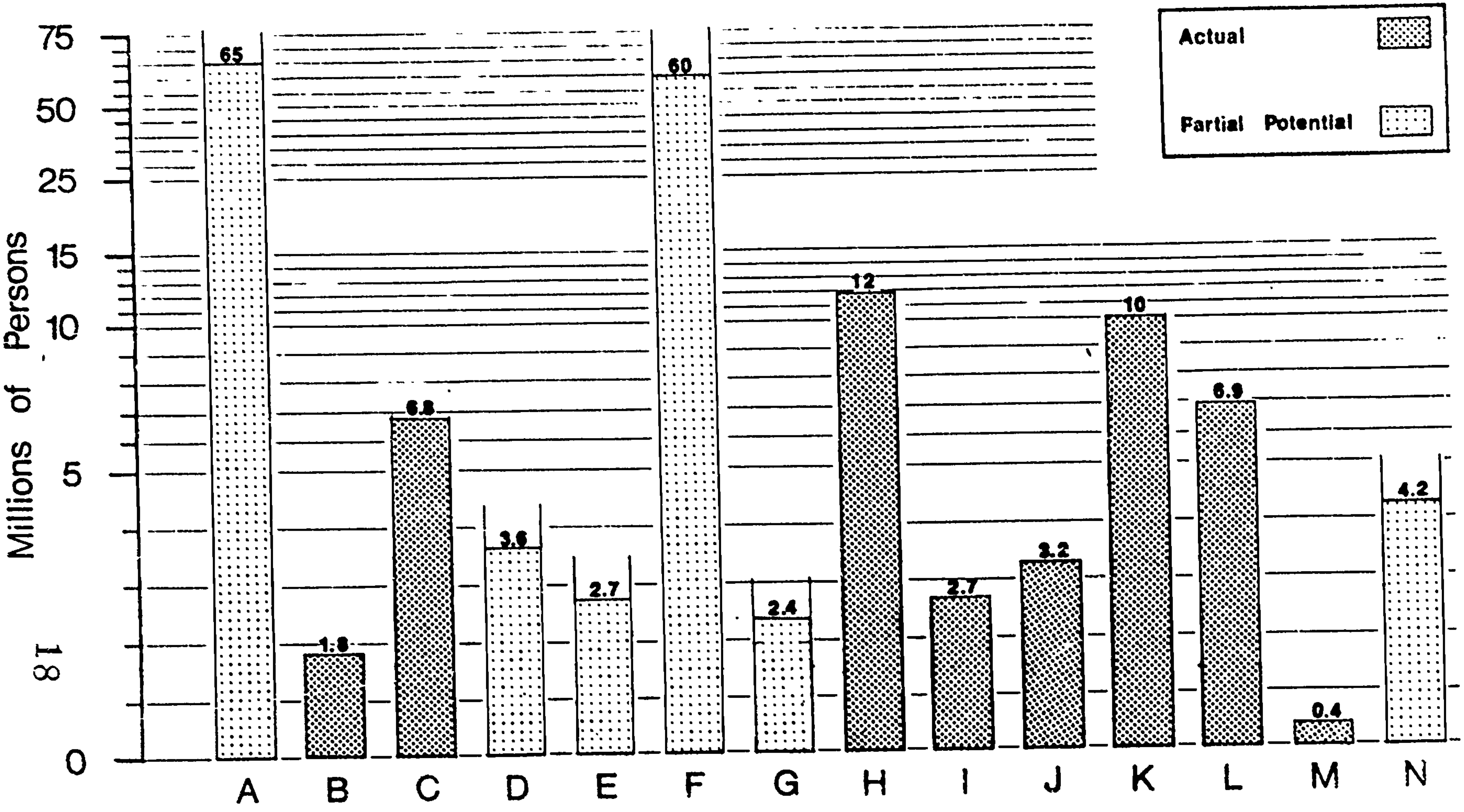


FIGURE 3-S: Scope of Federal Regulations

Federal Agency ANSI A117.1 Review X-Denotes addition to or change from ANSI A117.1-1961 (R-1971)	Department of Agriculture Soil Conservation Service	Department of Health, Education and Welfare	Department of Housing and Urban Development	Veterans Administation	Department of Defense	General Services Administration
1 SITE DEVELOPMENT					ANSI A117.1-1961, "Making Buildings & Facilities Accessible to Handicapped"	FPMR 101-17.1, "Access for the Physically Handicapped" (Adopts ANSI A117.1-1961)
Grading						
Walks	X	X		X		
Parking Facilities	X			X		
2 BUILDING						
Ramps	X	X	X	X		
Floors	X			X		
Elevators		X		X		
Entrances	X	X	X	X		
Doors and Doorways	X	X	X	X		
Corridors		X	X	X		
Stairs	X	X	X	X		
Toilets	X	X		X		
Lavatories	X	X		X		
Special Spaces		X		X		
Furniture Layouts						
3 PRODUCTS, CONTROLS INFORMATION						
Water Fountains	X	X		X		
Public Telephones		X		X		
Warnings		X	X	X		
Identification				X		
Controls		X		X		

FIGURE 4-5: Codes and Standards Review - Example of Review of Federal Agency Crigeria

Federal Agencies

	VETERANS ADMINISTRATION
1 SITE DEVELOPMENT	
Walks	Width: 72", maximum slope-3%, rest areas every 200' for walks with 2-3% slope
Parking Facilities	Width: accessible space between regular-13' 6"; series of accessible spaces-9' 0" wide with clear space 4' 0" wide
2 BUILDING	
Ramps	Slope: 4-8%, 5% preferred; handrails both sides; width 4' 0" between curbs, curbs 4"x4", level platform 5' 0" long (minimum); weather protection required
Floors	Carpets must be tight weave, low pile
Elevators	Call buttons at 3'4"; audible signals for up and down; 36" door; 7 lb. pressure; double handrails (32"x42"); minimum space: 5'8"x5'; auxilary call buttons
Entrances	Entry platforms 6'x6'; 18" each side doorway (single); 12" (double) level and at grade vestibules 6'6" deep
Doors and Doorways	34" clear opening, opening pressure 8 lb. (5 lb. preferred); flush thresh-holds; lever door handles preferred
Corridors	
Furniture Layouts	
Stairs	Handrails-both sides; notcatch clothes; treads with nosings of contrasting colors
Toilets and Lavatories	Required at visitor's entrance level; urinals-handle 40", lip at 15", 3' wide entrance door; provide for side transfer. conventional: 3'6" wide x 6'6" deep 34" door, parallel grab bars at 30", centered w.c. with 20" seat, lavatories: VA guide
Special Spaces	cafeterias, stores
3 PRODUCTS, CONTROLS INFORMATION	
Water Fountains	Required alcove placement, rim at 34", knee clearance 27"
Public Telephones	Number: 1 per floor; push buttons required
Warnings	Warning lines at walk-traffic intersections, stairs, doors, on glass doors
Identification	Path of travel marked with International Access Symbol, also toilet rooms
Controls	Alarms: 48"; outlets and other controls: 18"-40"

FIGURE 5-S: Example Review of Model Code

Model Codes		CRITERIA FROM SPECIAL HANDICAPPED SECTION (1975 Draft) BOCA
1 SITE DEVELOPMENT		
Walks		Width: 5'0"; slope 1:20 maximum
Parking Facilities	X	Number of accessible spaces according to chart of total spaces "close as possible" to elevators, ramps, walks, entrances
2 BUILDING		
Elevators	X	Minimum area: 25 sq.ft.; minimum dimension: 56", door width: 32" minimum; call buttons: braille plate 60" height maximum, braille plate at floor door jamb
Toilets and Lavatories		1 toilet room and stall accessible; minimum area at entrance: 60x60", 88" between w.c. and stall door, 72" deep, 42" wide, 32" door, grab bars 33" high, 42" long, 17" seat
Special Spaces & Requirements	X	Provisions for accessible residential units (1:25 access), assembly seats according to table, 36" checkout lanes, no turnstile
3 PRODUCTS, CONTROLS INFORMATION		
Water Fountains	X	5% or no less than 1; 30" maximum height, fully recessed not acceptable
Public Telephones	X	5% or no less than 1; all useable parts no higher than 54"

FIGURE 6-S: Example Review of Scope of State Regulations

State Review — A: Scope

Building types covered (Public: Public funds (general), State owned, State leased, Municipally owned, Schools; Private: Places of assembly, Residential (includes apts), Commercial, Industrial, Accommodations (hotels), Health facilities)

			Public funds (general)	State owned	State leased	Municipally owned	Schools	Places of assembly	Residential (includes apts)	Commercial	Industrial	Accommodations (hotels)	Health facilities
1 NEW ENGLAND	Connecticut	CT	X	X		X	/	/	/	/	/	/	
	Maine	ME	X	X		X	X						
	Massachusetts	MA	X	X		X	X	X	/	X		X	
	New Hampshire	NH	X				X						
	Rhode Island	RI	X	X		X		X		X		X	
	Vermont	VT	X				X						
2 MIDDLE ATLANTIC	Delaware	DE	X										
	Dist. of Columbia	DC	X										
	Maryland	MD	X	X		X	X	X	/				
	New Jersey	NJ	X				X						
	New York	NY	X				X	X	/			X	
	North Carolina	NC	X	X	X	X	X	X	/	X	X	X	X
	Pennsylvania	PA	X				X						
	Virginia	VA	X	X									
	West Virginia	WV	X	/	/	/	X	X	/	X		X	X

Phase of construction

			Existing	Alterations/renovations	Additions	Contract in process	Contract document completed	Under construction	New construction
1 NEW ENGLAND	Connecticut	CT		X	X		X		X
	Maine	ME		X	X				X
	Massachusetts	MA		X	X				X
	New Hampshire	NH							X
	Rhode Island	RI						X	X
	Vermont	VT							X
2 MIDDLE ATLANTIC	Delaware	DE		X	X				X
	Dist. of Columbia	DC							X
	Maryland	MD		X	X				X
	New Jersey	NJ							X
	New York	NY		X	X				X
	North Carolina	NC		X	X				X
	Pennsylvania	PA							X
	Virginia	VA		X	X				X
	West Virginia	WV			X		X	X	X

Enforcement and Review

			Building Code Council	Local municipality	State Fire Marshal	State Administrative Agency	Contracting agency	Barrier Free Design Board
1 NEW ENGLAND	Connecticut	CT	R			R E	R E	
	Maine	ME		E		E		
	Massachusetts	MA		E		E	E	R E
	New Hampshire	NH		E		R E		
	Rhode Island	RI		E		E	E	
	Vermont	VT		E		E		
2 MIDDLE ATLANTIC	Delaware	DE				R E		
	Dist. of Columbia	DC					R E	
	Maryland	MD		E		R E		
	New Jersey	NJ		E		R		
	New York	NY	R E	E		R E	E	
	North Carolina	NC	R E	E		E		
	Pennsylvania	PA				E		
	Virginia	VA		R E		R		
	West Virginia	WV	R	E		R	E	R E

R: review; E: enforcement; X: requirement; /: partial requirement

FIGURE 7-S: Example of Review of State Criteria

R: recommended
X: quantitative criteria
/: qualitative criteria
*: ANSI A117.1 section deleted

State Review

B: Building Elements

1 SITE DEVELOPMENT	ANSI REQUIREMENT	STATES WITH REQUIREMENTS ADDITIONAL TO ANSI
Siting		
grading	X	
proximity of facilities	/	NY
Outdoor Circulation - Walks		
width	X	FL, MA, MI
slope	X	NY, VA
surface		KS, MN, TX, VA
intersections	/	
level platform where door swings out	X	MO, WV
level platform where door swings in	X	MA
level platform dimension at door edge	X	MI, MN
handrails		NY, VA
rest areas		VA
Curb Cuts		
cuts per lineal block		CA, FL, KY, MI, NC, NJ, OR, VA, WI, WV
width		CA, NC, OR, WV
slope		CA, NC, OR, WV
surface		CA, WV
identification for blind		WV
Parking Facilities		
required no. of spaces	/	KY, MN, NC, NY, VA
space width	X	CT, NC, NY, VA
space identification	X	MA, MI, MN
planning of spaces	X	

FIGURE 8-S: Information Needs in Design for Access

TASK	INFORMATION NEEDS	CONTINGENCIES
1. passing through openings	a. height of openings b. width of openings c. shape of openings d. approach configuration e. number of openings needed	a. user group characteristics b. purpose of use c. how many people pass through at a time d. how quickly should they pass through e. opening function e.g. indoor/outdoor internal only f. frequency of use
2. operating electronic and mechanical controls	a. configuration of control b. location vis-a-vis reach c. force activation d. type of activation motion e. speed of activation f. relationship to other controls g. number of controls h. type of feedback	a. user group characteristics b. purpose of control c. sequence of activity in which control is a part d. familiarity of user with control
3. movement along route of travel	a. characteristics of surface b. friction between user and surface c. length of routes d. configuration of route e. exposure along route (to climate) f. overall pattern of circulation	a. user group characteristics b. purpose of travel along route c. origin and destination d. travel time necessary for route e. sequence of route travel
4. negotiating changes in level	a. degree of slope for ramp incline b. configuration of stair nosing c. height of stair raiser d. width of step e. length of run for incline for stairs f. location of movement assists g. configuration of movement assists h. configuration of stairways and ramps i. configuration and size of landings	a. user group characteristics b. purpose for which ramp or stairway is used c. origin and destination of ramp or stairway d. frequency of use

TASK	INFORMATION NEEDED	CONTINGENCIES
5. transferring from one body posture to another	a. number and type of assists needed for transfer b. configuration of assists c. location of assists d. strength of assists e. size of zone f. configuration of transfer zone g. size and configuration of built-in elements that are transfer points (e.g. toilet)	a. user group characteristics b. sequence of activities of which transfer is a part c. purpose of transfer d. frequency of transfer
6. searching for direction-finding information	a. type of coding method for awareness b. location of display c. exposure of display d. where information is needed e. content of information needed f. number of displays needed	a. user group characteristics b. type of information conveyed c. sequence of activities in which information is needed d. urgency of information needed e. competing information
7. interpreting information displays	a. type of coding method for interpretation b. complexity of information transmitted c. symbolic content of information d. where information is needed e. content of information f. exposure of display g. location of display h. number of displays needed	a. user group characteristics b. type of information conveyed c. reasons information is needed d. competing information
8. negotiating a series of movements in a confined space	a. size and configuration of dynamic space b. layout of elements in a space c. proximity of elements to each other d. number of space types needed	a. user group characteristics b. activities to take place in room c. sequence of activities desired d. frequence of activities

TASK	INFORMATION NEEDED	CONTINGENCIES
9. negotiating human and vehicular traffic	a. constraints on traffic flow b. controls on flow rate and direction c. separation of human and vehicular traffic	a. user group characteristics b. type of traffic c. intensity of traffic
10. use of fixtures, storage and work surfaces	a. height of placement b. clearances to approach c. configuration of fixtures d. type of surfaces	a. user group characteristics b. frequency of use c. sequence of use
11. avoiding hazards in the path of access	a. definition of hazards that should be avoided b. configuration of hazard-free zone c. size of hazard-free zone d. guards against exposure to hazards	a. user group characteristics b. type of hazards likely to be encountered c. risk factor desireable d. frequency of exposure to hazards

FIGURE 9A-S

Code:
N no info available
U info available, not empirically based
L limited valid info
A-adequate valid info
C-solutions based solely on situation analysis
O-solution obvious

Summary: Information on Task Environments for Access	FOR ABLE-BODIED PEOPLE	FOR DISABLED PEOPLE	SOURCES@, *, #
1 Passing Through Openings			
a. height of openings	A	A	4#, 15#
b. width of openings	A	A	4, 8, 15, 16*
c. approach configuration	A	L	4, 16*
d. number of openings needed	C	C	
2 Operating Electronic and Mechanical Controls			
a. configuration of control	A	U	11
b. location vis-a-vis reach	A	L	4, 6*, 4*
c. force activation	A	U	11, 13
d. type of activation motion	A	U	11, 13
e. speed of activation	O	O	
f. relationship to other controls	C	C	
g. number of controls	C	C	
h. type of feedback	O	O	

@ only noted for empirically based information
* information on disabled only
\# same sources for able-bodied and disabled

FIGURE 9-B S:

Summary (continued) Sources of Information
(On Task Environments for Access)

1. ANSI A117.1 Making buildings accessible and useable by the physically handicapped, 1971.

2. Birren, James E. Psychology of aging.

3. Corlett, E.N. et al. Ramps or stairs, Applied ergonomics.

4. Diffrient, Niels, et al. Humanscale 1/2/3.

5. Dixon, Charles E A study to determine the specifications of wheelchair ramps.

6. Floyd, W.F. et al. A study of the space requirements of wheelchair users, Paraplegia.

7. Goldsmith, Selwyn. Designing for the disabled.

8. Grandjean, Etieene Ergonomics of the home.

9. Kira, Alexander. The bathroom.

10. Leonard, J.A. S udies in blind mobility, Applied ergonomics.

11. McCormick, Ernest J. Human factors engineering.

12. McCullough, Helen E. et al. Space and design requirements for wheelchair kitchens.

13. Murrell, K.F.H. Ergonomics.

14. Steidl, Rose E. et al Work in the home.

15. Templer, John A. Stair shape and human movement.

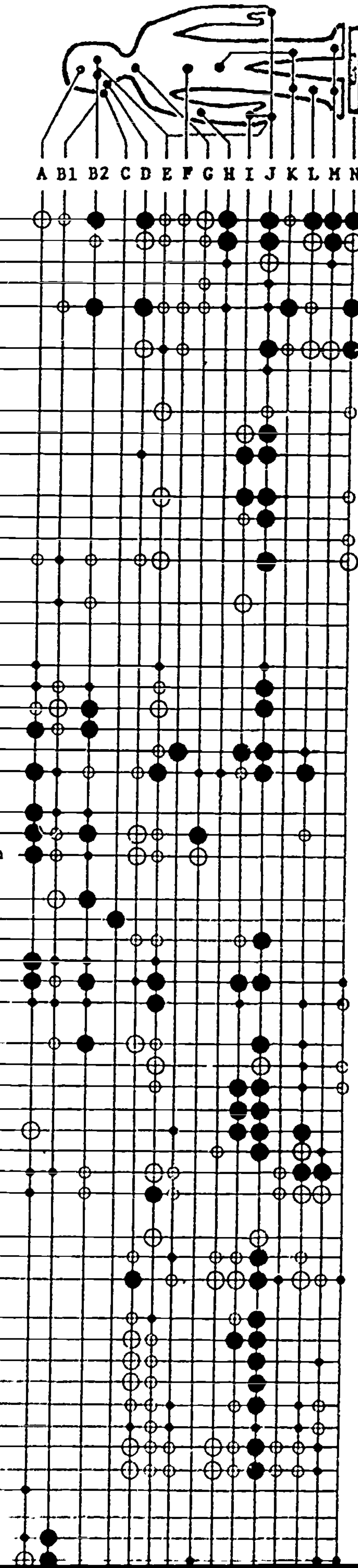
16. Thiberg, Sven et al. Anatomy for planners.

17. Walter, Felis. Four architectural movement studies for the wheelchair and ambulant disabled.

18. Brattgard, Sven Olaf. Unpublished research at the University of Goteborg, Sweden, 1967-74.

FIGURE 10-S: **DESIGN MATRIX: CONTROLS**

- ● (small) Potential problem
- ○ (small) Problem
- ○ (large) Severe problem
- ● (large) Impossibility



1 Vertical Location
- stretch up
- reach up
- middle range
- bend over
- kneel down

2 Horizontal Location
- long reach
- close

3 Type
- button
- lever
- knob

4 Size
- small
- medium
- large
- controls close together

5 Texture
- smooth
- textured

6 Complexity
- off/on
- discrete settings
- continuous settings
- with accompanying instructions
- requiring constant use
- requiring simultaneous actions

7 Logic
- illogical means of activation
- illogical orientation to user
- illogical orientation to controlled item

8 Feedback
- visual feedback
- audio feedback
- tactile feedback
- presence of time lag
- sensitive control
- coordination required

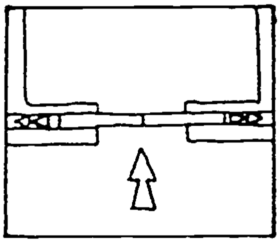
9 Activation
- touch only
- single finger
- two or three finger grasp
- one hand grasp
- two hands
- arm movement
- foot
- other, including head & torso

10 Force Required
- less than two pounds
- between two and ten pounds
- more than ten pounds

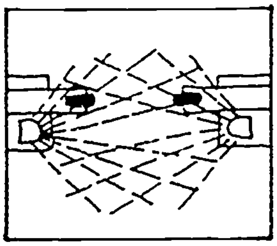
11 Mode of Activation
- rotate less than 90°
- rotate more than 90°
- slide left or right
- slide up or down
- pull
- push
- lift
- lower
- automatic

12 Visibility
- well lit
- poorly lit/shadow
- obscured

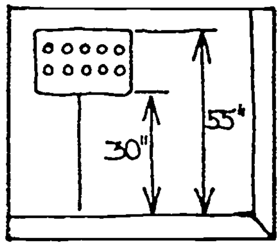
FIGURE 11S - Example of Product Recommendations



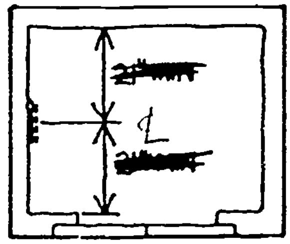
center opening door



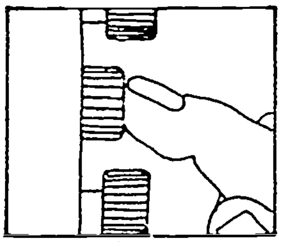
electronic detector and safety bumpers



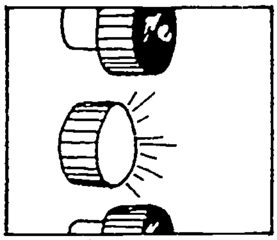
control panel height



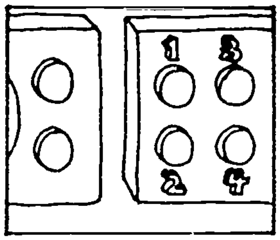
control location



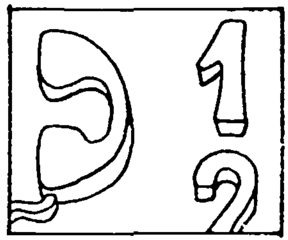
projecting push buttons



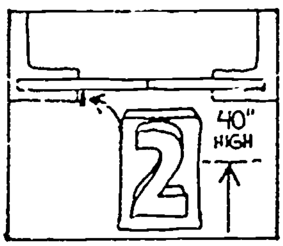
floor button remains depressed and lights up



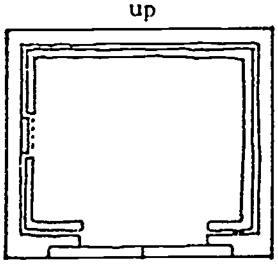
button layout 2 row odd/even.



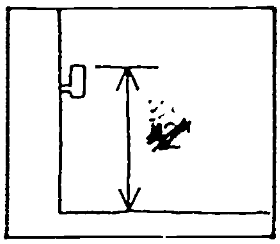
raised graphics



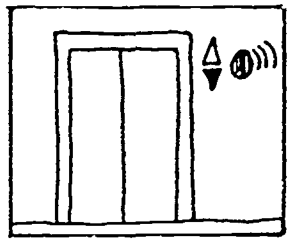
tactile floor number location



railing all around



railing height



combined audio and visual signals

Recommendations for Further Research -

While the above features are currently available they are not necessarily used in elevator design. Design attention is required in the following areas:

1. A consistent control format should be agreed to by all manufacturers, especially for the treatment of floor buttons in elevators serving large numbers of floors or zones within a building.

2. A consistent legible graphic display of information should be developed.

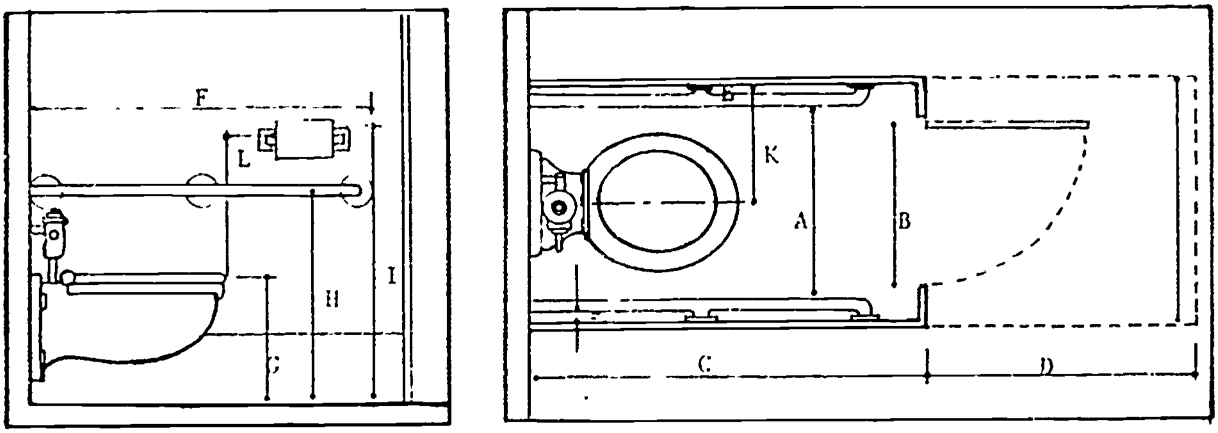
3. All important information displays should be multisensory.

4. Control information and control feedback should be provided in both visual and tactile modes. Raised numbers or other tactile cues should not appear on buttons but rather next to them where they will not cause accidental activation.

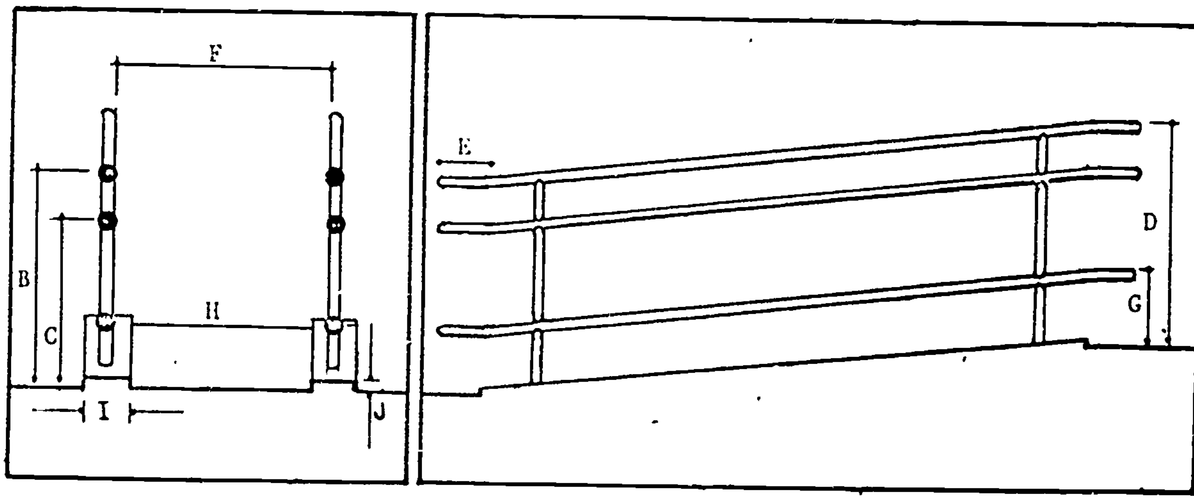
FIGURE 12A-5 (continued)

	DIMENSION U.S.	DIMENSION METRIC	SOURCE
D	32 in	81cm	Southern
	42	107	NC, WV
E	1 1/2	3.8	NC, WV, South Bend, Univ. of Texas System, Time Saver Stds., ANSI
F	36	91	MA, CA
	42	107	MI
	48	122	WV, UT, Graphic Stds., Access Chicago
	52	132	HEW, Univ. of Texas System, Time Saver Stds.
	54	137	NC
G	15	38	Vet Adm. (side entry)
	16-18	41-46	CT
	17.7	45	EFW, 1968
	18-20	46-51	WV, NJ, Housing the Handicapped
	19-20	48-51	MN
	19-21	48-53	DE, Access Chicago (1a)
	20	51	NC, ANSI, HEW, South Bend, Univ. of Texas System, Graphic Stds., Time Saver Stds., Vet Adm.
	20.5	52	R. Dumas
H	30	76	Vet Adm.
	32	81	(to top) WV, NY, South Bend
	33	84	NC, ANSI, CA, HEW, Univ. of Texas System, Graphic Stds., Time Saver Stds (o.c.), Rochester
I	39	99	Graphic Stds. (o.c.), Univ. of Texas System
	40	102	(maximum) NC, WV
J	36	91	NC
	42	107	Vet Adm.
	66	168	Vet Adm.
JD	32x32	81x81	IA
	42x36	107x91	NC, WV
	60x48	152x122	MI
	60x60	152x152	FL
K	15	38	Vet Adm (side transfer)
	16	41	CT (side transfer)
	18	46	Vet Adm. (from same wall w/grab bar), HEW (side transfer)
	35	89	CT (side transfer)
	37	94	Housing the Handicapped (side transfer)
	48	122	U of Texas System (side transfer)
	66	168	VA (side transfer)
	10	25	Housing the Handicapped

FIGURE 12AS - Example of Design Criteria



	DIMENSION		SOURCE
	U.S.	METRIC	
A	36 in	91cm	NC, WV, ANSI, HEW, South Bend, Univ. of Texas System, Graphic
			Stds., Time Saver Stds., Rochester
	42	107	(preferred) HEW
	44	112	FL
	51	130	CT (side transfer)
	52	132	LA
	59	150	Grandjean-Danish Stds.
	60	152	[illegible]
	65	165	U of Texas System
	66	168	Vet. Adm. (side entry)
B	32	81	NC, WV, ANSI, HEW, Univ. of Texas System, Graphic Stds., Time
			Saver Stds., Rochester, CT
	34	86	HEW (preferred) Vet Adm.
	36	91	MA
C	56	142	(minimum) HEW, ANSI, Univ. of Texas System, Time Saver Stds.,
			Rochester
	58	147	U of Texas System, CT
	57-60	145-152	Graphic Stds.
	60	152	(preferred) HEW, Time Saver Stds., ANSI
	66	169	(preferred) Goldsmith (door swings in), Housing the Handicapped (side entry)
	72	183	NC, MA, (if floor w.c.) Vet Adm.
	82.7	210	Grandjean-Danish Stds. & Rec.

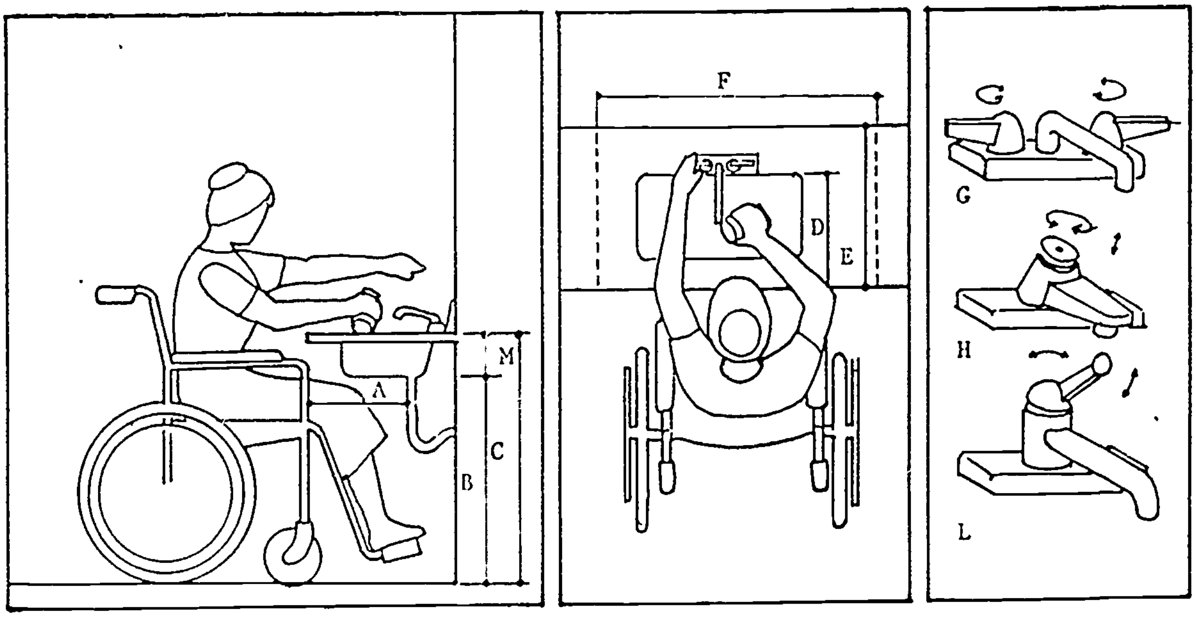


	DIMENSION U.S.	METRIC	SOURCE
B	30 30-34 in	76 76-86 cm	Housing the Handicapped Uniform
	32	81	HEW, HUD-MPS, South Bend, U. of Texas System, NYC, Time Saver Stds., Southern, ANSI, NC
	32-34	81-86	MN
	34	86	Rochester
	36	91	Goldsmith, ASLA, Housing the Handicapped
C	28	71	ASLA
	30	76	Goldsmith, Univ. of Texas System
D	38-39	97-99	Goldsmith
E	12	30	Goldsmith, ANSI, HEW, South Bend, Univ. of Texas System, Graphic Stds., Time Saver Stds, ASLA, Southern, NC
	18	46	NYC, ASLA (preferred), Housing the Handicapped
F	32	81	CT, DE, LA, MO, MS, NY, PA, Rochester
	36	91	NYC, ASLA (1-way), MI, NJ, Graphic Stds.
	42	107	Goldsmith (minimum), Univ. of Texas System
	44	112	FL, HUD-MPS, Uniform
	48	122	Goldsmith (preferred), NC, NY, HEW, Univ. of Texas System (preferred), Time Saver Stds.
	60	152	KA, MN.

Figure 13-S (continued)

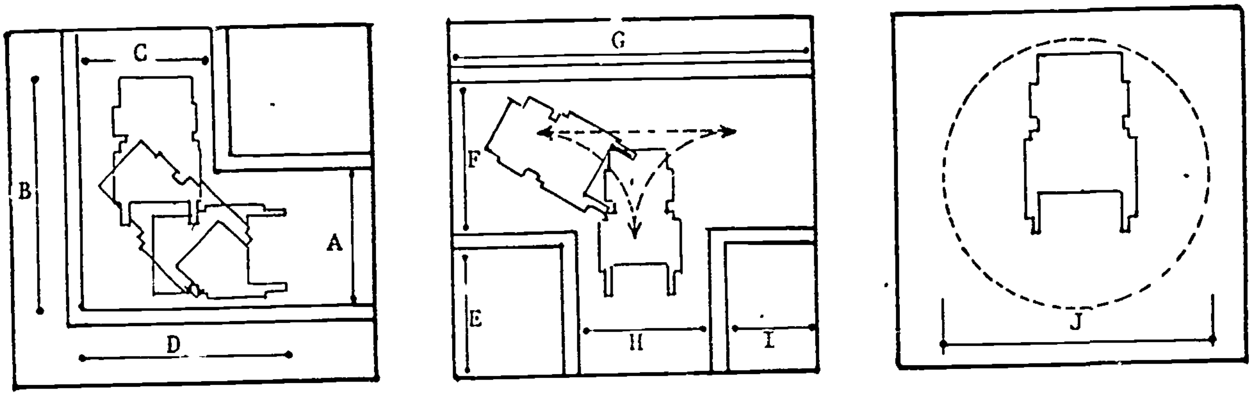
	DIMENSION U.S.	METRIC	SOURCE
	72 in	183 cm	ASLA (2-way)
G	16-18	41-46	HEW (child rail)
H	48	122	NC, Walter's Study , Vet. Adm.
*	Slope		
	1:7		Housing the Handicapped (15' indoors)
	1:8		OH, MN, NYC, (only if used by handicapped)
	1:9		Walter's Study (ambulant, 10' ramp)
	1:10		MA, Walter's Study (wheelchair user, 10'ramp) Souther, Uniform,
	.		HUD-MPS (with maximum height of 1')
	1:12		Graphic Stds, ASLA, Goldsmith, ANSI, HEW, South Bend, Univ. of
			Texas System, Time Saver Stds., Walter's Study (20'), VA, Southern
			D9 NSBR, HUD-MPS, Rochester
	1:16		Walter's Study (wheelchair user, 20' ramp)
	5%		Vet. Adm. (preferred)
	8-10%		VA.
I	2	5	Goldsmith (min.)
	3	8	Goldsmith (pref.)
IJ	2x2	5x5	NYC
	3x2	8x5	Goldsmith
	4x2	10x5	Graphic Stds.
	4x4	10x10	Vet. Adm.
J	2	5	U of Texas System, HEW
	4	10	Vet. Adm.
	6	15	Housing the Handicapped

Figure 14-S Example of Design Criteria



	DIMENSION		SOURCE
	U.S.	METRIC	
A	9 in	22.5 cm	Goldsmith
B	21.6	55	Grandjean-Ergon. of the home
	24	61	IA, Uniform, Southern, U of Ill (clearance for knees)
	26	66	Humanscale 1/2/3, Goldsmith, MA NY, Housing the Handicapped
	29	74	NC
	29.5	75	Graphic Stds., Univ. of Texas System, CA
	30	76	HEW, MN, U of Ill (clearance for chair arms)
C	31	79	Time-saver Stds., Goldsmith (pref.)
	32.5	82.6	Goldsmith (Max)
	33.5	85	Nat'l. Swed. Inst. for Bldg. Research, 1965
	34	86.4	NC, WV (Max)
D	20	50	D9 NSBR
E	16	40	Goldsmith
	24	61	Humanscale 1/2/3
F	24 30-	61 75	U of Ill.
	36	90	(Max) Univ. of Texas System
G	30	75	Housing the Handicapped not permitted - Vet. Adm.
H			HEW, Vet. Adm.
L			NC, WV, VA, HEW, Vet.Adm.
M	5	12.7	U of Ill
	5-6	12.7- 15.4	Housing the Handicapped

Figure 15-S Example of Design Criteria WHEELCHAIR DIMENSIONS



	DIMENSION		SOURCE
	U.S.	METRIC	
A	36"	91cm	Humanscale
	38	97	Walters Study
	40	102	Univ. of Texas System, Goldsmith
B	53½	136	Goldsmith
	55	140	Univ. of Texas System
	66	168	Humanscale
	96	244	Walters Study
C	30	76	Goldsmith
	36	91	Humanscale
	40	102	Univ. of Texas System
	46	117	Walters Study
D	55	140	Humanscale
	57	145	Goldsmith

Figure 15-S (continued)

DIMENSION			SOURCE
	U.S.	METRIC	
	66	168	Univ. of Texas System
	96	244	Walters Study
E	24.5	62	Humanscale
	48	122	Walters Study
F	40	102	Humanscale
	~~52~~	~~120~~	~~Walters Study, Brattgard 1 (desireable)~~
	58	147	Goldsmith
	84	213	ASLA-(large chair)
	43	110	Brattgard 1 (minimum)
G	65	165	Goldsmith
	~~74.5~~	~~190~~	~~Brattgard 1~~
	75	191	Humanscale
	96	244	ASLA
	134	3.35M	Walters Study
H	36	91	Humanscale
	38	95	Walters Study
	32	80	Brattgard 1
I	48	122	Walters Study
J	51	130	D9NSBR
	60	152	Time Saver Stds., ANSI
	62	158	Goldsmith, Univ. of Texas Systems
	63	160	NC
	64	163	ASLA
	65	165	NYC
	72	183	Humanscale
	86	218	Walters Study
	50.64x	128.6x	
	57.76	146.7	University of Illinois Study
	60	150	Brattgard 1 (desireable)
	50	130	Brattgard 1 (minimum)

REFERENCES

Allen, Richard C. Legal rights of the disabled and disadvantaged. published for National Citizens Conference on Rehabilitation and Disadvantaged: U.S. Dept. of Health, Education and Welfare, Washington, D.C. 1969.

Architectural and Transportation Barriers Compliance Board. First Report to the Congress of the United States, Nov. 1974. Washington, D.C.: U.S. Dept. of Health, Education and Welfare.

Bednars, M. Architecture for the Handicapped in Denmark, Sweden and Holland. Ann Arbor: Architectural Research Laboratory, University of Michigan, 1974.

Design for all Americans, report of National Commission on Architectural Barriers to Rehabilitation of the Handicapped, 1968, Washington, D.C.: Department of Health, Education and Welfare.

Design and construction of Federal facilities to be accessible to the physically handicapped hearings before Subcommittee on Public Buildings and Grounds, of the Committee on Public Works, House of Representatives, 91st Congress, First Session on HR 14464. Washington, D.C.: U.S. Government Printing Office, Dec. 9, 1969.

Iowa Chapter, American Institute for Architects, Easter Seal Society for Crippled Children and Adults of Iowa, Inc. and Iowa Governor's Committee on Employment of the Handicapped. Accessibility-the law and reality: A survey to test the application and effectiveness of Public Law 90-480. Des Moines, Iowa, 1973.

Laski, Frank. Civil rights victories for the handicapped, The social and rehabilitation record, 1974, pp 15-20.

President's Committee on Employment of the Physically Handicapped. Minutes-Annual meeting, May 7-8, 1959, Washington, D.C.

President's Committee on Employment of the Physically Handicapped. Minutes-Annual meeting, April 27-28, 1961

Demography of Disability

The American Society of Landscape Architects Foundation. Barrier-free site design. The U.S. Department of Housing and Urban Development, Washington, D.C., U.S. Government Printing Office, 1974.

The 1970 Census. Facts and figures on older Americans. 1971. U.S. Department of Health, Education and Welfare, Social and Rehabilitation Service, p 2.

National Center for Health Statistics, 1963-1965. Vital and health statistics, Series 10, No. 48, p 14.

National Center for Health Statistics, 1965-1967. Vital and health statistics, Series 11, No. 15, p 13.

Steinfeld, Edward. Barrier-free design for the elderly and disabled. Syracuse, New York: Syracuse University, 1974, I, p 5.

Standards and Codes Review

American National Standards Institute. Specifications for making buildings and facilities accessible to and useable by the physically handicapped. Rev. ed., New York: American National Standards Institute, 1971.

International Centre for Technical Aids, Housing and Transportation (ICTA). Norms concerning the accessibility for disabled persons to buildings and environments in different countries. Bromma, Sweden: ICTA Information Centre, 1974.

President's Committee on Employment of the Handicapped. Accommodation for the physically handicapped-summary of survey. Unpublished survey, Washington, D.C. 1973.

U.S. Department of Agriculture, Soil Conservation Service. Requirements for planning public facilities for the handicapped, TSC Technical notebook, recreation UD-16. Upper Darby, Pa.: Northeast Technical Service Center, 1974.

U.S. Department of Health, Education and Welfare. Design of barrier-free facilities, Technical handbook for facilities, engineering and construction manual. Washington, D.C.: Government Printing Office, 1973.

U.S. Department of Housing and Urban Development. Minimum property standards-housing for the elderly with special consideration for the handicapped. Washington, D.C.: Government Printing Office, 1971.

U.S. General Services Administration. A day on wheels. Washington, D.C: Government Printing Office, 1971.

U.S. Government. Congressional record, Vol 119, Pt. 6. Washington, D.C.: Government Printing Office, 1973.

U.S. Government. Congressional record, Vol 120, Pt. 3 Washington, D.C.: Government Printing Office, 1974.

U.S. Government. U.S. statutes at large, Vol 82. Washington, D.C.: Government Printing Office, 1969

Review of Human Factors Research

ANSI A11.7 Making buildings accessible and useable by the physically handicapped. New York: American National Standards Institute, 1971.

Birren, James E. Psychology of aging. Englewood Cliffs, N.J.: Prentice Hall, 1964

Brattgard, Sven Olaf. Unpublished research at the University of Goteborg, Sweden, 1967-1974.

Churchman, C. West. The systems approach. New York: Dell, 1968

Corlett, E.N., Hutcheson, C., Delugan, M.A. and Rogozenski, J. Ramps or stairs, Applied ergonomics, 3:4, pp 195-201, 1972.

Damon, A., Stoudt, H.W. and McFarland, R.A. The human body in equipment design. Cambridge, Mass.: Harvard University Press.

Diffrient, Niels, Tilley, Alvin R. and Bardagjy, Joan C. Human-scale 1/2/3. Cambridge, Mass.: MIT Press, 1974.

Dixon, Charles E. A study to determine the specifications of wheelchair ramps. PHD dissertation. University of Illinois, 1957.

Floyd, W.F., Guttmen, L., Noble, W., Parkes, K.R. and Ward, J. A study of the space requirements of wheelchair users, Paraplegia, 4, pp 24-37, May, 1966.

Goldsmith, Selwyn. Designing for the disabled. New York: McGraw-Hill, 1967.

Grandjean, Etiene. Ergonomics of the home. London: Taylor and Francis and New York: Halsted Press (a division of John Willey and Sons), 1973.

Harrigan, John E. Human factors information taxonomy: Fundamental human factors applications for architectural programs, Human factors, 16;4, pp 432-440, 16;4, 1974.

Jones, J. Christopher, Methods and results of seating research, Sitting posture. Grandjean, E. (Ed). London: Taylor and Francis, 1969.

Jones, J. Christopher. Fitting for action 1/2, Design, 135.

Kidwell, Ann Middleton and Greer, Peter Swantz, Site perception and the non-visual experience. New York: American Foundation for the Blind, 1975.

Kira, Alexander. The bathroom. Ithaca, New York: Cornell University, Center for Housing and Environmental Studies, 1966.

Kroemer, K.H. Eberhard. Human strength: Terminology, measurement and interpretation of data, Human factors, 12(3), pp 297-313, 1970.

Leonard, J.A. Studies in blind mobility, Applied ergonomics. March, 1972, pp 37-46.

McCormick, Ernest J. Human factors engineering. New York: McGraw-Hill, 1970.

McCullough, Helen E. and Farnham, Mary B. Kitchens for women in wheelchairs. Urban, Ill.: College of Agriculture Extension Service, Circular 841, 1961.

McCullough, Helen E. and Farnham, Mary B. Space and design requirements for wheelchair kitchens. Urbana, Ill.: College of Agriculture Extension Service, Bulletin No. 661, 1960.

Murrell, K.F.H. Ergonomics. London: Chapman and Hall, 1965.

Parsons, Henry M. Why human factors research in environmental designs? Man environment transactions (ERDA 5), Carson, D.H. (ed.) Milwaukee: Environmental Design Research Association, 1974.

Poulton, E.C. Bias in ergonomic experiments, Applied ergonomics, 4:1, pp 17-18, 1973.

Steidl, Rose E. and Bratton, Esther C. Work in the home. New York: Willey, 1968.

Steidl, Rose E. Difficulty factors in homemaking tasks: Implications for environmental design, Human factors, 1972, 14(5), pp 471-482, 1972.

Templer, John A. Stair shape and human movement. Unpublished doctoral dissertation. New York: Columbia University, 1974.

Thiberg, Sven and Wester, Per-Olof. Anatomy for planners. Stockholm: National Institute for Building Research, Raports 20: 1965 and R12: 1970.

Walter, Felix. Four architectural movement studies for the wheelchair and ambulant disabled. London: Disabled Living Foundation, 1971.

Webb, Eugene J., Campbell, Donald T., Schwartz, Richard D. and Sechrest, Lee. Unobtrusive measures. Chicago: Rand McNally 1966.

Webb, Eugene J., Campbell, Donald T., Schwartz, Richard D. and Sechrest, Lee. Unobtrusive measures. Chicago: Rand McNally, 1966.

Spatial Behavior of Disabled People

Altman, Irwin. Territorial behavior in humans: An analysis of the concept, L. Pastalan & D. Carson (eds.) in Spatial behavior of older people. University of Michigan: The Institute of Gerontology, 1970, pp 1-24.

Clarke, Linda. Explorations into the nature of environmental codes, Journal of architectural research, January, 1974, p. 34.

DeLong, Alton J. the micro-spatial structure of the older person: Some implications for planning the social and spatial environment, L. Pastalan and D. Carson (eds.) in Spatial behavior of older people. University of Michigan Press, 1970, pp 68-87.

Esser, Arstide H., Chamberlain, Amparo S., Chapple, Eliot D., and Kline, Nathan S. Territoriality of patients on a research ward, Recent advances in sociological psychiatry, Vol. 7, 1965, pp 37-44.

Glaser, B.G., and Strauss, A.L. Awareness of dying. Chicago: Aldine, 1965.

Glaser, B.C., and Strauss, A.L. Time for dying. Chicago: Aldine, 1968.

Goffman, E. Asylums. New York: Anchor, 1961.

Goffman, E. Stigma: Notes on the management of spoiled identity. Englewood Cliffs: Prentice Hall, 1963.

Hall, Edward T. The silent language. Greenwich, CT: Doubleday, 1959.

Hall Edward T. The hidden dimension. Garden City, N.Y.: Anchor, 1969.

Hart, R.A., and Moore, G.T. The development of spatial congnition: A review, R.M. Downs & D. Stea (eds.) in Image & environment: Cognitive mapping & spatial behavior. Chicago: Aldine, 1973, pp 246-288.

Herschberger, Robert. A study of meaning and architecture, Henry Sanoff and Sidney Cohn (eds.) in EDRA 1. Chapel Hill, NC.: Environmental Design Research Association, 1970.

Ittleson, William H., Proshansky, Harold M., Rivlin, Leanne G., and Winkel, Gary H. An introduction to environmental psychology. New York: Holt, Rhinehart and Winston, 1974.

Lawton, M.P. and Nahemow, L. Ecology and the aging process, C. Eisdorfer and M.P. Lawton (eds.) in The psychology of adult development and aging. Washington: American Psychological Association, 1973, pp 619-674.

Lewin, Kurt. Principles of topological psychology. New York: McGraw Hill, 1936.

Lyman, Stanford, and Scott, Marrin. Territoriality: A neglected social dimension, Social problems, 1967.

Mead,, G.H. Mind, self and society. Chicago: University of Chicago, 1934.

Perrin, C. With man in mind. Cambridge, MA: MIT, 1970.

Rapoport, Amos. House form and culture. Englewood Cliffs, NJ: Prentice-Hall, 1969.

Sommer, Robert. Personal space: The behavioral basis of design. Prentice-Hall, 1969.

Strauss, A.L. Mirrors & masks: The search for identity. San Francisco: Sociology Press, 1969.

Suttles, Gerald. The social order of the slum. Chicago: University of Chicago, 1968.

White, R.W. Motivation reconsidered: The concept of competence, H.M. Proshansky, W.H. Ittleson, L.G. Rubin (eds.) in Environmental psychology. New York: Holt, Rhinehart and Winston, 1970, pp 125-133.

Adaptation Aids and Design Guides

Teleoperators and human augmentation-new NASA publication, Journal of the American Geriatrics Society, XVI (July, 1969), 842.

Goldsmith, Selwyn. Designing for the disabled (2nd ed). New York: McGraw-Hill, 1967.

May, Elizabeth E., Waggoner, Neva R., and Hotte, Eleanor B. Independent living for the handicapped and the elderly. Boston: Houghton Mifflin Co., 1974.

Meredith, Diane K. and Olson, Sharon C. Wheelchair interiors. Chicago: National Easter Seal Society for Crippled Children and Adults, 1973.

Neef, Gertrude, A study of the daily activities of ten homemakers confined to wheelchairs with the factors involved in their abilities to adjust to their physical handicaps. Unpublished M.S. thesis, Ithaca, New York: Cornell University, 1954.

Occupational Therapy Department, Kenny Rehabilitation Institute. Homemaking aids for the disabled. Minneapolis, Minn.: American Rehabilitation Foundation, 1967.

Rosenberg, Charlot. Assistive devices for the handicapped. Minneapolis, Minn: American Rehabilitation Foundation, 1968.

Rusk, Howard A. and Taylor, Eugene J. Living with a disability. New York: Doubleday and Co., 1953.

Rusk, Howard A., Kristeller, Edith L., Judson, Julia A., Hunt, Gladys M. and Zimmerman, Muriel E. A manual for training the disabled homemaker (3rd ed.). New York: The Institute of Rehabilitation Medicine, 1967.

Rusk, Howard A. Mealtime manual for the aged and the handicapped. New York: The Institute of Rehabilitation Medicine, 1970.

State University Construction Fund. Making colleges and universities accessible to handicapped students. Albany, New York: State University Construction Fund, 1968.

Vermilya, Howard P. Building and facility standards for the physically handicapped, _Time saver standards_ (4th ed.). J.H. Callendar, New York: McGraw-Hill, 1966.

Wheeler, Virginia H. _Planning kitchens for handicapped homemakers_. New York: The Institute of Rehabilitation Medicine, 1965.