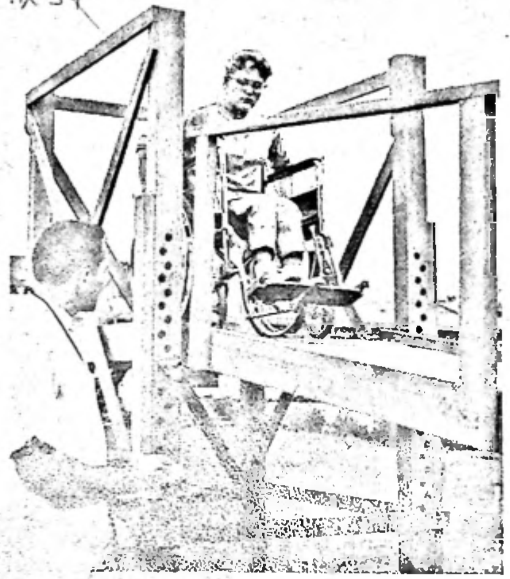
Rehabilitation Record.
No more architectural barriers.
A group of articles on architectural
provisions for building for the
handicapped. 1961.



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NO MORE ARCHITECTURAL BARRIERS

Washington architect Leon Chatelain, Jr., is a prime advocate and leading practitioner of the theory that public buildings and grounds of our day should not have the steep stairs, the high curbs, the hard-to-open doors, and all the other features that impose formidable barriers to people with physical handicaps.

In the accompanying article, Mr. Chatelain tells of the concentrated research and study that led to newly formulated specifications to make buildings and facilities as readily accessible to the handicapped as to other people. His discussion contains a summary of those standards and of their scope. Copies of the precise standards may be obtained from the National Society for Crippled Children and Adults, 2023 West Ogden Avenue, Chicago 12, Illinois.

The University of Illinois has made substantial architectural modifications to allow its handicapped students easier access to classes and other campus activities. This program, which has brought enormous benefit to handicapped students and has also proved beneficial to able-bodied students, is described in this issue.

While the standards under discussion apply to public facilities and not to residential housing, many adaptations of customary home design can be made for the greater utility and comfort of a handicapped homemaker. A third article in this section demonstrates many of these adaptations.

OPENING PUBLIC BUILDINGS TO THE HANDICAPPED

LEON CHATELAIN, JR.

Getting in and out of buildings is a major problem for the physically handicapped. When architectural design ignores this problem, normal opportunities of education, recreation, and employment may be needlessly denied to qualified and deserving people.

The correction of this problem is not within the realm of the professional rehabilitation worker. It is, rather up to the architect, engineer, designer, builder, manufacturer, and also to legislators and municipal leaders. The professional engaged in rehabilitation is only too eager to give his encouragement, assistance, and guidance for the correction of these evils.

If we will correct these abuses of building design, we will make it possible to use the talents and resources of millions of physically handicapped individuals for the betterment of all mankind.

It was in an endeavor to resolve this problem that a group of experts and consultants met in May

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Mr. Chatelain is senior member of the architectural firm of Chatelain, Gauger & Nolan of Washington, D.C. He was chairman of the steering committee of the architectural barriers project discussed in this article.

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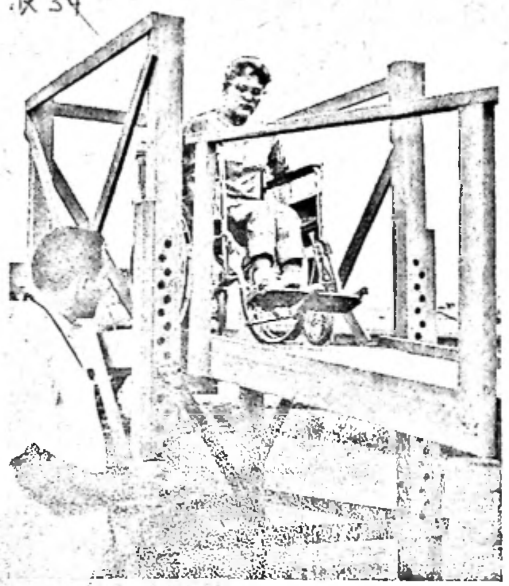

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1959 to discuss the formation of an American Standards Association Committee to study the problems of architectural barriers in buildings used by the physically handicapped. This enterprise became known officially as A.S.A. Project A-117—"Making Buildings and Facilities Accessible and Usable to the Physically Handicapped."

Earlier consultations between the chairman of the President's Committee on Employment of the Physically Handicapped and an executive of the American Standards Association resulted in inviting individuals, interested in and qualified to assist in attacking the problems of architectural barriers, to meet with key personnel of the American Standards Association.

Among the vital decisions made at the opening meeting were:

1. That the problems of architectural barriers as they affect the physically handicapped justified an all-out effort by every organization interested in this problem.
2. That the American Standards Association would approve the project as one that would result in an acceptable American Standard.
3. That the co-sponsors would be the President's Committee on Employment of the Physically Handicapped and the National Society for Crippled Children and Adults and that the principal financial support would be granted by the National Society for Crippled Children and Adults. The National Society later decided to provide $20,000 to support this project.

Steering Committee

A 7-member steering committee was appointed, along with a sectional committee, national in scope, representing about 75 professional and trade associations, societies, and Government agencies interested in this problem. A comprehensive "work outline" was developed. With this as a guide, each member of the committee investigated independently specific areas which related to his basic interests and knowledge. We were most fortunate to have Professor T. J. Nugent, supervisor of the Student Rehabilitation Center at the University of Illinois, as secretary to the committee. He used the University's extensive testing facilities and University students with every conceivable handicap to provide the committee with the data necessary for its many decisions.

Ramps were constructed that were adjustable to any given combination of pitch and length. They had adjustable hand rails. Research men tested wheelchair-bound individuals with various disabilities under every conceivable condition. Another area of basic research performed at the University of Illinois was the determination of the turning-space of a wheelchair and the vertical and horizontal reach of the individual using it. Each test involved people with various types of disability and of various ages and circumstances.

The American Standards Committee concerned itself with every major disability group, including:

1. Non-ambulatory—persons confined to wheelchairs.
2. Semi-ambulatory—including those who use braces or crutches, amputees, arthritics, spastics, pulmonary and cardiac cases.
3. Blind or partially sighted.
4. Deaf or hard of hearing.
5. Persons with faulty coordination, including victims of palsy from brain injury, spinal injury, or peripheral nerve injury.
6. Aging, especially persons with reduced mobility, flexibility, coordination, and perceptiveness.

Now, after a little more than 2 years of many meetings, consultations and further research, the standards have come into being. The American Standards Association's approval involves review by all Association committees and boards concerned with building, safety, fire egress, and protection.

These standards will be used by architects, designers, engineers, builders—all who want to make their buildings accessible to the physically handicaped. Building officials, legislators, and Government officials will, it is hoped, make these specifications mandatory in their building regulations, in addition to using them to make their own public buildings accessible to disabled people.

These standards or specifications now cover the essential elements in the use of buildings and facilities by the handicapped. They include:

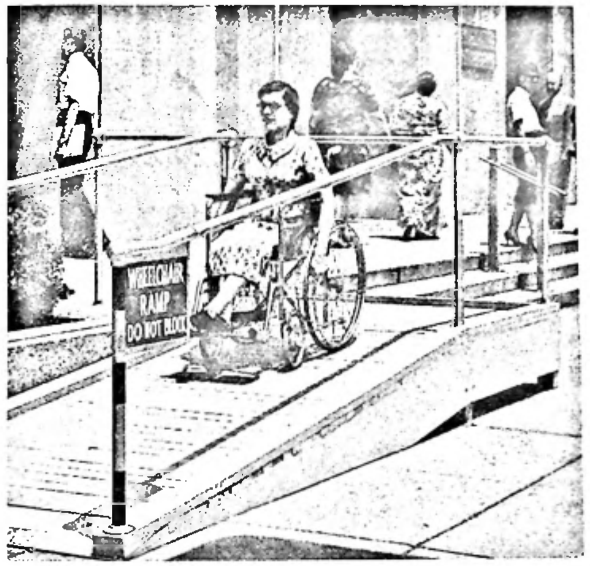
The grading of ground should be done, even when contrary to existing topography, so that it attains a level with a normal entrance that will make a building or facility accessible.

Public walks have been specified to be at least 48 inches wide with a grade no greater than 5 percent. Walks are to have a continuous surface, not interrupted by steps or abrupt changes in level. Where they cross other walks, driveways, or parking lots, they should blend to a common level. This does not mean the entire elimination of curbs but rather that the walk and driveway be formed to one surface at their juncture.

Parking lots should have spaces which are accessible and identified for use by the physically handicapped. If the space is not open on one side for a person in a wheelchair or on braces or crutches to get in or out, then some parking spaces 12 feet wide should be provided. Handicapped persons should not be compelled to wheel or walk behind parked cars.

Doors generally should be no less than 32 inches in width. Revolving doors cannot be used by those in wheelchairs or on crutches. Double doors are not permitted unless they can operate in unison by one single effort or unless each leaf is at least 32 inches in width. Of course automatic doors solve the problem excellently. Doors should not be too heavy to be operated by children or the aged. Thresholds should be as nearly flush as possible.

Floors are required to have a nonslip surface and be of a common level throughout.



Older buildings can be equipped with wheelchair ramps. This one is in use at the Department of Health, Education, and Welfare building in Washington, D.C., where the Office of Vocational Rehabilitation has its headquarters.

Entrances, at least one to every building, should be usable by individuals in wheelchairs and that entrance should have access to the elevator in a multi-story building.

Ramps should have a gradient no greater than 1 foot in 12 feet, or 8.33 percent. It is interesting to note that practically every building code now permits ramps with a rise of 10 percent. The American Standards Association comittee decided this was excessive and dangerous unless special precautions were taken. The standards require ramps to have nonslip surfaces, at least one handrail, a level platform at the top, and at least 6 feet of straight clearance at the bottom.

Stairs, of course, are the Number One enemy of the wheelchair. Where they must be used, it is recommended that the height of the riser be not more than 7 inches and that the commonly known nosing be discarded for a continuous type riser and tread. At least one handrail should be extended 18 inches beyond both the top and bottom steps.

Toilet rooms are required to have at least one stall that is wide enough for a person in a wheelchair. Mirrors, shelves, towel racks, and other dispensers should be placed within reach of those in wheelchairs. Drain pipes and hot water pipes should be covered or protected so that a person without sensation will not burn himself.

Water fountains should have spouts and controls designed and placed with an eye to the requirements of the physically handicapped. Fortunately, the new designs of wall-mounted drinking fountains, when placed at the proper height, meet the requirements for use by the handicapped.

Public telephones can be arranged so that they are reachable by those in wheelchairs. An appropriate number of telephones should also be equipped for the hard-of-hearing. It is recommended that architects and builders work closely with their local telephone company in planning this facility.

Elevators should be accessible and usable by the physically handicapped. Elevator cabs should

These automatic doors at the HEW building, with the wheelchair ramp outside, provide ready access for disabled persons.

be large enough to turn a wheelchair.

Controls and switches for lights, heat, ventilation, windows, venetian blinds, fire alarms, etc., should be located within reach of the handicapped.

Identification of rooms and offices should be done by raised letters to help the blind. Any door not intended for normal use and which might prove dangerous if a blind person were to exit or enter should be quickly identifiable by the use of knurling, small beads or ridges, on gripping surfaces.

Warning signals should include both flashing lights and audible sound.

Hazards that should be avoided include access doors or manhole covers in floors, low-hanging door closers, low-hanging signs, ceiling lights, or similar objects which protrude into regular trafficways. Openings in pavements or floors should be protected by both audible and visual signals.

The actual standards are much more specific in dimensioning, in use of materials, and in methods of construction and design than the foregoing summary. There are obviously many more areas that need attention.

American Standards are subject to periodic review. They are reaffirmed or revised to meet changing economic conditions and technological progress. There are many more refinements and niceties that can be added in future studies. We who are interested expect to keep the subject continually before us. More importantly, however, we want the public to keep it in mind in planning a new building or in purchasing or remodelling an old one.

Now, we come to the most important part of this program—education of the public concerning these simple standards. There is nothing in them that will cause problems of design, nor will any of the features or specifications increase the cost for the builder. Existing buildings may easily be adapted to these standards without any great outlay of money. In practice, we find that the standards not only benefit the physically handicapped but also enable the public in general to use the facilities with greater ease and comfort. These standards will also make all buildings safer for everyone.

We look forward to the day in the not too distant future when every building and every facility will be usable by everyone—the able bodied as well as the physically handicapped.

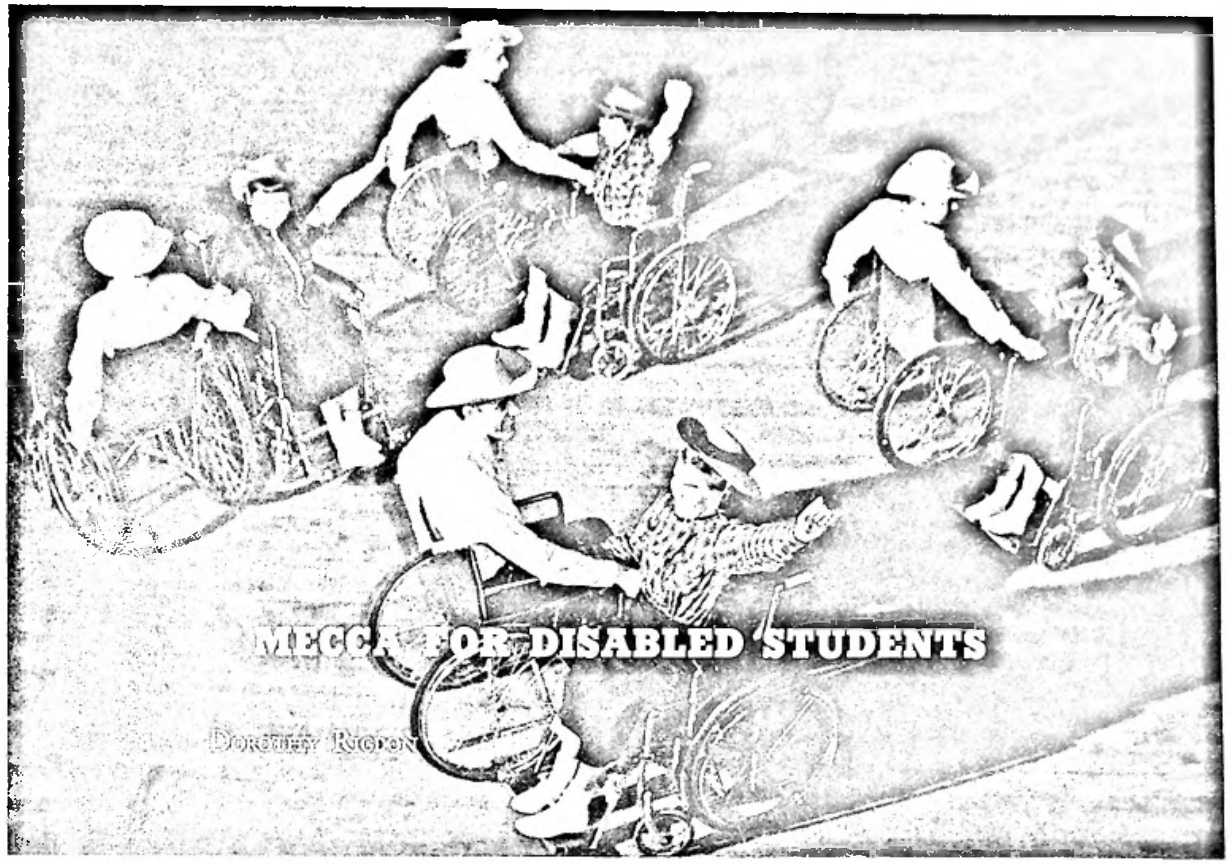
Easy Access

"Governor Rockefeller has directed that all present and future State-owned buildings be modified to provide easy access to persons with physical handicaps. The new State policy follows a 1961 recommendation of the Governor's Council on Rehabilitation and the Interdepartmental Health and Hospital Council.

"The Governor has requested the State Department of Public Works to incorporate such features as gently sloping ramps, ground-level entrances, automatic treadle door openers, and handrails in the plans for all new State structures. The Department will also survey existing structures to determine what steps may be taken to provide comparable features in these buildings.

"The policy will not only enable physically handicapped persons having business with State agencies to visit these offices in person but will also permit more extensive employment by the State of those with ambulatory impairments."

—from a statement by
the Governor's press secretary



MECCA FOR DISABLED STUDENTS

Dorothy Rigdon

"Bill, push yourself up that ramp. If you can do it, we'll admit you to school here. If you can't, you and your attendant can both get back in your car and go home."

The young man in the wheelchair looked with amazement into the unsmiling face of Professor Tim Nugent. His weakened hands slowly gripped the wheels he never pushed himself.

"Stand back," he said to the attendant his family had sent to propel him through his college education.

Four minutes later, Bill had struggled halfway up the ramp to Tim Nugent's office, to a point where he could see the sign on the door: "T. J. Nugent, Director, Student Rehabilitation Center, University of Illinois."

Sweat shone on his face, but a smile shone there, too. And another lit the face of Tim Nugent. "O.K., Bill. Send your friend home. You'll do all right on your own."

And Bill did. In fact, he did more than all right. He was an honor graduate of the University of Illinois College of Mathematics last year. Now he is working for an advanced degree on a scholarship at Princeton University.

Since the day he got his jarring introduction to this unique program for handicapped students and its no less unique director, Bill has never had to be pushed. Neither have the hundreds of other wheelchair students who have attended the University of Illinois in the 14 years since its rehabilitation program began.

Nobody helps the crutch patients either, or any of the other disabled students. That is frowned upon. The first requirement of 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.

After they have passed the medical examinations and the entrance requirements that all students must fulfill, disabled students are introduced to the University in an orientation program held in the week immediately preceding the opening of the fall

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Miss Rigdon is editor of the Rehabilitation Record.

semester. In advance of the rush and confusion of regular registration day, they have a chance to select class sections that are most easily accessible and to plan schedules fitted to their individual conditions and needs. They also receive the regular school orientation, including instruction in good study habits, in planning efficient use of time, and in handling personal and medical problems.

The essence of the rehabilitation program, as Director Nugent expresses it, is "to see that, if a young man or woman has the potential to be an engineer or doctor or scientist, he is allowed to be one instead of being channeled into watchmaking or left to sit in idleness."

What the University catalog says is that the program "coordinates all facilities, services, and functions for the realization of each individual's vocational objective without the neglect of his physical, emotional, and social development."

A look at what handicapped students did in competition with the other 23,000 students at the University in the school year ending last June indicates how well the special program is working.

Total enrollment of disabled students was 188. Of the 124 men, 74 were in wheelchairs. Thirty-five of the 64 women in the group were wheelchair students.

These 188 students pursued 53 courses of study at the University and had scholastic averages above the general level of the rest of the student body. One of the 1961 salutatorians was a wheelchair coed.

More than 140 of them participated in one or more of the several wheelchair sports that require a high degree of athletic skill and present a truly astounding spectacle.

Wheelchair basketball is very popular on the campus. The University team, the Gizz Kids, last year won the National Wheelchair Games championship for the second time.

Eight students from the University were on the 24-member United States team at the Paralympics—held in September 1960 in Rome as part of the Olympic Games. They competed with teams from 23 other countries. The 8 came home with 10 world records and more gold, silver, and bronze medals than any other 8 people in the entire Olympics. Proud as it is of this athletic accomplishment, the University is even prouder to note that these 8 people represented 7 courses of study in 6 colleges and had a grade point average of 4.2—not far short of the 5 points that are the maximum possible to attain in scholarship.

Spearhead of the Paralympic team was 23-year-old Ronald Stein of O'Fallon, Ill., who set four world records in Rome, won the pentathlon, and was proclaimed the world's outstanding wheelchair athlete.

Another student, a freshman last year, holds three world records in track and field events. He is one of several students who have perfected the technique of tilting back in a wheelchair until only the large wheels are in operation and positively flying down the steps of some of the buildings, to the considerable astonishment of anybody witnessing this performance the first time.

"They look like any other buses from the outside, until they pull up to the curb."

The wheelchair athletic program includes basketball, baseball, football, bowling, archery, and track and field events. A light-weight railing running along the approach to the bowling alley at the left of the player provides a guide for blind students, some of whom have become bowlers any league would be lucky to have as members.

Square dancing in wheelchairs, as done at the University, is beautiful to behold and an obvious source of much enjoyment for the young men and women who do it with such grace.

Therapy is a regular part of the physical education curriculum, carrying credit, just as do regulation physical education courses. It is required 3 times a week of every first and second-year disabled student.

Since the Student Rehabilitation Center began 14 years ago, 209 handicapped students have received degrees from the University of Illinois. Several have won master's degrees and 10 have earned their doctorates.

Partly through the good offices of the student center, every one of these 209 graduates was promptly placed in a job. This year the group's average annual salary is $6,600.

"Among these people are some who couldn't tie their own shoes or dial a telephone when they entered school here," beams Director Nugent. "One of them, now a technical writer in Chicago, started here as a freshman at the age of 39. He was a traumatic paraplegic, was bedbound, and had an attendant constantly at hand. He finished here in 3 years with highest honors."

The first wheelchair student at the University was Don Swift of Lapeer, Mich., an honor student and a basketball star. He never left the campus. He is a personnel officer on the faculty.

The first young man to finish the medical school in a wheelchair is a practicing physician in Seattle, Wash. One of the women graduates is in charge of rehabilitation counseling at Washington University in St. Louis. The chief of rehabilitation services for the Illinois Division of Vocational Rehabilitation is a paraplegic who got his degree in spite of the fact that he had been considered too handicapped to go to high school.

One graduate is an ordained minister, several are teachers, eight of them at universities.

Contributing much to the successful college careers of these handicapped students are the many architectural features incorporated into new buildings or added to older structures to ease access to university facilities.

Shower stalls have grab bars and fold-back seats.

One of the most striking of these features is a fleet of four orange and blue buses. They look like any other buses from the outside, until they pull up to the curb. When the front door opens, a hydraulic lift unfolds and lowers to sidewalk level. Waiting wheelchair students, without help, wheel on and are lifted to the level of the bus floor. They then wheel themselves past the driver and into the body of the bus, where they turn, face the front, lock the wheels of their chairs, and off they go. Except for a few seats near the rear, for crutch walkers, blind students, and others, the interior of the bus is vacant space, reserved for wheelchairs.

These buses run on regular schedules, passing the residence halls and the classroom areas. If a disabled student misses the bus and is late for class, that is his problem. But if he breaks an axle and cannot operate his chair, his plight is promptly taken care of. The rehabiliation center sends a new axle and the bus driver installs it, all in a very few minutes.

Sixty-one ramps have been built so that wheelchair students can make their own way in and out of buildings. A recent survey by the Center disclosed, incidentally, that 82 percent of the entire student body and faculty who enter and leave one specific building on the campus use the ramp instead of the steps.

For the past 7 years, it has been a regulation that the design of all new campus structures must be approved by Nugent, who makes sure that appropriate adaptations are made for the convenience of his handicapped group. In those 7 years, 21 new buildings have gone up, incorporating many ingenious features, all of which are welcomed and used by the able students. (The term "able student" is used regularly at the University of Illinois, probably the only place in the world in which the so-called normal person has a distinguishing label.)

Assembly Hall, now being completed, allows space in its principal seating area for 124 wheelchairs. Other new buildings have at least one entrance which either has ramps or is entered from ground level with no curbing.

When there is street or sewer repair work on the campus, the workmen put up barriers around any ditch or uneven space before they leave the job for the night. The barriers have the standard flashing red light to warn students of danger, but they also have a clicking signal to warn blind students that the usually unobstructed roadway is not to be traversed.

To make it possible for an able student and a disabled student to share any dormitory room—which is the way space is allocated at the University—all residence rooms have desks designed so a wheelchair can move in close. The beds have drawers built in below the mattress level so they can be reached from the bed.

Telephone design allows for use by all.

The closets have low rods for coats, trousers or skirts, blouses or shirts, so the wheelchair student can reach his clothing. Lavatories and drinking fountains are at "wheelchair level." Toilet and shower stalls have grab bars and fold-back seats for those who cannot stand unaided.

Specially designed telephones, one of the latest innovations, are located in a soundproofed cubicle, open at the front, and are placed low, so that a student in a wheelchair can reach the transmitter and insert the coin.

In addition to the obvious benefits of this rehabilitation program for the students it serves, there are other dividends of significance. Among them are:

1. The attitude of the University's 23,000 students toward the handicapped has become just what rehabilitation experts agree it ought to be—they look upon them as fellow students, period. This attitude has spread from the campus to the townspeople of Urbana and Champaign. Seven churches in the two cities have built ramps for the convenience of disabled people in their congregations.

2. Other schools and bodies of various kinds are drawing upon the University's experience with disabled students. The University of Missouri, for example, has studied the program thoroughly and is initiating one of its own on its campus at Columbia, Mo. Several other schools have either started or plan to start similar programs. During the past school year, staff members from seven universities received briefing and training at the Center. Their studies included orientation, observation and experience in the area of their study, and internship in such disciplines as rehabilitation counseling, therapy, nursing of the disabled, and speech and hearing rehabilitation. Many more requests for lectures, workshop participation, panel discussion, and similar activity come to Director Nugent than he can accept, but the off-campus appearances he is able to make promote better public understanding of the physically handicapped.

3. The varied research the Center has done from the beginning has been of interest and benefit not only to schools but to all kinds of rehabilitation facilities. The Center's work on the architectural standards project featured in this section, for example, will be widely utilized.

All of these results and many more are flowing from a program that began in the 1947–48 school year in a temporary branch of the University in Galesburg, Ill., in buildings once occupied by an Army general hospital. The staff: Tim Nugent, full of the zeal he gained in working for his college degrees and has never lost.

At the end of that first year, the Galesburg branch of the University was closed and no facilities on the main campus, or on any other school campus, were available to the few World War II disabled veterans who had enrolled for rehabilitation services.

Tim Nugent rounded up 27 wheelchair veterans and took them to the State capitol and into the office of the Governor, Adlai E. Stevenson. There they put on such a demonstration of wheelchair dexterity that they got what they wanted—attention for their situation. Then came a similar demonstration at the University, to show how well these students could use the school's facilities. That fall the rehabilitation operation was moved to the main campus in Urbana. The facilities, then and now: two wooden army surplus barracks-like structures. Here Tim Nugent and a staff of 28 provide the services that help handicapped students forget their drawbacks as much as possible and concentrate instead on their talents.

Some Center services:

. . . A medical supervisor has authority over physical and medical evaluation, medical consultation, medical counseling, and the coordination of any extended medical treatment.

. . . A full-time registered physical therapist and four graduate assistants administer physical therapy.

. . . Counseling is done by the director, assisted by one full-time counselor, one half-time counselor, and as many graduate trainees as can be used. Last year, for the first time, as the result of an extension and improvement project, the Center had a resident counselor from the State DVR, along with a secretary.

. . . Many special services are furnished by the whole staff and any available and qualified volunteers. Just one example: A Braille club was organized last spring with 80 members, mostly faculty and faculty wives. They learned Braille transcription and worked through the summer to transcribe textbooks for use in fall courses and for the permanent Braille library. All told, 300 volunteers read to blind students during the 1960–61 school year.

. . . An integral part of the Center's program is Delta Sigma Omicron, a coeducational service fraternity of physically handicapped students. It was established in 1949 at the University to promote the academic, physical, and social welfare of local disabled students and of disabled people everywhere. Its aims are best stated in its motto: "To exercise our abilities to a maximum so as to minimize our disabilities, that we may live most and serve best."

There have been notable accomplishments since the day 14 years ago when Tim Nugent and the "wheelchair pickets" stormed the State capitol. But the accomplishments have not stacked up fast enough to please Tim Nugent. The main reason he feels that way is that he cannot begin to keep up with the demands—more often they are anxious pleas—of the growing number of disabled students who want to come to the University of Illinois. This past September, more than 500 applied. There was room for only 50 new students.

MODEL HOME FOR THE DISABLED

Muriel E. Zimmerman

Living effectively, comfortably, and happily in some kind of dwelling, be it an individual house, apartment, hotel room, or trailer, is something that concerns us all, all over the world. Most of us manage quite well. Yet even in the United States, with our high standard of living, few of us are without some frustration in our housing. Take the average closet. It is either too small to hold all it must, or so large it requires moving all the front items to get at the things in back, or a stool or chair is needed to reach the top shelf. Today there are numerous closet accessories and organizers to combat some of these disadvantages, but rarely do they completely overcome the initial poor planning of space.

Highly polished floors minimize the cleaning problem, but are apt to add to the danger of slip-

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Miss Zimmerman is consultant on self-help devices and homemaking at the Institute of Physical Medicine and Rehabilitation in New York.

ping and falling, as do shining porcelain and tile finishes in the bathroom. In the kitchen, ovens or broilers placed too high or too low are the cause of many burns. Home accident rates are still high.

If the average dweller sometimes finds living accommodations a problem, even more do disabled persons who must use crutches or wheelchairs, or the elderly who cannot reach or bend easily and who usually tire quickly. Too frequently they cannot function adequately without help and must live in institutions, or be homebound or even "room bound."

For some time, the Institute of Physical Medicine and Rehabilitation has been interested in setting forth basic principles for overcoming architectural barriers, rather than in designing special homes for the disabled. An opportunity to put this philosophy into practice came with the building of the Horizon Home in Florida and the New York model known as the Functional Home for Easier Living. These houses result from the interest of a civic-minded citizen, Mr. James Rosati, a Florida builder, who sponsored the original home in his St. Petersburg housing development and who has donated the New York model to the Institute. Cooperating with the projects was the General Electric Co., which is also convinced that equipment for such housing can be made generally available to all.

The Functional Home for Easier Living actually looks like many modern one-story ranch houses. Basic style and architecture may change as future modes dictate, but architectural hazards and barriers must be avoided and need never exist.

While steps can be negotiated by the average nondisabled person, they have always been a problem for small children, elderly persons, and anyone transporting such equipment as a baby carriage, bicycle, or large piece of furniture. With imaginative designing, steps can be eliminated altogether, or replaced by a gently sloping ramp. The entrance to the Functional Home has a 5-degree pitch, leveling off to 2 degrees at the door. This provides for a reasonably level space to rest a chair while opening the door, yet permits adequate drainage. The carport flooring is also slightly ramped and is 1 foot wider than the usual standard carport to allow room for the wheelchair beside the car.

Base cupboard has toe space.

All doorways are at least 36 inches wide and there are no threshold sills except at entrances. Even these are recessed and have a polyethylene tubing strip in the center which offers little or no obstruction.

Bar facilitates getting in and out of tub.

Some general features in the interior of the house are: Nonskid flooring of terrazzo with colored carborundum chips (unwaxed!); light switches 36 inches from the floor instead of the standard 42 inches; outlets 24 to 36 inches from the floor; master control switches for light fixtures at convenient locations, such as entrance doors and in master bedroom, and lower, easily operated windows of push-bar awning type. (Casement, crank-operated type, are also convenient.) All window screens are on the inside and easy to remove for cleaning. If window sills are covered with tile, they are easily cleaned, and pull drapes are less of a problem than shades or venetian blinds. There is even an electrically operated control for opening and closing draperies by persons with very limited use of their hands. And an intercom system, installed as part of the regular telephone system to contact persons in other parts of the house and to identify visitors at the front door, is being installed.

A built-in vacuum cleaner system makes it unnecessary to handle a canister or tank. It requires only a flexible hose and attachments. The hose attaches easily to conveniently located outlets that transfer the dust to a fire-proof storage tank, which may be in the utility room or a convenient closet. It needs emptying only about every 3 months with average use.

A built-in adjustable ironing board can be adapted for working either sitting or standing. An overhead spotlight supplies adequate illumination.

The bathroom is slightly larger than the usual bathroom, being approximately 8 feet by 7 feet (8 feet by 10 feet is even better). Grab bars are available at both toilet and tub. The latter also has a seat installed at the end and an adjustable-height shower. The water controls are at the side back. The tub can be used by persons able to transfer only onto a seat, from where they can take a shower; or the convenient bars may help to transfer from seat down into the tub. Vertical sections of the grab bars aid persons stepping into the tub. Suction-cup mats or safety strips in the tub prevent slipping. For persons with paralyzed lower extremities who depend on their arms for transfer, the safety strips on the tub bottom should not be used, for they prevent the legs from sliding as the body is lowered into the tub. But some of the safety strips placed on the outside top edge of the tub will insure a better grip.

NOTE: For those who prefer showers, a shower stall may replace the tub. Desirable size is 3 feet by 4 feet. Place drain in a back corner and slope floor gently backwards. This makes it possible to reduce the usual riser to a slightly rounded sill. Grab bars, separate controls and an adjustable-height shower, and safety mats are still applicable. Built-in seats are optional.

Other bathroom features are open area underneath wash bowl, single-control water faucet, a built-in counter surface around and adjacent to sink, pull-out drawer storage space, an extended rather than recessed medicine cabinet, and a mirror hung for viewing from either a standing or a sitting position. The entrance door is hinged in the middle for folding, thus allowing more space to maneuver while closing the door. A lever-type handle facilitates opening and closing. A sliding door may be preferable, if it can be accommodated.

Closets in this house are only 24 inches deep and have double sliding doors across the entire front. For short garments—blouses, shirts, skirts, and trousers—the closet rod is installed 42 inches from the floor for easier reach. The low shelf directly above the rod is easier to reach than the closet floor space left under short garments hanging from the standard closet rod. A narrow section for long garments is also desirable.

Kitchen design has striking innovations.

Probably the greatest area of change is in the kitchen, where the homemaker is apt to spend a good deal of her time. Sit-down areas with under-counter space and work areas with convenient storage and easy-to-use appliances and fixtures constitute the basic approach. Counter surfaces are 31 inches in height with 29½ to 30 inches underneath clearance. One area over the clothes washer and dish washer is the standard 36 inches.

It may be argued that the 31-inch height is inconvenient for the average nondisabled housewife. Yet much of the current planning would indicate that the standard 36 inches is really too high for many kitchen preparation activities in terms of energy-saving techniques even when one is standing. The housewife of average height would find 31 to 33 inches more comfortable for mixing, beating, chopping, or cutting, whether standing or sitting on a stool (which brings the counter to about lap-height). The person seated in a wheelchair can work more easily on a 31-inch counter and use either a lapboard or a pull-out board at about 26 to 27 inches for beating and chopping.

One new model range is now coming out with a top cooking surface height at about 33 inches. This makes it easier for stirring and looking into pots on the back burners. If burner arrangements are staggered or L-shaped, they prevent reaching over a hot burner and reduce the hazard of burning. If the range has an adjoining counter surface of

Closet shelf and clothes rod are easy to reach.

the same height, pots can be slid off hot burners instead of lifted.

The sink is only 6 inches in depth, which means less reaching and bending. The single-lever mixing valve water control is easier to handle than the conventional separate controls. The exposed underneath part of the sink and hot water pipes should be covered to prevent danger of burning. An adjoining counter surface between sink and dishwasher eliminates carrying and excessive handling of dirty dishes.

Convenient storage areas are a boon to any homemaker. Some vertical file areas obviate stacking, and adjustable shelving in other areas does the same. This makes unnecessary the handling of top dishes on a stack to remove the bottom ones. It saves not only energy, but time. Adequate storage also provides for keeping articles at their place of use, thus cutting down unnecessary trips to assemble materials for a specific job.

One of the most wasted and most valuable areas of space in many kitchens is that between the bottom of the cupboards and the counter surface. Midway cabinets, from 4 to 6 inches deep, will hold a host of frequently used items at the easiest level for reaching. (Some persons may use pegboard and hang their utensils.) Under-counter storage is best provided by easy-sliding drawers and tilt bins, or lazy susans, which brings contents out within easy reach.

All base cupboards should be provided with a 9- or 10-inch high, 6-inch deep, toe space. It would be helpful if all appliances were also thus equipped. This extra space provides room for foot pedals of wheelchair and permits easier maneuvering.

A new electric refrigerator, with swingout, adjustable shelves and crisper bins, adjustable door storage and separate pull-out drawer freezer compartment, are easy to use for anyone. The magnetic door catch, opened either by a handle or by a foot pedal, is operable by wheelchair occupants, crutch users, or anyone with both hands full.

Most of the furniture in the model home is standard but was selected with an eye to avoiding features that are obstructive to the disabled, such as insufficient kneehole opening in desk, too low chairs and couches, chairs with front cross-bars and tables with cross-bars lower than 10 inches. The beds are electrically operated Gatch beds, with specially designed head and foot boards incorporating built-in grab bars. Separate footboards made of the same wood and finish are unnoticeable, yet provide toe space at the end of the mattress when one is lying prone, to prevent heel cord shortening.

Last, but not least, is the self-operating heating and air-conditioning system, which is gas-fired forced air. A single switch changes from one system to the other or shuts off both.

Perhaps the most exciting aspect of this and similar homes is the cost. In Mr. Rosati's Skyview Development in Florida, the house—with lot and fully equipped kitchen—sells for $13,500. In New York and other areas it is estimated to sell for about $17,500. This is truly a functional home.

NOTE: Limited quantities of this section, "No More Architectural Barriers," will be available as a reprint from the *Rehabilitation Record*. Copies may be obtained free from the Office of Vocational Rehabilitation.