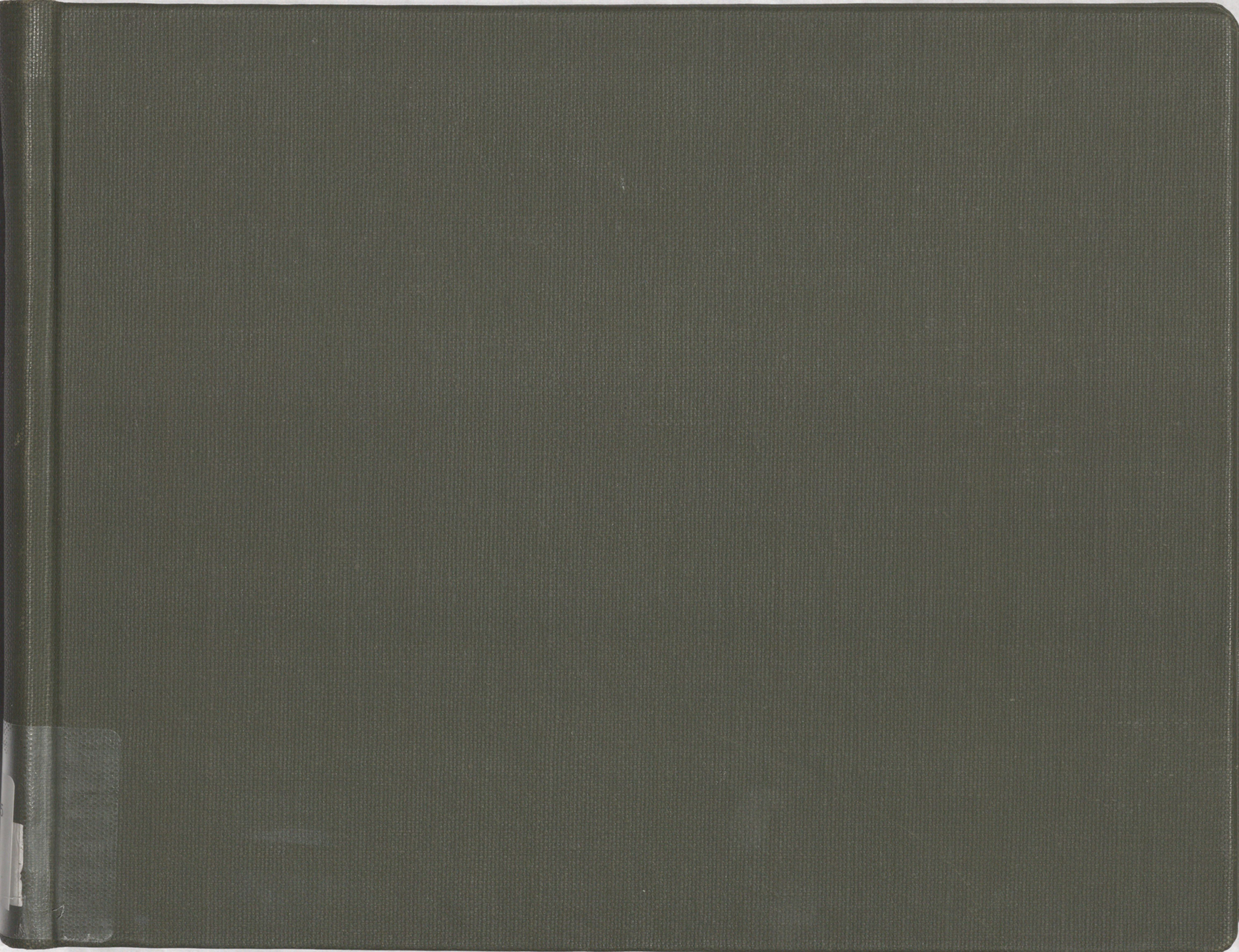
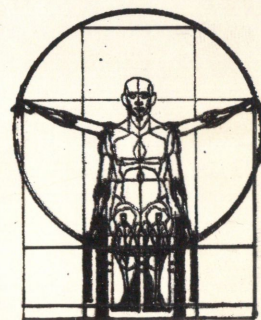




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My THANKS to:

Mr. Francis Woods

Ms. Jayne VanAlstyne

Mr. Ilmar Reinvald

For their help and encouragement.

introduction

"The worker becomes poorer the more wealth he produces and the more his production increases in power and extent. The worker becomes an even cheaper commodity the more goods he creates".

Karl Marx

In today's world of architecture and the architect, with many firms having Masters of Business Administration as their top man, where does the craftsman come in? I use the word craftsman instead of architect since an architect is a craftsman. He is creating a one of a kind. He puts his life into the object (building) and his life belongs to the building. Most of today's architects are becoming increasingly alienated from what they create. You see firms becoming factories, fitting detail sheets into present designs, assuming that they will work, trying to get more work, even though they cannot handle what they have, forgetting or neglecting the laws or rules of proportion.

In school we are forced into a sense of production rather than thought. Our work isn't voluntary but imposed. We lose the feeling of a craftsman for the sake of production. Our curriculum is being structured towards the mechanical, rather than of the fine arts. (I do not mean that we do not have to know how a building goes together, but there has got

to be a balance between the nuts and bolts and the aesthetics.) We find concepts crushed before our eyes because of some detail we haven't had a chance to fully work out. We cast out the concept for one we know will work or the borrowing of a concept. We have got to stop and analyze what is happening to architecture and the architect, or in other words, the craftsman?

"It is not the satisfaction of a need, but only a means for satisfying other needs."

Karl Marx

We all have our thoughts on architecture, we all can paraphrase other architects from the beginning of time on how scale, proportion, sun, materials, humanism, etc. work in architecture and how they can be or should be applied.

My thoughts or thesis on architecture stem from what I have started to point out above.

"There is a logical hierarchy in the scale or size of an architectural environment and there are profound connections and relationships between these hierarchies."

We must treat all aspects of a designed architectural environment equally. Concept should not out weigh detail nor should detail out weigh concept. The screening of the sun

should not outweigh the interior space nor should the interior space outweigh the landscaping, etc. as approached by design. In dealing with the sun for example, if we shade our building to such an extreme that the sun cannot be allowed to enter the building we have outweighed the interior space for which the sun was to illuminate. For the sun's light is as important as that interior space, also this screen affects the building's facade in relation to site, etc. Every aspect of architecture must be in complete marriage with all other aspects. It is when this marriage is achieved that you have solved the problem.

We must consider but not assume that a standard detail will work for two different buildings or that a structural system that we once used will be suitable for our present project. We must treat each building as an individual piece of art architecture with its own structural, mechanical, interior, exterior space, etc.

In solving a problem we should keep the principles of architecture in mind or use them but not expound on them or let one outweigh the other. If we gear our solution mainly to environmental needs we may outweigh other functions of the building (interior space) to achieve these environmental conditions. If we expound on humanism and strive for an architectural solution

the human scale in favor of other architectural factors we have outweighed other equally important needs. It is when this marriage of concept (the building) with detail (humanism, environmental, energy conservation, sun angles, interior finishes) we have achieved our goal as architects.

As architects we must use the principles of humanism, environment, indigenous materials, etc., but in using these principles they must all be of equally importance in the reflection of the micro as well as the macro architectural environment.

**the
institute**

**the
physical
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**the
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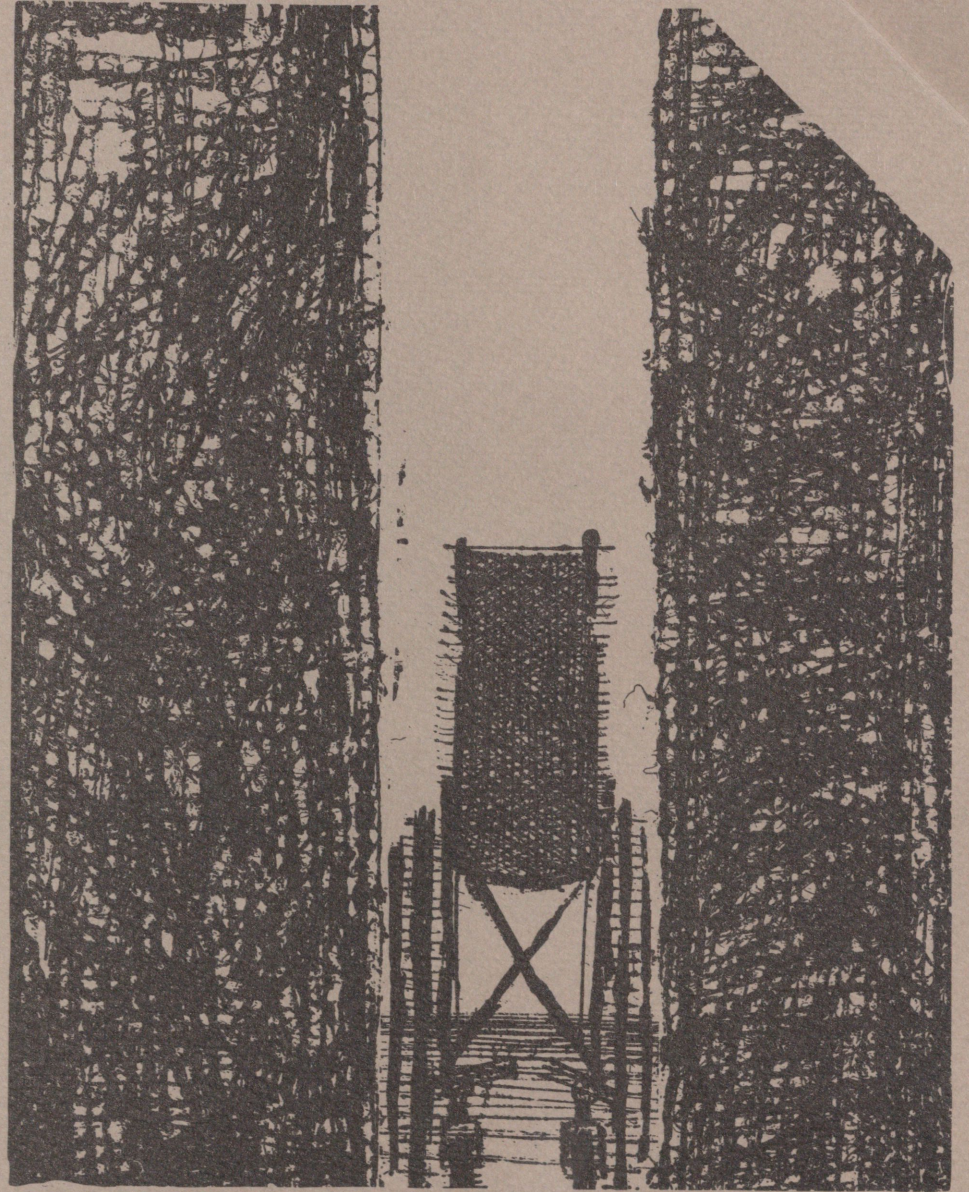
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the
institute

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The reason for this institute is that today there are approximately twenty-five million people who are physically disabled. Of these, ten million cannot function normally and another 680,000 use wheel chairs. There are five million whose physical disabilities prevent them from completing the simplest tasks. (Everyday routine chores such as opening cereal boxes or picking up small objects) This is a small estimate. We must consider the many more individuals who are less visibly handicapped such as the aged, the arthritic, the partially blind, and the temporarily injured.

In 1971 an estimated 30 percent of the population suffered on activity restricting injury. This means that 62 million Americans had an accident in a car, in an office or factory, or in a home that prevented them from functioning in a normal manner. We will classify them as temporarily disabled. Regarding the number of disabled or handicapped there is one estimate that within 10 years, one-half the population will be either permanently handicapped or living with a chronic disease, or over 65. There is another estimate in the public health document that indicates more than 80 million people, or 44 percent of the civilian non-institutional population, experience one or more chronic disease or impairment over a 24 month period, and of these, 22 million were limited in their activities as a result of chronic conditions, exclusive of blindness or deafness. The disabled might fairly be defined as the physically impaired. The physically impaired person is unable to perform in certain tasks successfully by definition. With these figures and facts before us why are the disabled forced into an environment that was designed for a

person who will never be injured, never become ill, nor never age. The handicapped or disabled person lives in a society consisting of thousands of barriers. In addition we all suffer from a world designed for this elite group. Many parts of our man made environment were not designed for any people at all but merely engineered down through time by new materials and new methods. Door knobs offer one example, they are often too big for children to grasp, require too much tension for the arthritic and the elderly, and have to be turned so much before releasing that any packages one may have been holding at the time are almost certain to wind up on the floor. Door latches or levers which could be opened with an elbow or knee, if necessary, might as easily have been used here as in Europe. Tapered plugs that slip out of the hand is another example. The plug if designed for the handicapped or elderly with taper running opposite direction would also be easier for everyone to use.

The most common design and construction of buildings and facilities cause problems for the physically handicapped. Sunken plazas and raised open areas accessible only by stairs often have no railings and railings are absolutely essential. Terrazo sidewalks become a hazard in the rain. Revolving doors and doors that open out over the steps are hazardous. Broad steps with shallow risers create an awkward walking situation. Take for instance a person with sight impairment, who may or may not be legally blind, has difficulty gauging distances and this in relation to stairs can be a real hazard. Here again railings and standardized risers would not only be more convenient but safer for all.

"Over the centuries, the architect has taken advantage of the apparently unlimited ability of the human being to tolerate discomfort, inconvenience and even danger".

"Although the physical incapacibilities of disabled people sometimes are extremely severe they do not - with the important exception of those people confined to wheel chairs - pose new problems to the architect but only more extreme degrees of existing problems. The normal person is liable to fall on a polished floor, trip over a threshold, has limitations of reach and he can see clearly only over a limited distance".

Selwyn Goldsmith

Goldsmith is addressing himself directly to problems of architectural barriers. The barriers a disabled person experiences do not just include the architect. The product designer creates appliances that need all the manual dexterity one can give to make it function. The package designer creates jars, cans, etc. that can only be opened by extreme force or by a can opener that a product designer has created. The interior designer creates surfaces which can cause injury. These barriers make it very difficult to project the physically handicapped into normal situations of education, recreation, and employment. Future products and buildings will need a greater flexibility if they are to meet the needs of this growing atypical population.

In Goldsmith's quote he states my beliefs why we need this institute. What would otherwise be regarded as a refinement now becomes a necessity; non-slip floors, low level shelves, accessible windows, used appliances, and intelligently planned spaces. For when the designer designs for the disabled he is also designing for the betterment of all.

There are direct correlations between a person in a wheel chair, a person who is elderly (over 65), and a temporarily disabled person all need as much security grabbing as possible, the ramp water fountains that have easy access and easy depressors. A person in a wheel chair needs an opening of 32" and a person on crutches also needs a crutch space of 32". The kick space for a wheel chair is 16" and this is also the needed kick space for crutches. Thress holds should be minimal for all three. There are many more examples of how handicapped and normal people can function in harmony.

This is what the scope of the institute of consolidation of designers will be: to create an environment that can function for both disabled and normal people without creating a tension between them.

A good example of this tension is a bathroom in our architecture building. Here the designer put in a toilet for the physically handicapped (wheel chair) required by law. At the same time he put in one for normal people. Since the ratio of normal students to handicapped (wheel chair) students is 600 + 0.5 it is an inconvenience to use the raisen toilet. They could have avoided the tension by putting a handrailing in one stall with

required door space for a wheel chair and still keep a normal person bowl height. Both could have used the toilet without any inconvenience. All problems are not this easy to solve but this is one case in which the institute would come in or be called upon to analyze the situation.

Another function of the institute would be to consolidate all data on the physically handicapped that has been carried on by government agencies or grants. This would also be a source of funding for the institute instead of giving grants to agencies all over the U.S. for research and then having this research filed away or not published, the institute will become the one agency on research for the physically handicapped.

The institute would set all standards for doors, ramps, packaging, etc. concerning the physically disabled.

In addition it would serve as design firm. The following examples may best illustrate how the institute would function.

Example one: A member of your family has lost mobility of his legs. (accident, arthritis, age, etc.) He can not function at home anymore. The institute will send you necessary information on how to reconstruct your living space so both you can function normally. This may be in pamphlet form or by taking your home in the form of photographs of interior spaces and floor plan and showing you specifically where changes should be made and how to make them.

Example two: A hospital needs a new bed type for a category of disabled people. The hospital sends to the institute the program. The institute designs bed, builds prototype or presents drawings for production to client. Client finds own manufacturer of his choice.

Example three: Campbell Soup Company needs a new packaging system for the handicapped market. Institute designs container or gives patent rights to Campbell Soup Company.

Example four: S.O.M. is doing a mass transit system geared for the use of handicapped as well as "normal" people. S.O.M. may send personal to institute, request staff to come to S.O.M. or use institute as consultant.

Example five: Designer needs information on handicapped. Gets information by mail, phone or in person.

The image of the institute will not be of a building filled with ramps, elevators, different doors, different materials, different forms of hardware but a building to house designers to carry on their work.

The charges made will be within the studios, finding different heights for tables, beds, etc.

Although industry has already begun to realize the need for designing products that are more functional and hopefully aesthetically pleasing, the increased information that can be obtained for the designer will help him to satisfy more of the population in his products and buildings.

The goal of the institute is primarily to reduce societies effect on the handicapped by a better sense of design application within our environment. The problems of the physically handicapped are not going to be eliminated by design modifications alone but the stress factor can be reduce so that their environment does not become one more barrier to independent living.

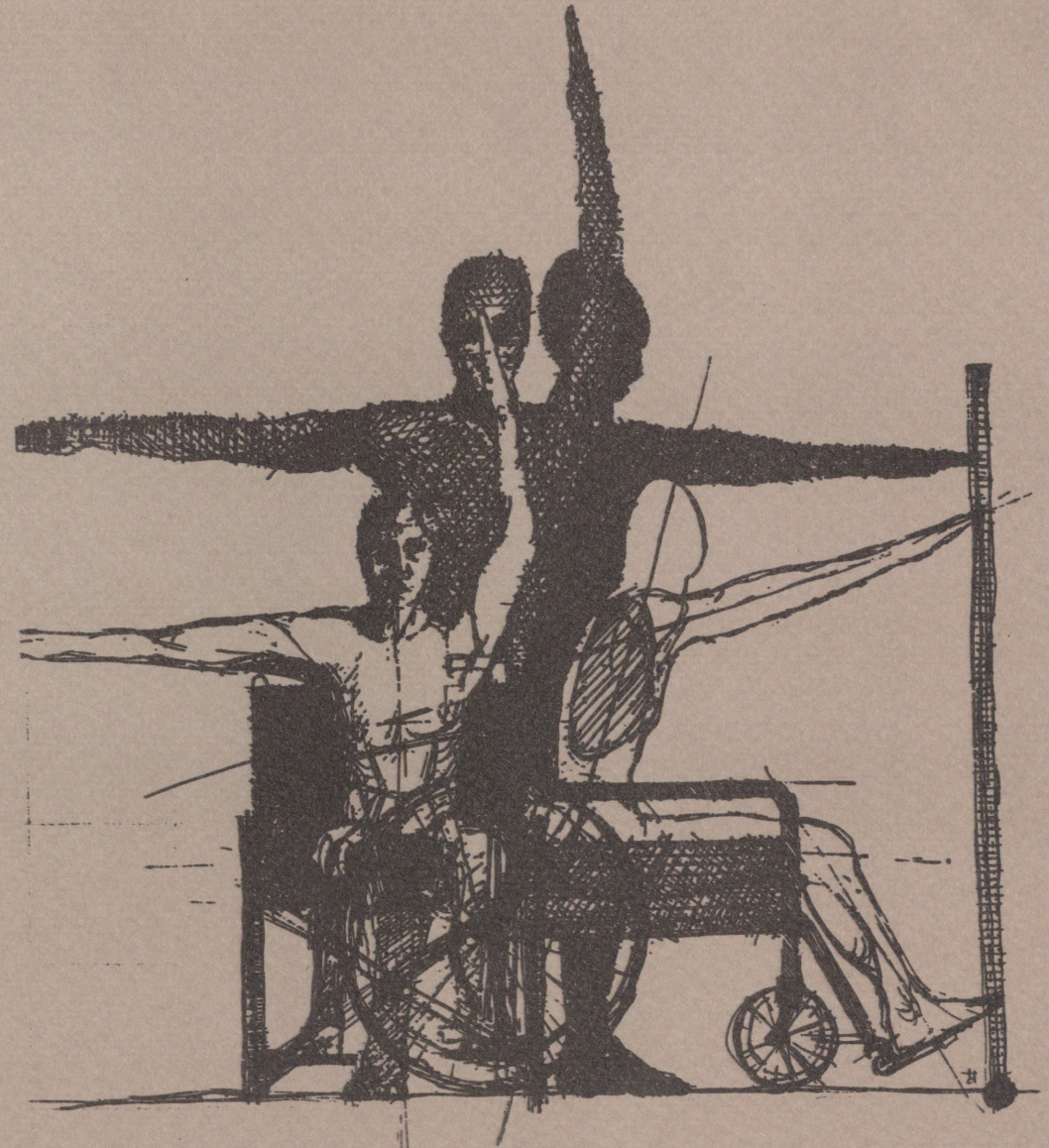
The institute itself will be a location for product, architectural, interior, etc. Designers working together to define and remove todays barriers that occur for the physically handicapped.

The practicality of this institute is that the handicapped person would like to be independent and may find this increased independence by having his near environment (the space contained within 4 walls) adapted to his needs (functional equipment design).

The more the handicapped become incorporated into the existing community, the less visible as a separate group they will become. This requires an understanding of the building barriers around us that can be removed to the benefit of us all.

the
physical
handicapped

2



The information in this section was compiled from various books on the physically handicapped and of their human factors.

In dealing with the handicapped as well as the normal we must be aware of their human factors. We have to start relating the building to the individual and not the individual to the building. We must also be aware that a person in a wheel chair does not go as fast as a normal person. So slow your building down by detailing, plants, something they can relate to. Provide an interest in materials even if its a paving pattern or tile finish.

A bibliography is listed at the end of this section dealing with the handicapped.

The following is what one should try and design for not just the handicapped and elderly but for the betterman of all.

Fire Protection - one solution would be to provide within the area accessible to the handicapped an area of refuge on each floor. This area of refuge could be either on the side of a firewall that is away from the potential fire source, or in an area within the enclosure at a fire stair. It should be located out of the way of main traffic circulation, particularly in a stair well; added benefit would be achieved if this space were equipped with a break glass alarm device to signal by bell or light that someone is in the refuge area. Fire extinguishers and alarm boxes should be located on walls at a height accessible to the wheel chair user. The top of the extinguisher should be about 4 feet from the floor.

The fire alarm box should have a pull type hands easily grasped. Where possible for the sake of the deaf, the alarm system should provide visible as well as audible signals.

Automatic Door Closers - Fire Doors - when automatic door closers are adjusted for the sake of wheelchair and crutch users, there is danger that a fire door so adjusted may not remain effectively closed in a strong draft. Fire doors, under such conditions, may advantageously be equipped with electro-magnetic smoke and heat sensitive door holders, which would hold the fire door open during normal use and would close it during a fire.

Unlike other handicapped people, who can make their way through existing architecture, wheelchair users need special environmental safety measures, and certain architectural elements have to be restructured for them if barriers are to be eliminated.

Barriers:

1. Floors

- a. Steps and curbs should be eliminated whenever possible. Maximum threshold or curb height is 1 inch.
- b. Scatter rugs and rugs with a deep pile and abrupt edges should be avoided.
- c. Floor gratings may interfere with wheel travel.
- d. Slippery floor surfaces should not be used.

2. Walls

- a. Rough walls can cause hand abrasions.
- b. Objects projecting from the wall should be kept to a minimum.

3. Doors

- a. Sliding doors are an obstacle to the wheelchair user unless they are automatic and have no obstructing tracks. Revolving doors are impossible.
- b. A spacing of 78 inch between two sets of doors (one set behind the other) avoids a wheelchair trap.
- c. Doors must be easy to open. The maximum force is 8 pounds.
- d. Lever handles on all doors and water faucets are preferred.
- e. Automatic doors are the best.
- f. Kickplates must be 16 inches high for wheelchair users; they are normally 13 inches high.
- g. Door widths must have a 32 inch minimum clear opening.
- h. Bathroom doors must swing outward but be placed so that they do not interfere with traffic.

4. Space

- a. Wheelchair "parking" space is required in theaters, auditoriums, stadiums, and other public gathering places.
- b. Increased aisle space and parking space is required in cafeterias, restaurants, and libraries.
- c. Public toilet stalls, showers, and phone booths need to be large enough to accommodate a wheelchair.

5. Reach

- a. Phones (including the coin slot), drinking fountains, vending machines, light switches, and fire alarms must be within easy reach. The handy reach zone is 36-48 inches, measured from the floor. A 54 inch high coin slot has been accepted in the U.S. to accommodate the ambulant and a large percentage of wheelchair users.

- b. Peepholes must be 40 inches high; they are normally 60 inches high.

6. Walks and ramps

- a. The maximum recommended grade for walks is 3 percent.
- b. Walks with a 3-5 percent grade require rest areas.
The minimum width is 48 inches.
- c. Ramps generally have a 5-8 percent grade. They require rest areas every 30 feet, restricting curbs 2 inches high, and handrails on both sides.
- d. The maximum grade for ramps is 8-10 percent. Such ramps require rest areas every 15 feet, handrails, and restricting curbs 30 inches apart.
- e. Rest platforms have a minimum length of 54 in. (137.2 cm).
- f. Ramps should be textured to provide a non-skid surface.

7. Elevators

- a. The minimum size for a residential elevator capable of accommodating one wheelchair and one attendant is 40 in. wide by 52 in. deep.
- b. The minimum size for a public elevator to allow for wheelchairs is 66 in. wide by 61 in. deep.
- c. The minimum elevator door opening is 32 in. (81.3 cm) wide.
- d. Elevators should be easily accessible.

8. Bathrooms

- a. A 360° turn is desirable in a bathroom (see selector 3a); a 180° turn is acceptable and requires a space 60 in. square, 54 x 63 in. or 52 x 69 in.
- b. Lavatory height from rim to floor is 32.5 in. maximum.
- c. Lavatory bowl depths over 6 in. interfere with leg room.

- d. The minimum knee well width under the lavatory is 28 in.
- e. Pedestals and leg supports on lavatories should be avoided. Counters or wall mountings are preferred.
- f. Exposed drain and hot water pipes must be insulated.
- g. Tub height is 16 in. minimum, 19 in. maximum.
- h. An adjoining tub seat 18 in. wide is required, sloped to drain.
- i. Nonskid material should be provided for the tub bottom.
- j. A cantilevered toilet gives increased foot space for maneuvering.
- k. Nonslip grab bars are necessary as assists near the tub and toilet.
- l. Medicine cabinet height from top to floor is 60 in. maximum. Cabinet should be located on the wall that is free from fixtures.

9. Showers

- a. Shower stalls are 36 in. square for wheelchair users.
- b. A folding seat should be hinged on the side wall opposite the shower head.
- c. The seat size is 14 x 36 in. and is 19 in. high. If the wall to which the seat is attached continues beyond the stall, the seat should extend 9 in. outside to facilitate transference from the wheelchair to the shower seat.
- d. Horizontal grab bars are recommended along the three sides of the stall 33 in. above the floor.
- e. Water controls and soap tray should be 42 in. above the floor.
- f. Shower curb height is 2 in. maximum.
- g. The floor should have a nonskid surface and be at the same level as the floor outside the stall.
- h. When two showers are adjacent one should be right-handed and the other left-handed.

10. Kitchens

- a. Sink height from rim to floor is 32.5 in. maximum.
- b. Sink bowl depths over 6 in. interfere with leg room.
- c. The minimum width for the knee well under the sink is 28 in.

- d. Pedestals and leg supports on sinks should be avoided. Counters with knee wells or wall mountings are preferred.
- e. Exposed drain and hot water pipes must be insulated.
- f. The optimum counter and range height is 31 in.
- g. The cooking range knee well should be 28 in. wide and a minimum of 26 in. high.
- h. Cooking range controls are located at the front for easy reach.
- i. Wall ovens should be 31 in. high, measured from oven bottom to floor. Side hinged doors are preferred. The oven should not be below the cooking range.

11. Furniture

- a. Surroundings should be pleasant, not institutional-looking.
- b. Special consideration should be given to shelves and storage areas to acknowledge the limited arm reach in all direction due to the wheelchair dimensions.
- c. Tables must clear armrests. Some wheelchairs have a special armrest cutaway for a close approach.
- d. Clearance must be provided for the hands while operating the driving rims.
- e. Increased toe space is required.
- f. Access space is needed around the bed. Allow 40 in between twin beds or between bed side and one wall, 54 in. (137.2 cm) between bed side and furniture, and 48 in. (121.9 cm) at the foot of the bed.

Crutch Users

People on crutches may be only temporarily handicapped, but they too need consideration.

- 1. Floors should not be slippery when wet or dry. Slippery floors or thickly padded seating make it difficult for people wearing leg braces to rise out of a chair.

2. Scatter rugs and rugs with a deep pile should be avoided.
3. Stairs are better than long or steep ramps for crutch users.
4. Handrails for stairs must be strong because they are used for pushing and pulling. Decorative, slippery, and oversize handrails should be avoided.
5. Curbs should be as low as possible and not exceed 6 in. in height.
6. Reach should be limited to an area between head height and knee height.
7. Crutch users may only be able to have one hand free; for this reason hold-down faucets are impossible.

More stair accidents are due to slippery treads:

- 29% Slippery treads
- 23% Short treads
- 16% No handrails
- 32% Other (no single item exceeds 8%)

Stairs

If stairs cannot be eliminated, or ramps cannot be used, the following requirements for stairs for the elderly should be noted.

1. Treads
 - a. Nonskid surfaces should be used; outdoor steps should be sanded or salted if icy.
 - b. Overpadded carpeting can cause tripping.
 - c. Treads less than 9.5 in. are inadequate for descending steps.
2. Risers
 - a. Risers over 7 in. are too steep; risers less than 4 in. are hazardous.
 - b. The sum of the tread and riser is best at 18-20 in.
 - c. Open risers can cause shin injuries, tripping, and falling.
 - d. Variations in risers on the same staircase change the walking rhythm and lead to accidents.

- e. Single risers, which are often overlooked, can be hazardous. Painting risers yellow or white calls attention to them.

3. Handrails

- a. Handrails should be smooth and round for a comfortable, safe grip. The best diameter is 1.5-2 in.
- b. Provide a 2 in. (5.1cm) hand clearance between the railing and wall.
- c. Handrails should terminate in such a way that they cannot catch clothing.
- d. Handrails that extend horizontally beyond the lowest step and beyond the highest step give a clue as to where the stairs end.
- e. Handrails should be able to withstand a lateral force of at least 200 lb. (90.7kg).
- f. Handrails 42 in. (106.7 cm) high on landings and balconies are easy to see, and since they are above a person's center of gravity they protect one from toppling. The optimum handrail height on stairs is 30-34 in. (76.2-86.4 cm) above the tread, measured from the nosing.

4. Landings

- a. There should be a resting point for the elderly at every 72 in. rise on indoor stairs and at every 48 in. rise on outdoor stairs.
- b. A landing must be provided as a transition between steps and a door. It must be large enough to provide clearance beyond swinging doors.
- c. Landings should be used for changing the direction of steps.

5. Stair width

- a. To allow one person to pass another person going in the other direction, the stair width should be 48-51 in.
- b. To allow two people to pass one person going in the other direction, the width should be 72-75 in.
- c. For each extra person, add 24 in.
- d. The minimum for service stairs (if used by one person) or for deliberate restriction is 24 in.

Furniture

In designing furniture for the elderly, one should keep in mind that they have some special requirements.

1. Chairs

- a. It is difficult to get out of seats that are lower than the individual's compressed seat height.
- b. Armrests the same length as the seat assist one in rising out of a chair.
- c. Chairs should be light and easy to move.
- d. Sturdy chairs give a sense of security.
- e. An opening between the backrest and seat facilitates cleaning but may be drafty.

2. Footstools

The maximum height is 12 in.

3. Tables

- a. Work and dining tables must be steady and sturdy.
- b. The minimum height for coffee tables is 24 in. to reduce bending.

4. Shelves

The elderly cannot reach as high or stoop as low as younger people. For shelf heights, see selector 3b.

5. Beds

- a. The minimum height from the top of mattress to the floor is 17 in. This facilitates making the bed without too much stooping.
- b. Beds higher than 21 in. cannot be used as a seat and are difficult to climb into.
- c. A bed whose height is 27 in. (68.6 cm) is convenient for nursing.
- d. If the tops of the headboard and footboard are 12 in. above the mattress, they provide hand supports for making the bed.

6. Lighting

Poor lighting on stairs can lead to accidents.

Doors

1. Material

- a. Door windows should be unbreakable since many door accidents result in injuries caused by broken glass.
- b. Full-length transparent doors should have markings to indicate their presence; otherwise people tend to walk into them.

Openings

- a. Doors should not open into hazardous areas such as stairs or traffic.
- b. The minimum angle for a safe door opening is 90°.
- c. Doors must swing outward from small confined spaces to permit extrication of a collapsed person.
- d. Folding and sliding doors are much safer than double swinging doors.
- e. Door and jamb edges should be rounded or cushioned to minimize scissor cutting and smashing of fingers.
- f. Sticking doors can release suddenly, creating unforeseen injuries.

3. Hardware

- a. Doorknobs are hazardous to grab if sharp or broken.
- b. Lever handles are easier for most people to operate.
- c. A hand clearance of 2.7 in. is required between doorknob and door frame.
- d. Nonlatching or releasable hardware allows a person to escape from a closet.
- e. Strike plates and push bars must not catch clothing.
- f. If a doorstop causes rapid rebounding, injuries may occur. Doorstops should be mounted near the top of the door so that they do not cause tripping.
- g. Automatic door closers should be adjusted to make opening doors easy. Doors should be made to close slowly.

REFERENCES

- Beyer, Glenn H. and Welss, Frank. The Cornell Kitchen Product Design Through Research. Cornell University, Ithaca, New York. 1952
- Goldsmith, Selwyn. Designing For the Disabled. London: Riba, 66
Portland Place: 1967
- Lowman, M.D., Edward W. and Rusk, M.D., Howard A. Self Help Devices, Part 1. Reprint from Post Graduate Medicine: 1962
- McCullough, Helen E. and Farnham, Mary B. Kitchens For Women on Wheel-Chairs. University of Illinois, Extension Service in Agriculture and Home Economics, Urbana, Illinois: November 1961
- Munkey, Mrs. E.W. A Letter to Jayne Van Alstyne: 20 June 1970
- Steidl, Rose E. and Bratton, Esther Crew. Work In The Home.
New York, London, Sydney - John Wiley & Sons: 1968
- Wheeler, Virginia Hart. Planning Kitchens For Handicapped Homemakers.
New York University Medical Center: The Institute of Physical Medicine and Rehabilitation.

BIBLIOGRAPHY

Design for Legibility of Visual Displays, 481-1016-97A.

Weight, Height and Selected Body Dimensions of Adults, United States 1960-1962, National Center for Health Statistics, Series 11, #81, June 1965.

Human Engineering, E.J. McCormick, 1957.

The Human Body in Equipment Design, Damon, Stoudt and McFarland, 1966

Research Techniques in Human Engineering, Alphonse Chapanis, 1959

"Human Performance", John Senders, International Science & Technology, No. 55, July 1966, pp. 58-68.

"Words, Words, Words", Alphonse Chapanis, Human Factors*, Vol. 7, No. 1, February 1965, pp. 1-17.

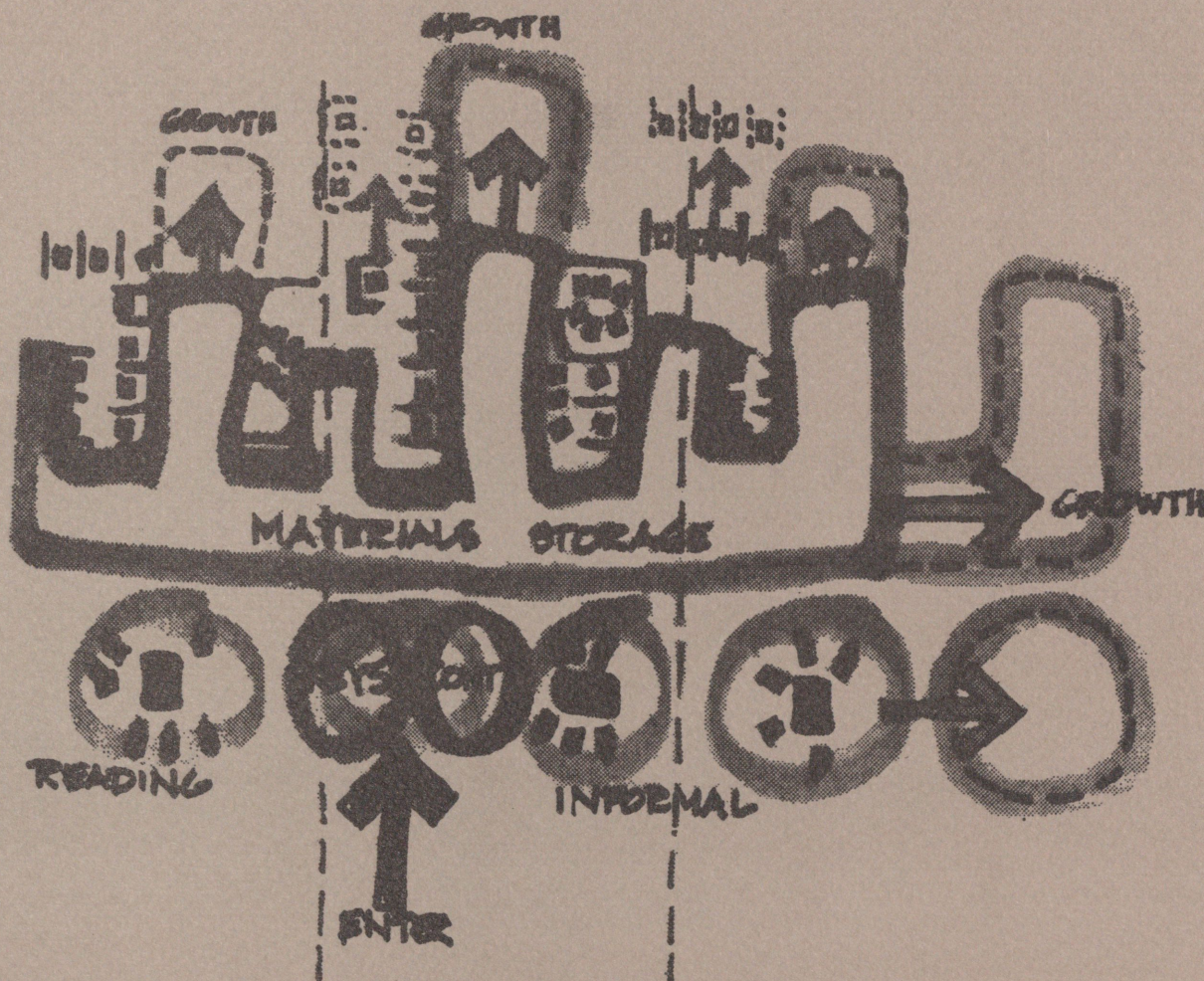
"Folk Norms and Biomechanics", Rudolf J. Drillis, Human Factors*, No. 5, Vol. 5, October 1963, pp. 427-441.

"Human Factors interaction With Industrial Design", Human Factors* Vol. 8, No. 4, August 1966.

* Human Factors Journal of Human Factors Society

the
program

3



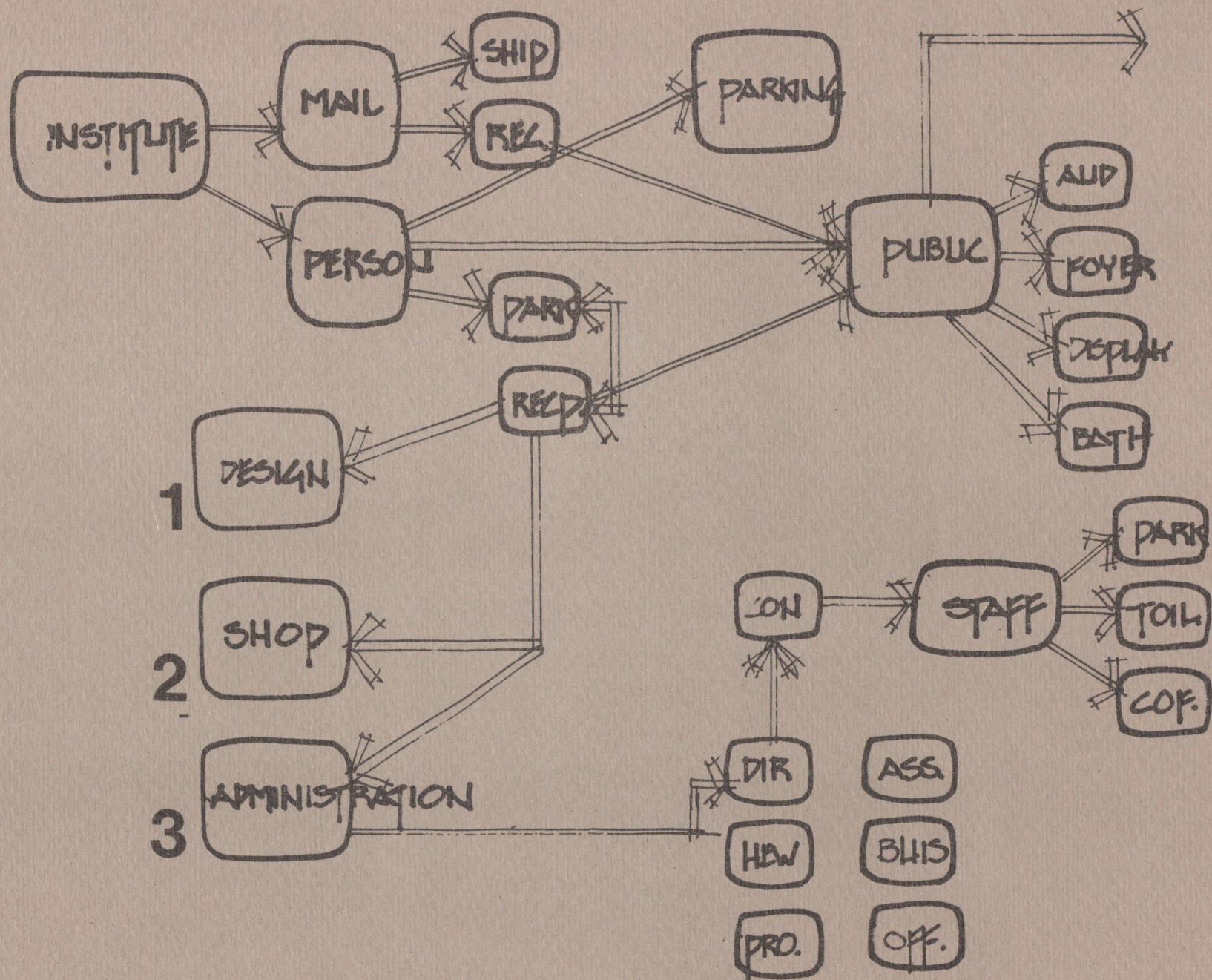
In programming the institute there was not a similar standard or building type to follow in space or function. I broke down the institute into 3 general or basic divisions into which this building would logically follow.

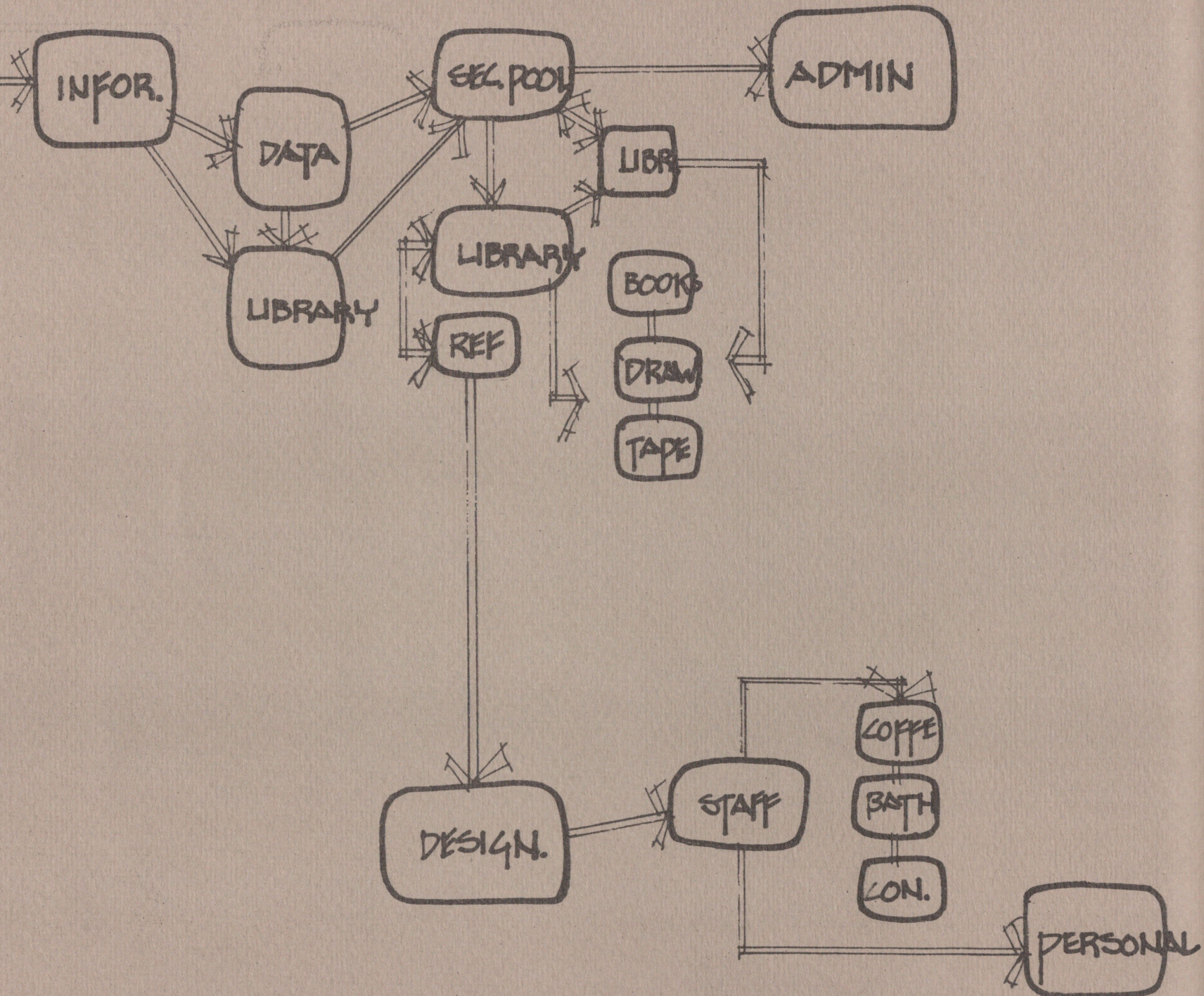
1. Operations which would be of an administrative nature and deal mainly with the public (director, financial, social, HEW, auditorium, receiving.)
2. Design which would include all operations dealing with the creativity of designers.
3. Fabrication, the construction of prototype and an area of 3 dimensional creativity (wood, plastics, metal, shipping receiving:

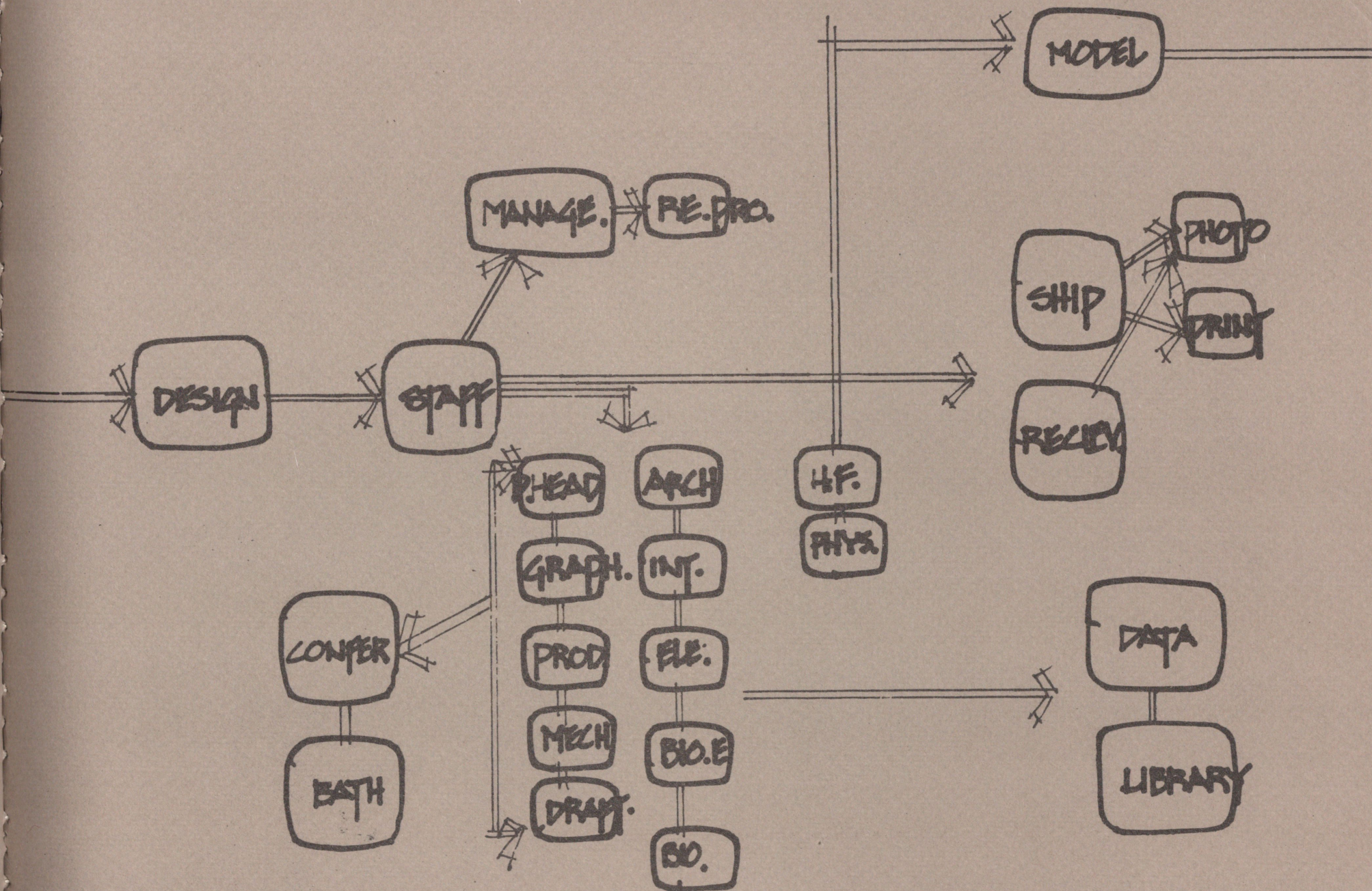
With these three divisions set, I followed a product, (design problem), a client (hospital) and an out of house designer needing assistance or information about the physically handicapped and the general public, through two dimensional space and analyzed which each would need or encounter to solve each problem. As each client or problem was taken through the institute, the development of 3 dimension spaces took place until the preliminary program was developed. This was only the first step. I had taken all examples from administration through fabrication neglecting that each could

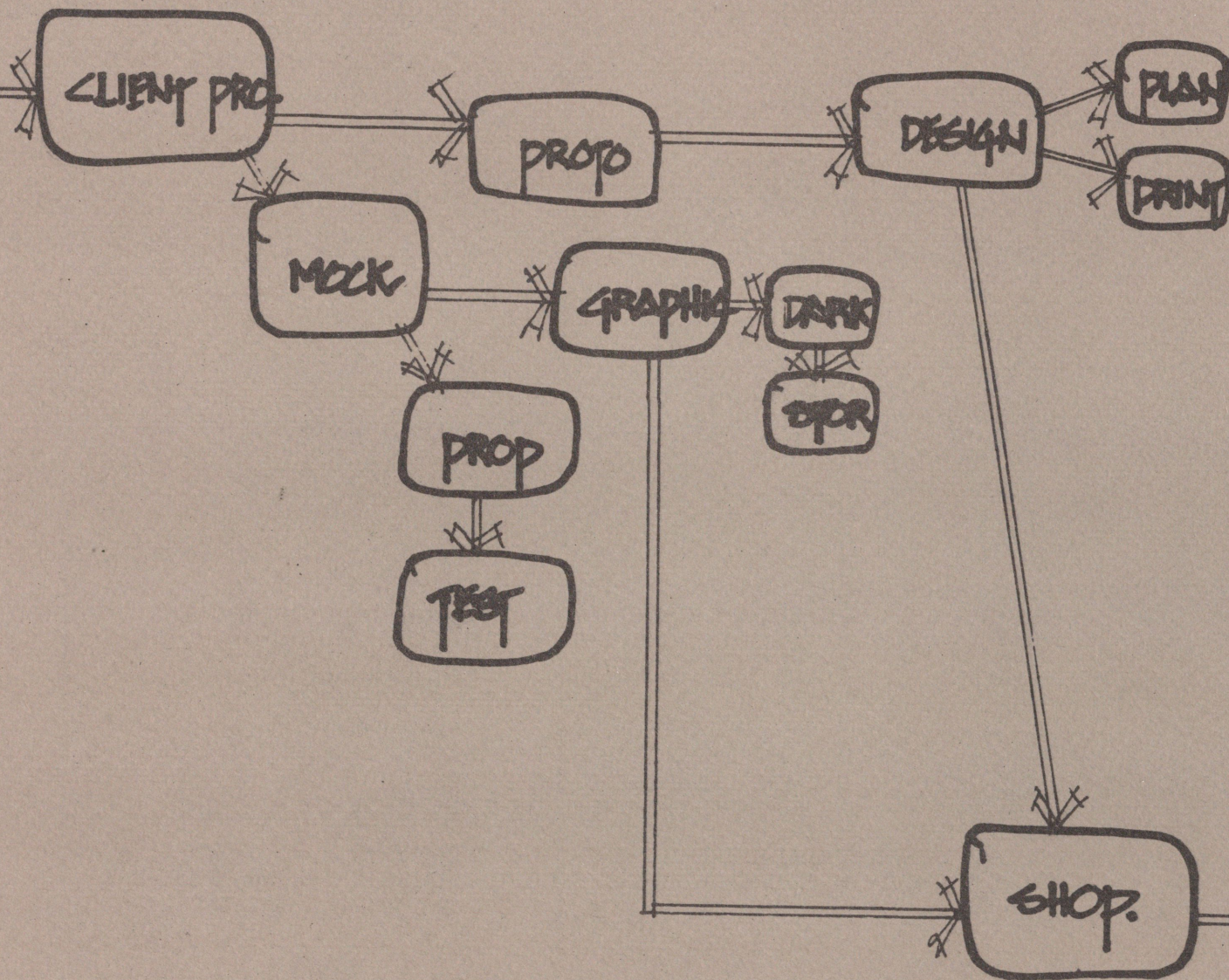
be reversed. Example would be instead of a hospital asking the institute to design a bed for a certain range of disabled people they sent the bed to the analyzed and adjusted for the physically handicapped. This would be taking the bed through fabrication or design before administration, but each would influence the outcome of the bed. As the spaces evolved (two dimensional) they had to be defined as to how large, what volume, necessity of light, equipment (three dimensional space). As the spaces became defined they also reflected type and number of personal needed. Always keeping in mind a sense of circulation and interaction of the personnel in the 3 divisions, a system of connection was developed relating each division to one another.

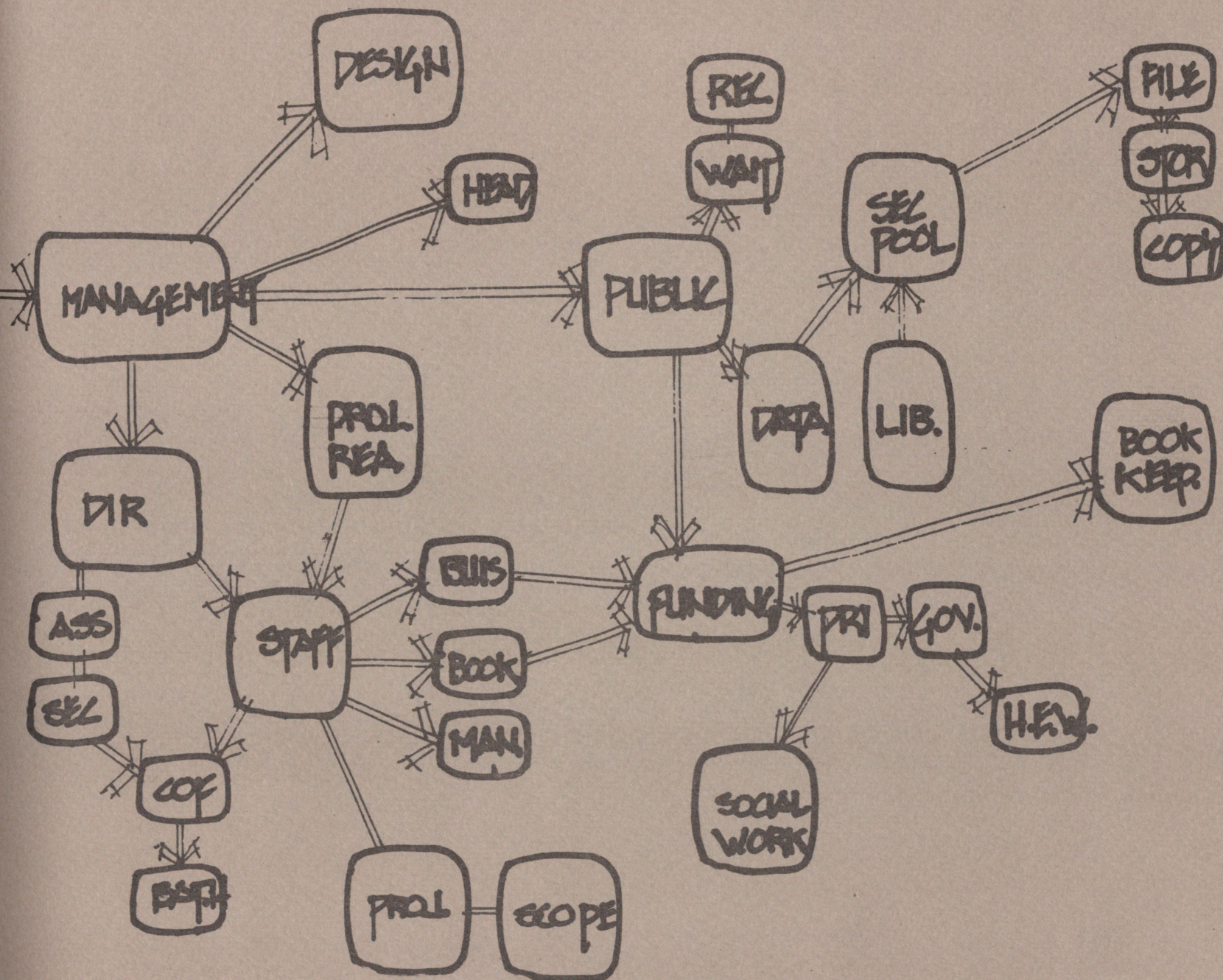
The following sheets are the program and room analysis for the institute keeping in mind the ergonomics of the physically handicapped.

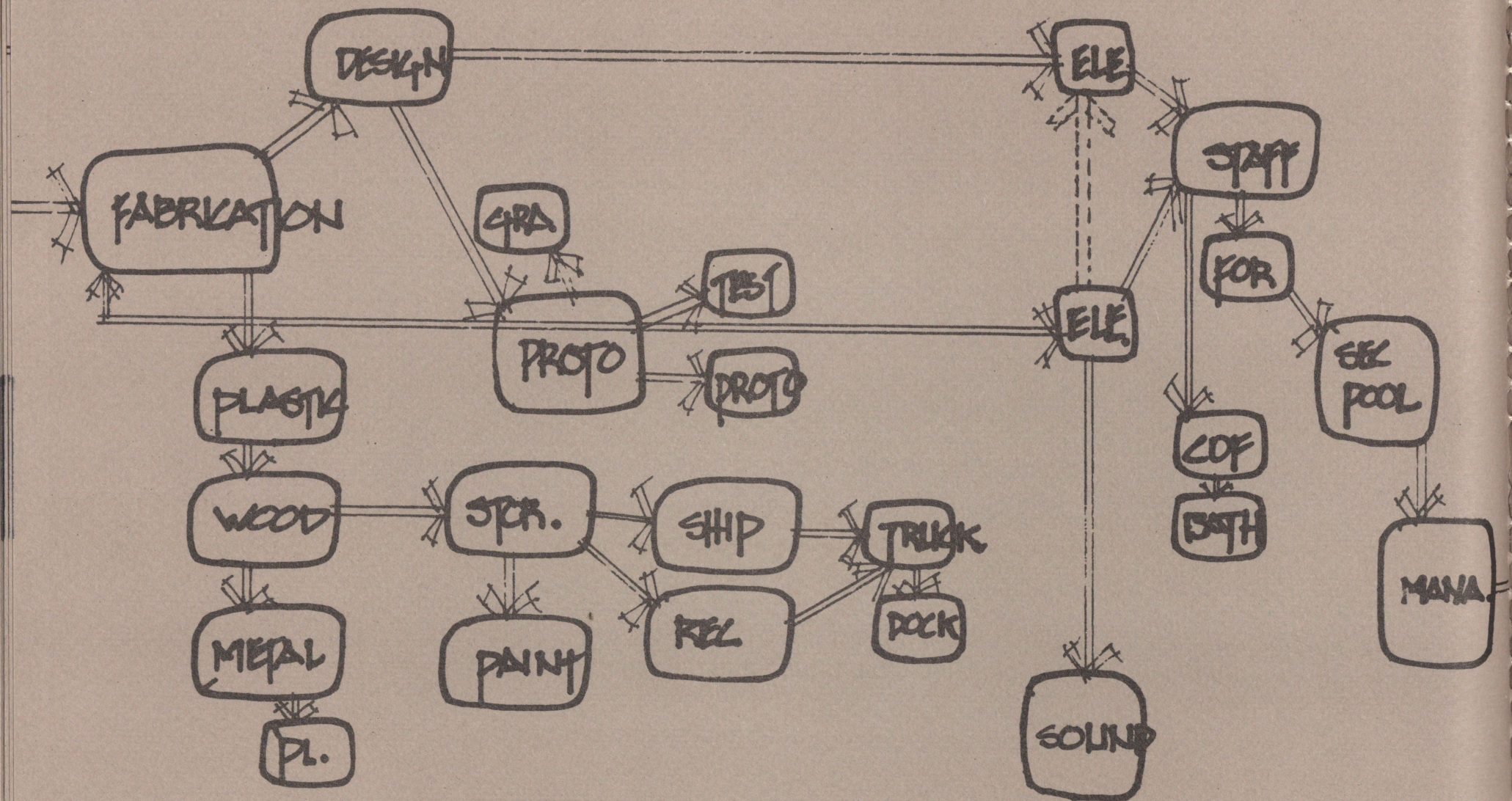












space DISPLAY AREA

function FOR DISPLAYING CUR.
RENT & PAST PROJ. OBJECTS. AN AREA
TELLING THE PUBLIC WHAT THE INSTITUTE
IS ALL ABOUT.

access MUST BE IN DIRECT RELATION
WITH THE PUBLIC.

comments FOR DISPLAYING AREA
SHOULD BE AS FLEXIBLE AS POSSIBLE
WALL AREA FOR HANGING WORK

materials

FLOOR

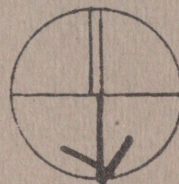
ABRAISON

PHOTO MLIRIALS.

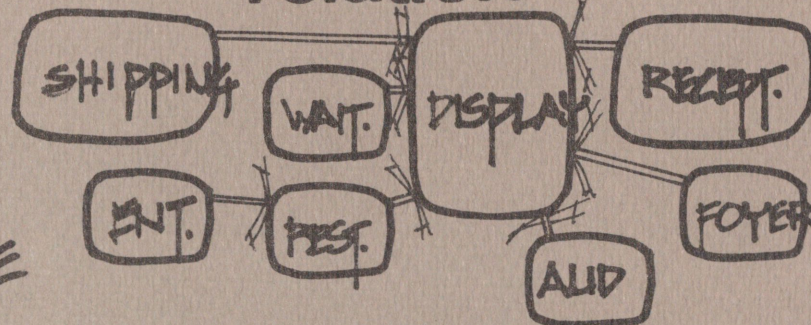
volume 9'-10'

area 300 SQ FT.

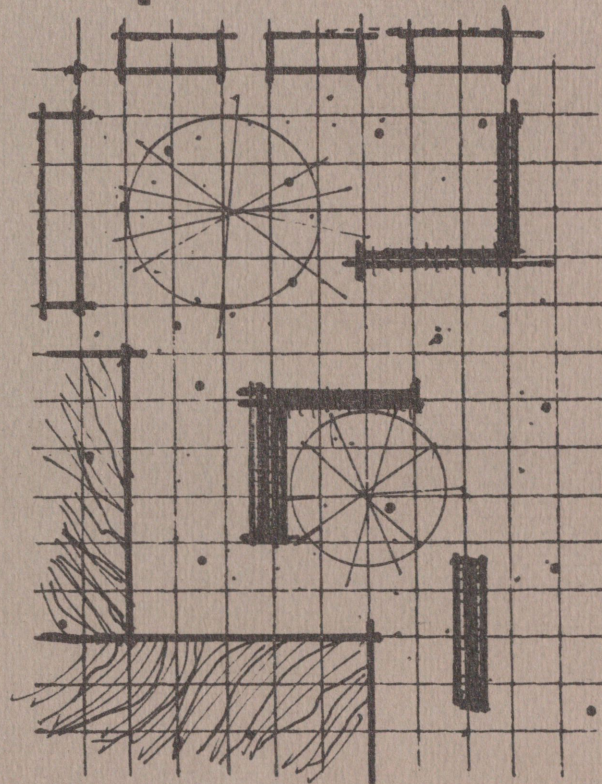
orientation



relation



requirements



space DESIGN LIBRARY

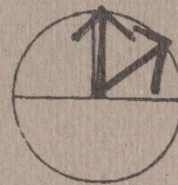
function STORING OF DESIGN
MANUALS, DOCUMENTS SPEC. BOOKS.

access PRIMARILY DESIGN

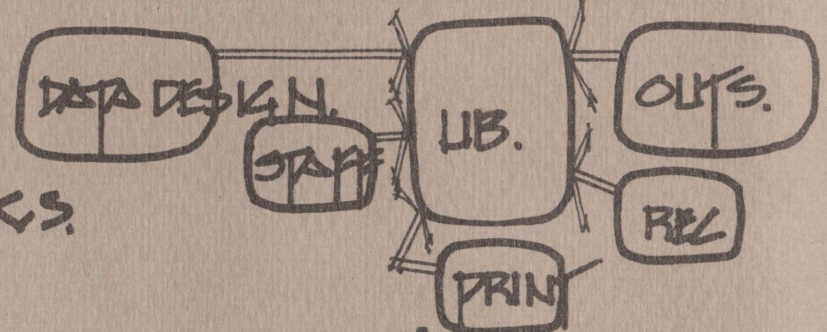
comments MAY BE CONNECTED WITH
MAIN LIBRARY OR DATA CENTER

materials volume 8'-0"
NATURAL LIGHT
LIGHT COLORS area 400 sq ft.

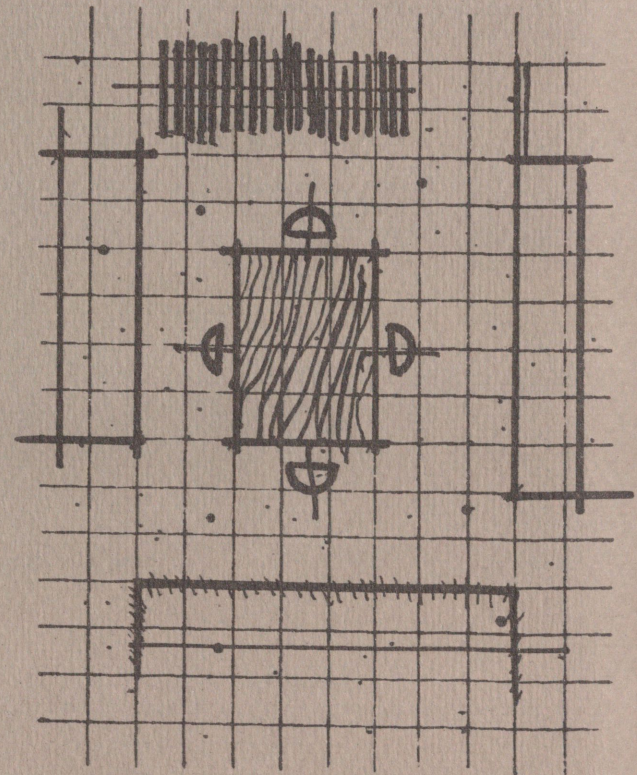
orientation



relation



requirements



space PHOTO ROOM

function PHOTOGRAPHING PRODUCTS
OR DESIGN SOLUTIONS. MUST HAVE
AN AREA INSIDE AS WELL AS OUTSIDE.

access DIRECT RELATION WITH
DESIGN OR SHOP.

comments SPACE SHOULD BE AS
OPEN AS POSSIBLE

materials

TILE.

ABRAISON

INCANDESCENT

NATURAL

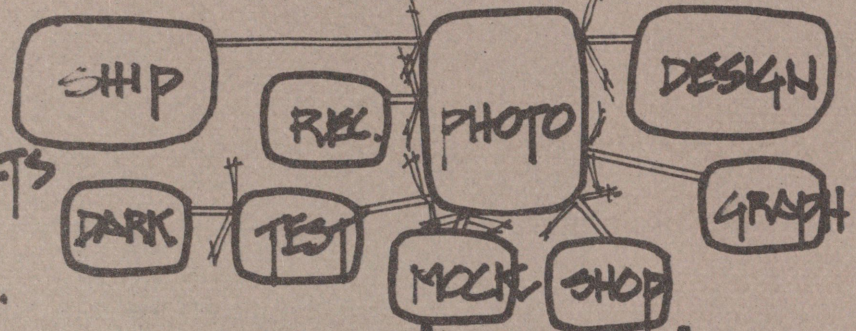
volume 10'-0"

area 576 SQ FT

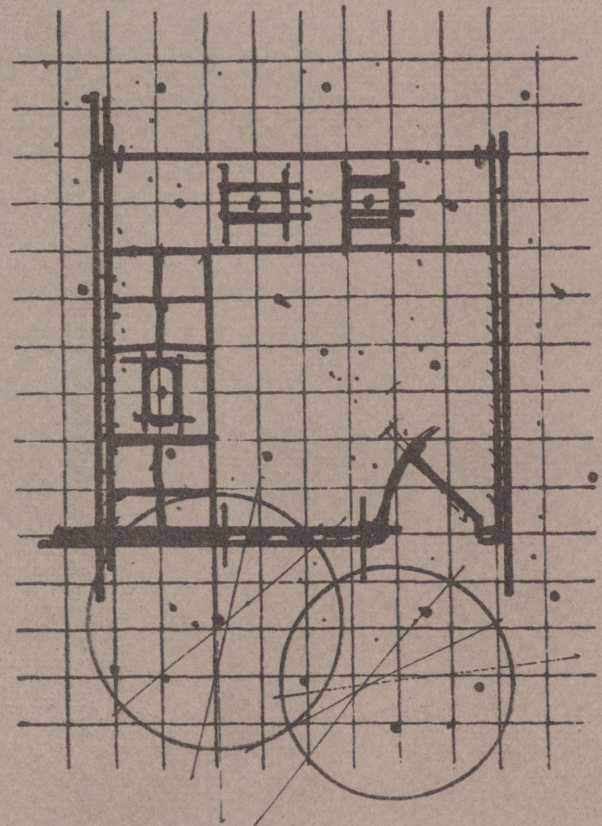
orientation



relation



requirements



space PRINT REPRODUCTION

function REPRODUCTION OF
DRAWINGS FOR CLIENTS AS WELL AS
INHOUSE USE.

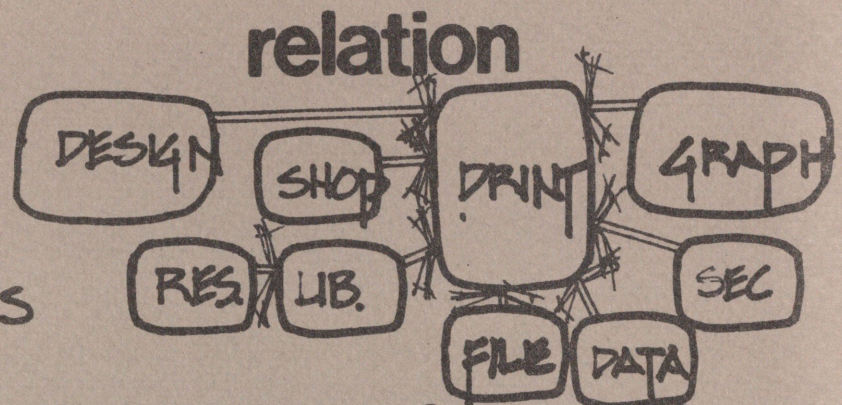
access LOCATED IN DESIGN ROOM.

comments MAY NOT BE ENCLOSED
BUT SHOULD HAVE PERMANENT POSITION.

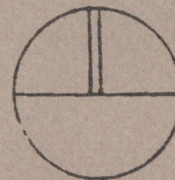
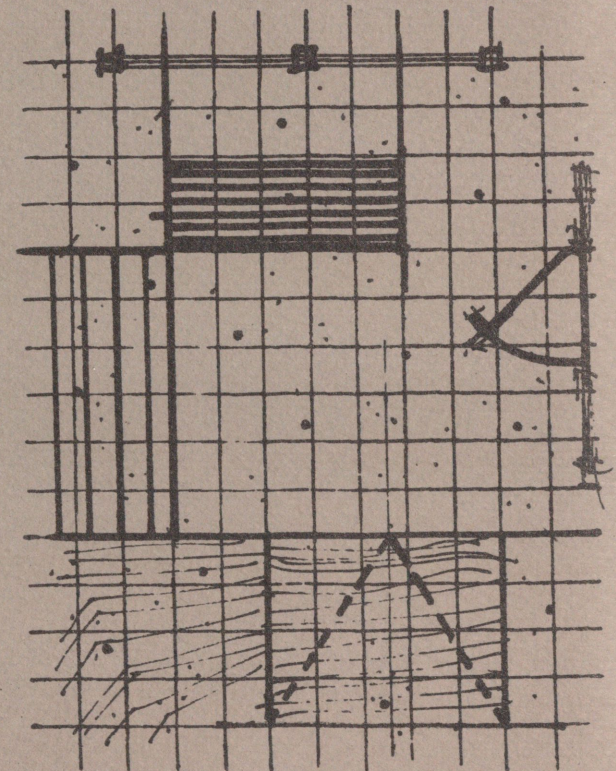
materials
LOW INTENSITY
INCANDESCENT
LIGHTING.

volume 7'-8 - 8'-0 **orientation**

area 140' SQ FT.



requirements



space RECEPTIONIST

function THE RECEIVING AND
DIRECTION OF VISITORS IN PER-
SON, PHONE MAIL

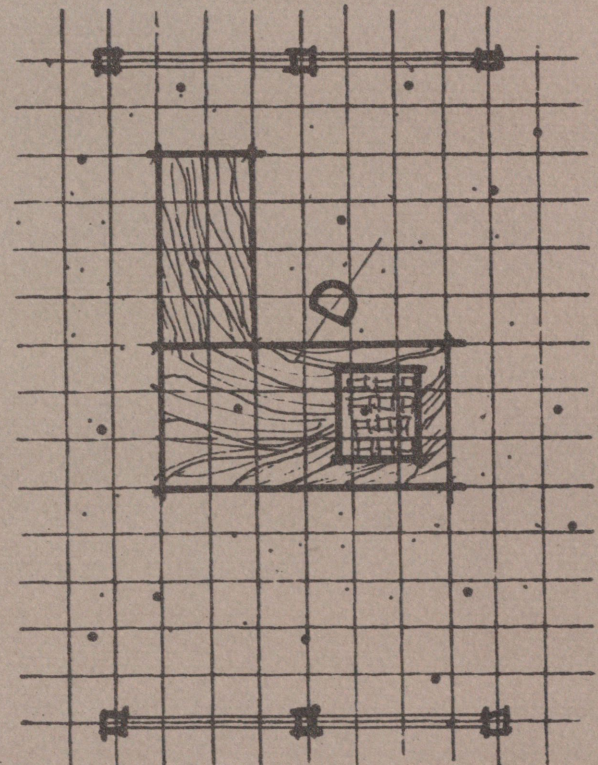
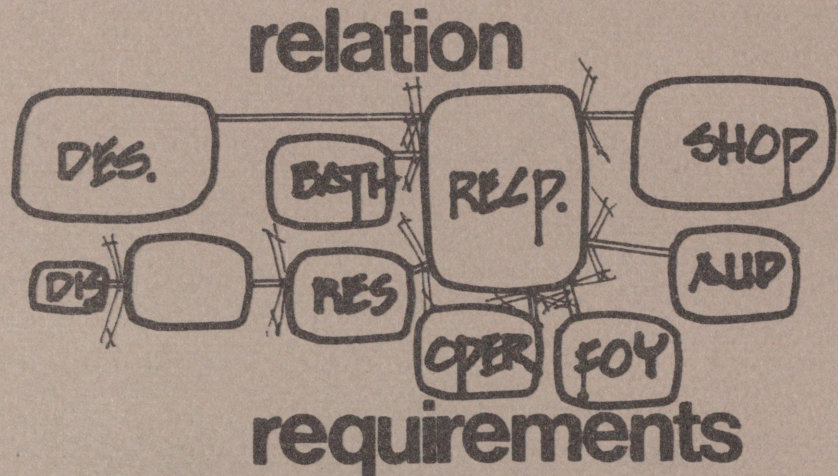
access PROXIMITY TO PUBLIC
ENTRANCE.

comments BASICALLY OPEN AREA
BUT MIGHT NEED SPATIAL DEFINITION
CONTROL FOR ALL PUBLIC.

materials

volume 8'-9'-0" **orientation**

area 140 sq ft.



space PUBLIC RESTROOM

function FOR THE USE OF VISITORS
MAYBE CONNECTED WITH STAFF TOILETS

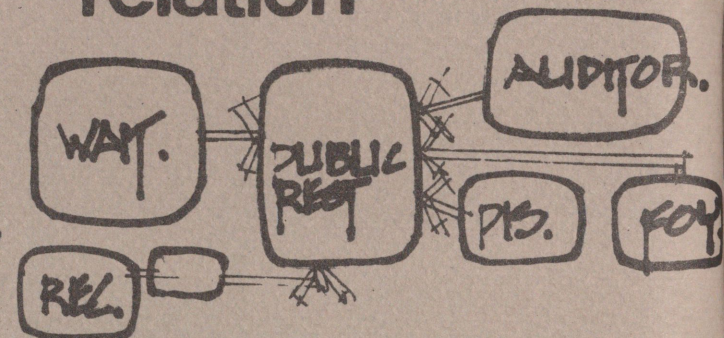
access PROXIMITY OR CLOSNESS
WITH RECEPTIONIST

comments MATERIAL CHANGE TO
BE OF THE FOYER, HALLWAY, RAILING
OR TOILET FOR P.H.

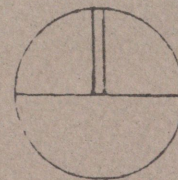
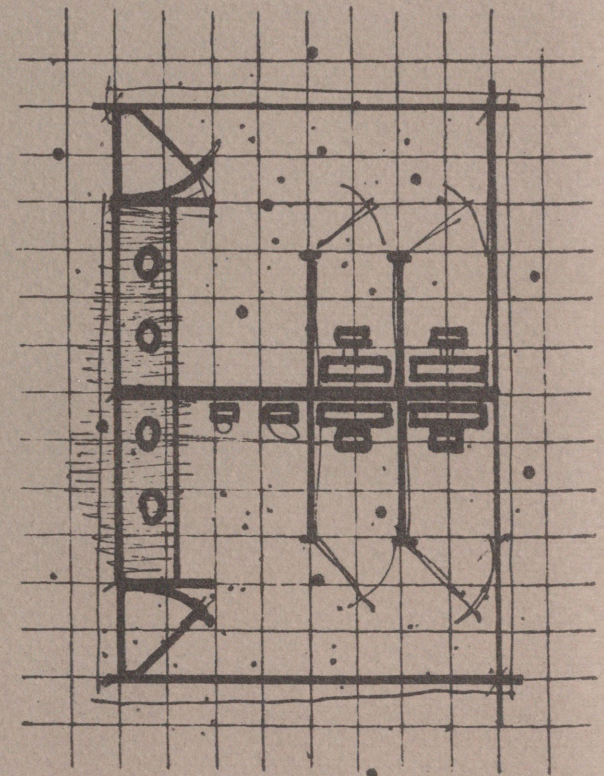
materials volume 7'8" orientation

CERAMIC TILE
FLUORESCENCE LIGHTING
area 396 sq ft.

relation



requirements



space PROJECTION ROOM

function THE SET UP AND SHOWING
OF SLIDES FILMS 16mm 35mm 2x2 2x4

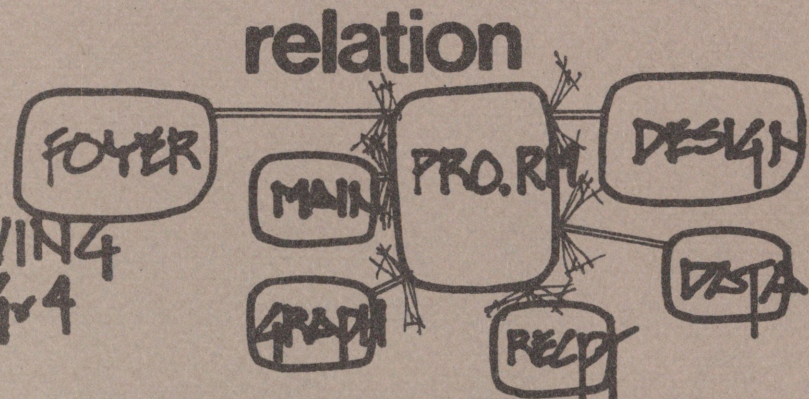
access AUDITORIUM.

comments BOOTH SHOULD BE FLEXIBLE
FOR ALL MEDIAS AND DIFFERENT SET UPS
SHOULD BE ABLE TO ENTER AND EXIT WITH
OUT INTERFERING WITH PROGRAM. LIGHT
AND SOUND LOCK

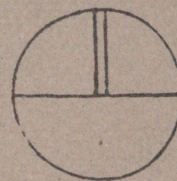
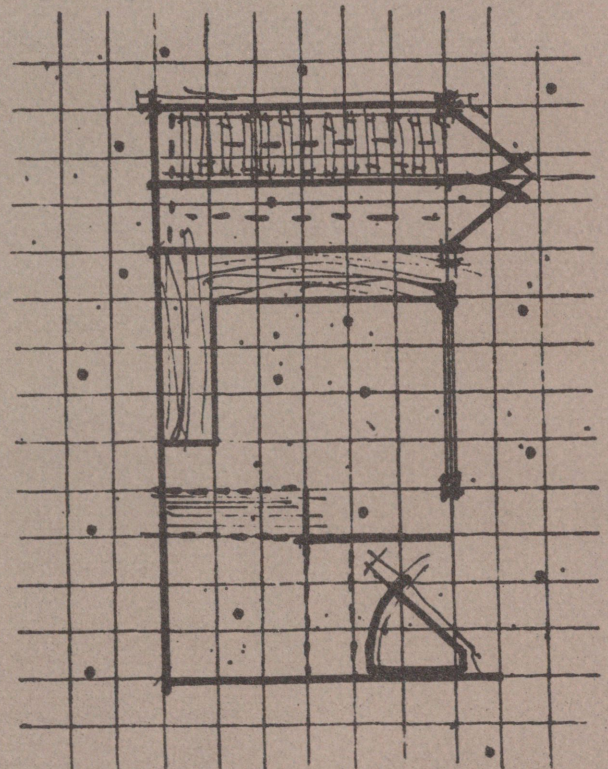
materials
INCANDESCENT

volume 7'8-8'0" orientation

area 250 sq ft.



requirements



space JANITORS CLOSET.

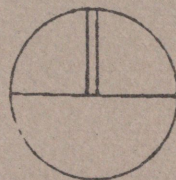
function MAINTAINANCE OF
EXTERIOR & INTERIOR FINISHES STORAGE
OF LAMPS & CLEANING ARTICLES.
access AN AREA WITH IN EACH OF
THE MAIN OPERATIONS.

comments RACKS PLACED FOR EASY
STORAGE OF WAXES, LAMPS ETC.

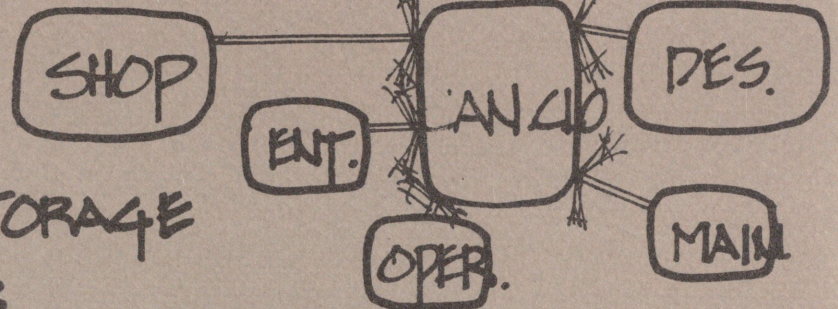
materials
INCANDESCENT.
CONCRETE.

volume 8'-10' orientation

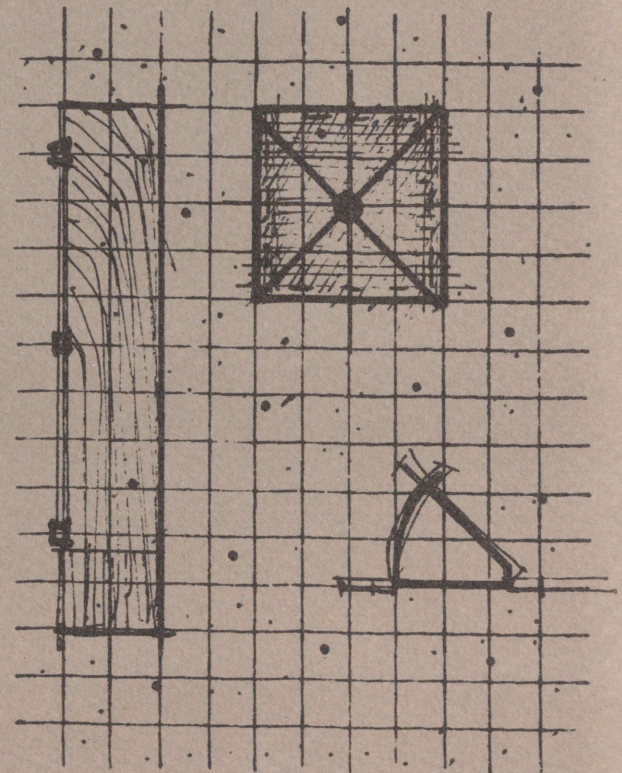
area 4 @ 100 sq ft.



relation



requirements



space OFFICE DESIGN HEAD

function IN CHARGE OF DESIGN
LAYOUT OF STAFF AND PROJECTS
CO-ORDINATOR.

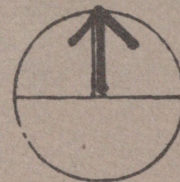
access PROXIMITY TO ENTRANCE OF
DESIGN STUDIO

comments DIRECT RELATIONSHIP WITH
STAFF-ADMINISTRATION

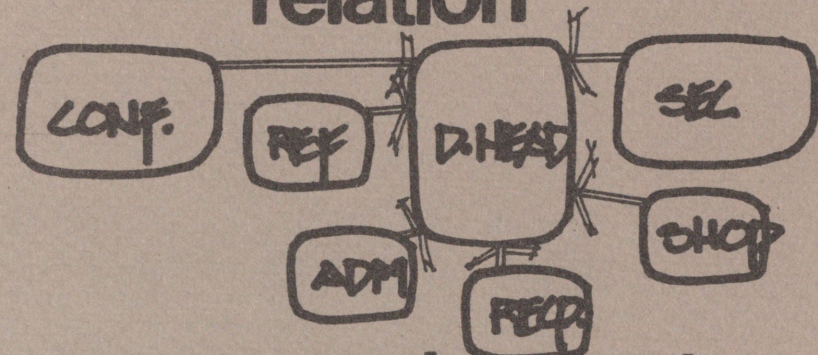
materials
INCANDESCENT
FLUORESCENT

volume 8'-0"
area 250 sq ft.

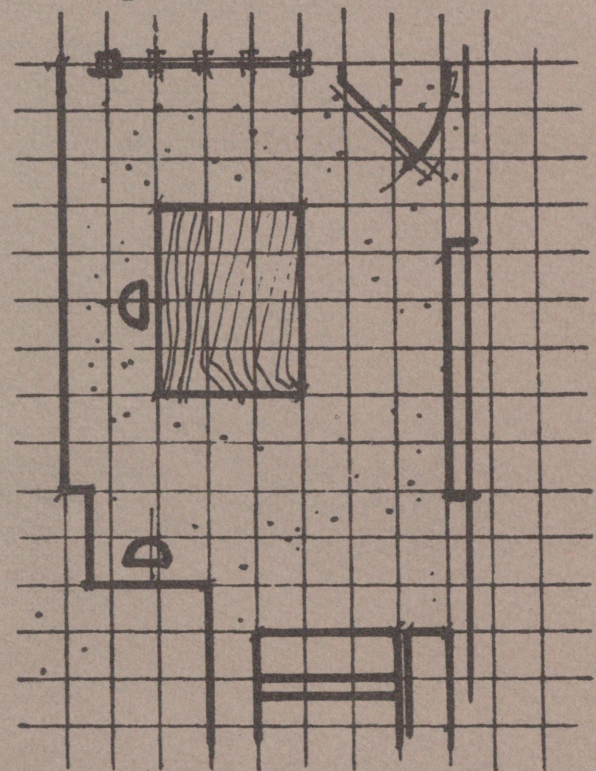
orientation



relation



requirements



space DESIGN STUDIO

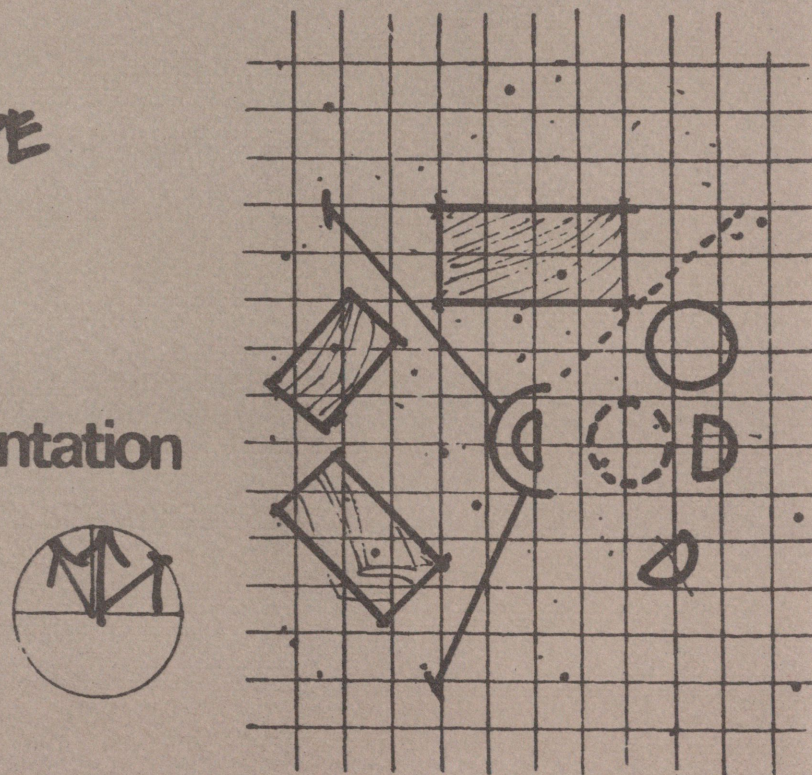
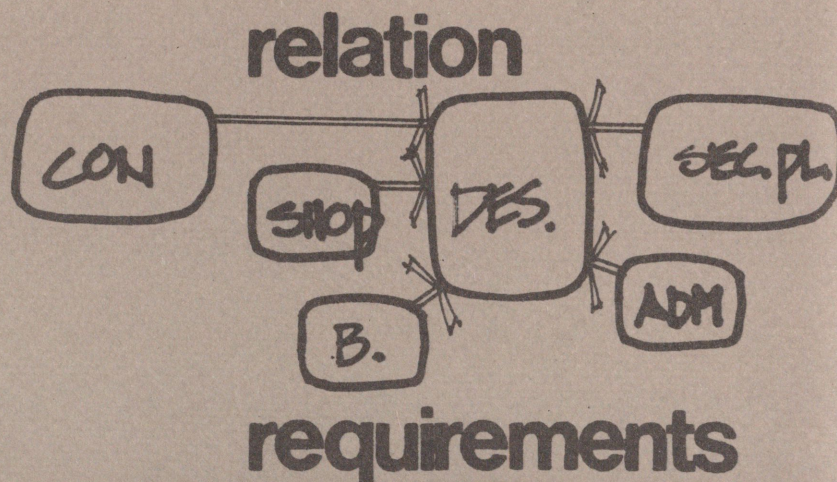
function 2 AND 3D CREATIVITY
OF DESIGN SOLUTIONS

access

comments OFFICE LANDSCAPE

materials
INCANDESCENT.

volume 8'-9'0" orientation
area 1600 sq ft.



space LOCKER ROOM

function STORAGE, CHANGE AREA,
BATH ROOM, WASH AREA FOR SHOP
EMPLOYEES.

access IN PROXIMITY TO SHOP.
STAFF ENTRANCE.

comments CENTRAL WASH AREA, HALF
WALL TYPE, LOCKERS. STACKED

materials
FLUORESCENT

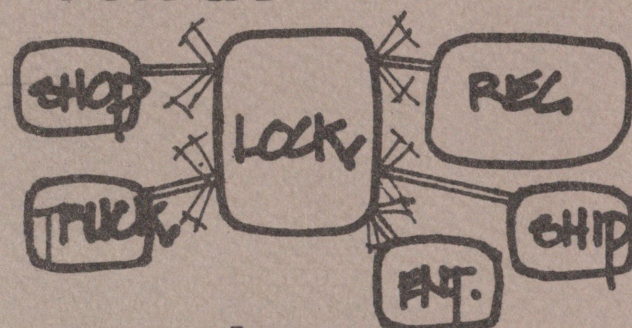
volume 8'-0"

orientation

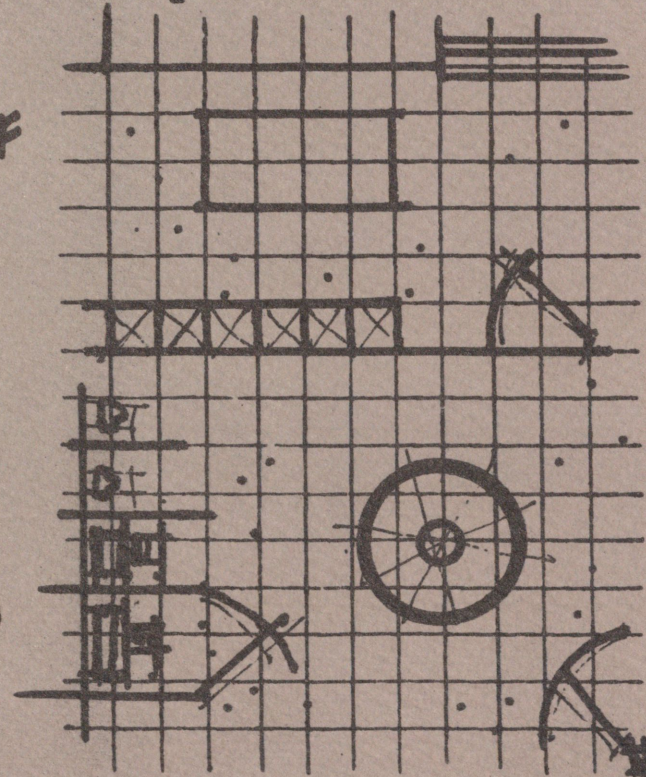
area 408 sq ft



relation



requirements



space SOCIAL WORKER

function WORKING WITH PUBLIC
THAT NEED ASSISTANCE & FINANCIAL
AID.

access NEAR RECEPTIONIST. LOBBY
ENTRY WAY

comments PLACED IN SUKII A MANNER
THAT THE INDIVIDUAL HAS A SENSE OF
PRIVACY BUT STILL NOT SEPERATED.

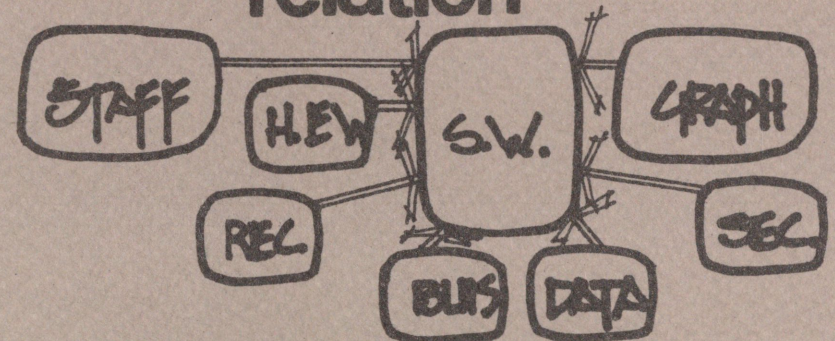
materials
FLUORESCENT

volume 7'8"-80" orientation

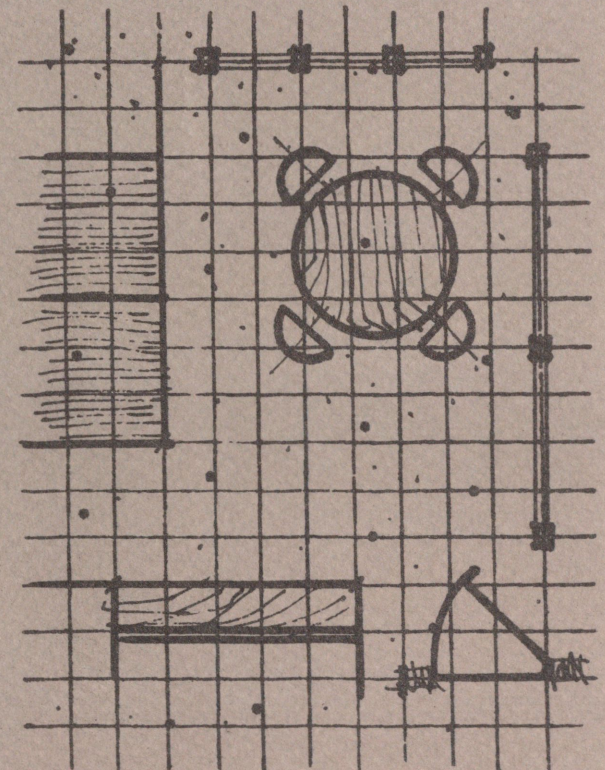
area 256 sq ft.



relation



requirements



space PAINT SHOP.

function FINISH WORK ON PROTO.
TYPE MODELS AND MOCKUP EQUIP.

access SHOP

comments SHOULD BE CUT OFF FROM
REST OF SHOP. PAINT STORAGE, FLEXIBILITY.

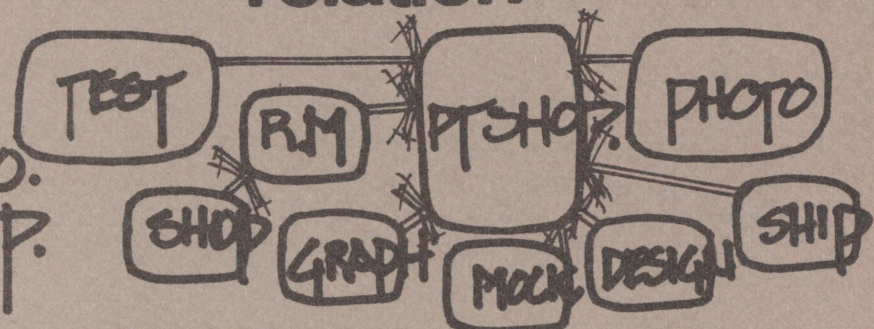
materials
INCANDESCENT.

volume 10'-0"
area 400 sq ft.

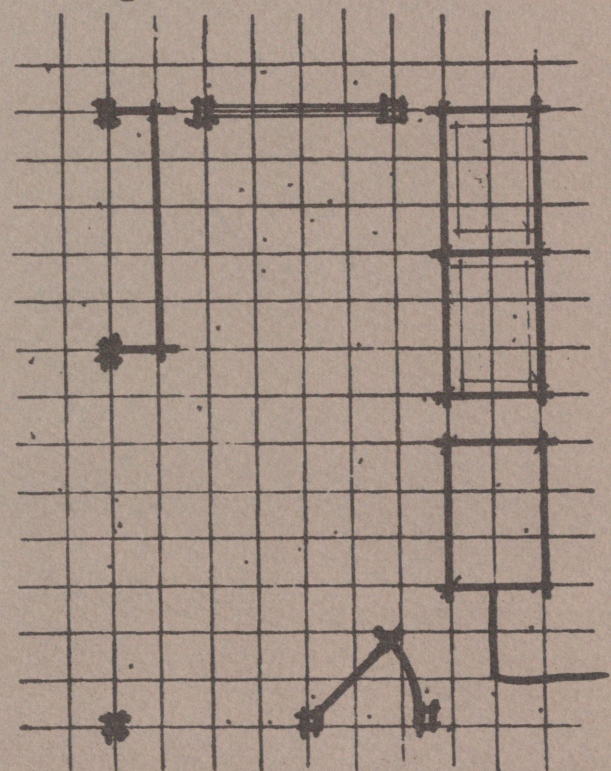
orientation



relation



requirements



space SECRETARIAL POOL

function GENERAL SECRETARIAL
WORK FOR INSTITUTE, MIMEO, XEROX
FILING.

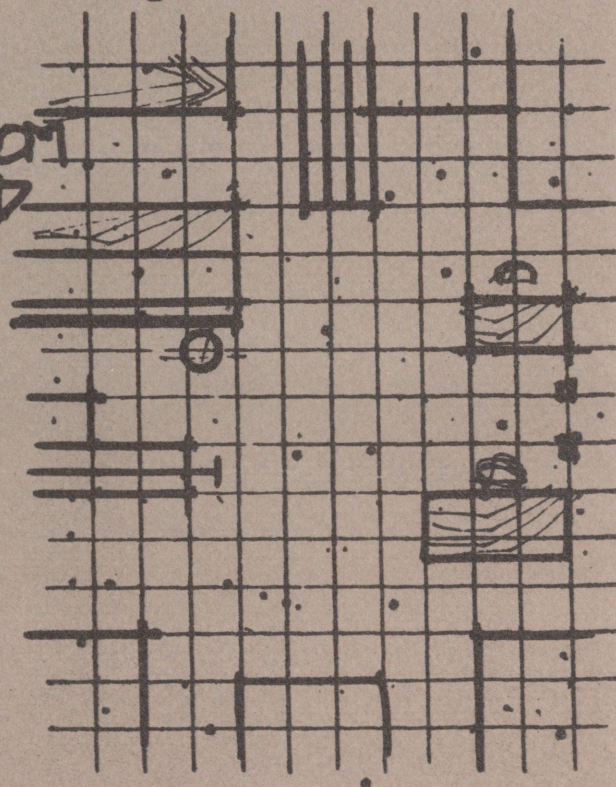
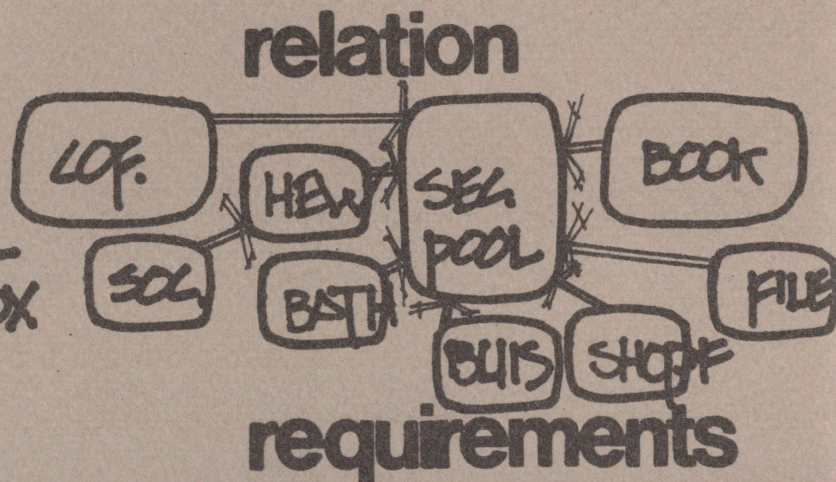
access ADMINISTRATIVE.

comments OPEN AREA FOR EASE OF ROOM
CHANGE. SHOULD BE CENTRALLY LOCATED
OR CONNECTED. ALL PHASES OF
INSTITUTE.

materials
INCANDESCENT

volume 7'8"-9'0" orientation

area 650 sq ft



space DARK ROOM.

function PHOTO PROCESSING OF
WORK DONE, PAMPHLETS, GENERAL
INFORMATION OF INSTITUTE.

access NEAR DESIGN OR
GRAPHIC

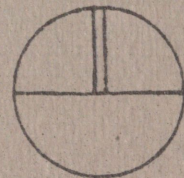
comments STORAGE AREA FOR
LONG TERM STORAGE OF FILMS AND
PAPER.

materials
TILE, MAIN.

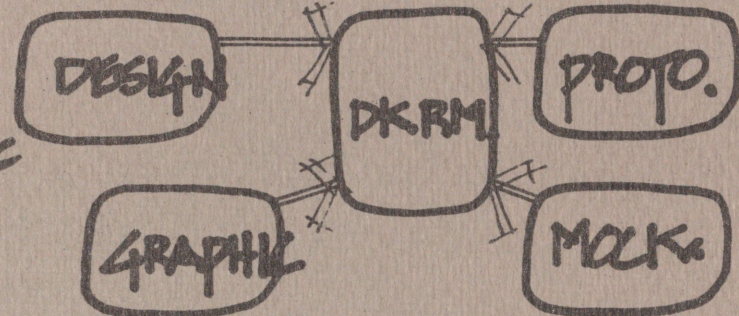
volume 8'0"

orientation

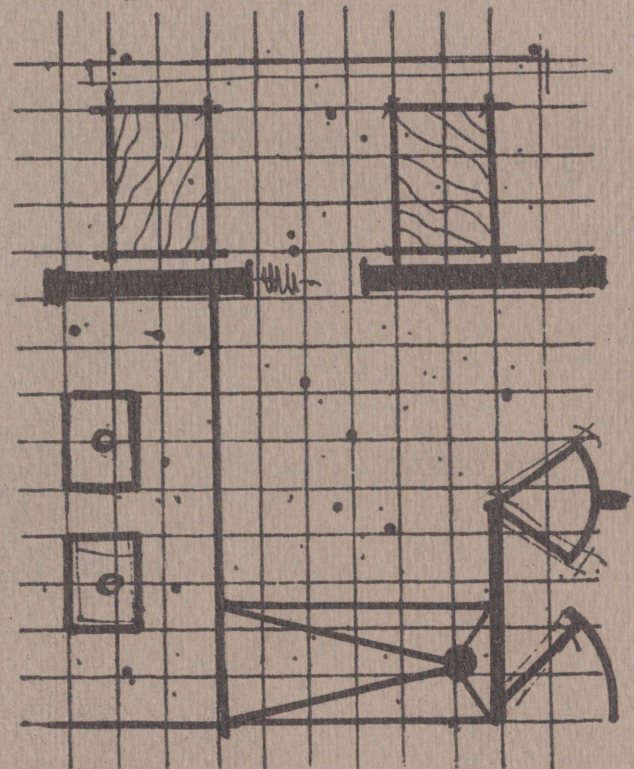
area 250 sq ft.



relation



requirements



space EMPLOYEE BATHROOM

function FACILITIES FOR STAFF.

access PROXIMITY TO STAFF AREA

comments MAY BE WITH PUBLIC REST-
ROOM IF CENTRALLY LOCATED.
LOUNGE AREA FOR WOMEN.

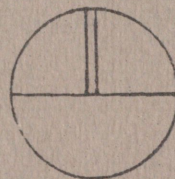
materials

TILE
EASY MAINT.
FLUORESCENT.

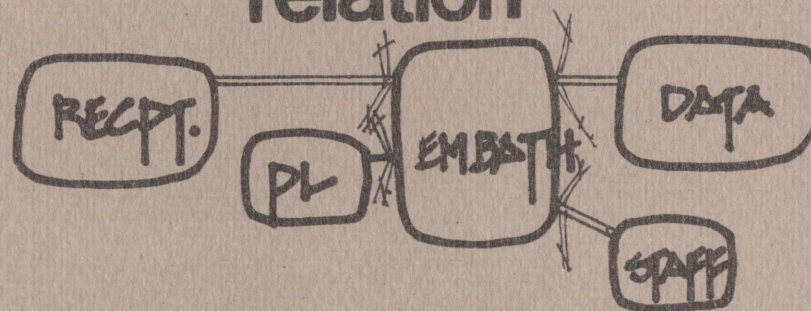
volume 8'0"

area 300 sq ft.

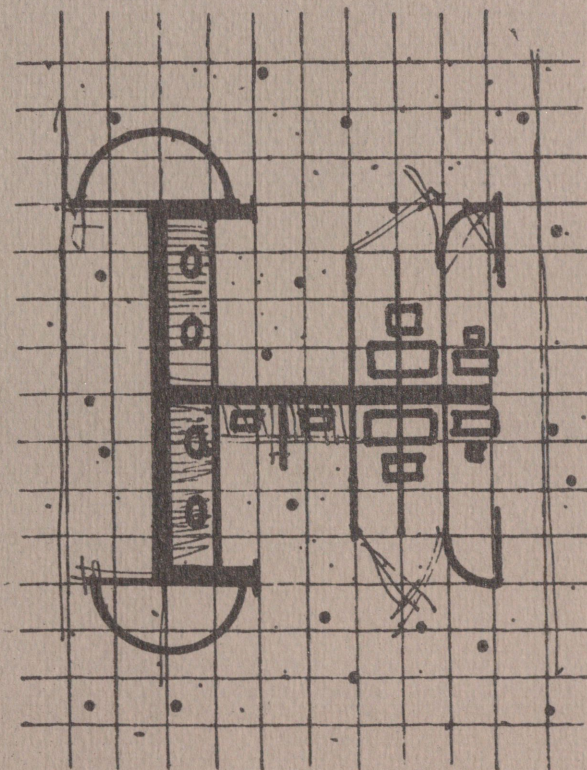
orientation



relation



requirements



space COFFE - LUNCH

function A PLACE A WAY FROM
THE DESK. TRANSITION AREA FROM
HOME TO WORK

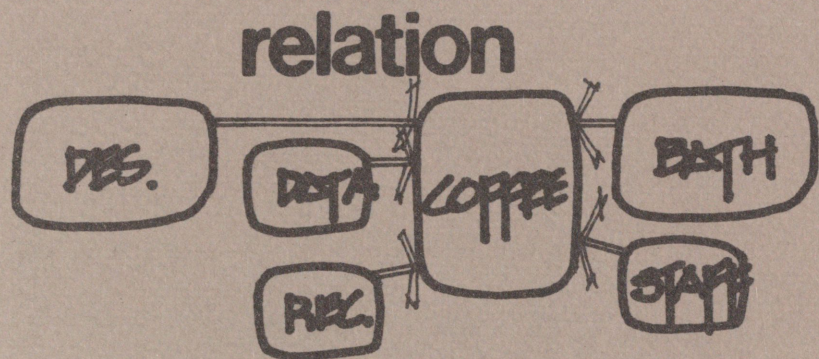
access CENTRAL - LOCATION

comments EXTERIOR OPENING
SHOULD HAVE GOOD PSYCH. SETTING

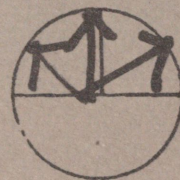
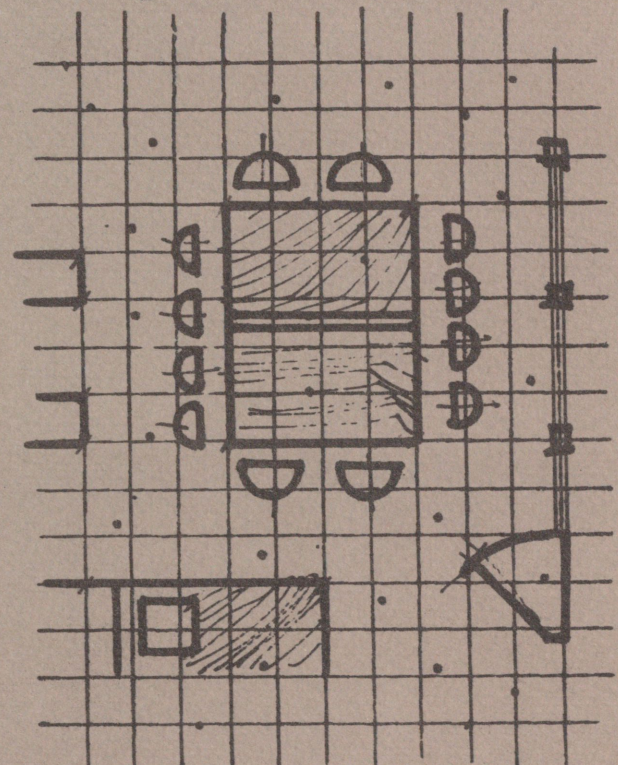
materials
FLUORESCENT.

volume 7'-8" - 8'-0" orientation

area 250 sq ft.



requirements



space RELIEVING AREA.

function THE RELIEVING OF MAIL
RAW MATERIALS, DESIGN PRODUCTS
EQUIPMENT.

access STAFF PARKING -
SHOP AREA. SERVICE ENTRANCE

comments AREA FOR TEMPORARY
STORAGE UNPACKING MAY TAKE PLACE
ON LOADING DOCK. REL. AND SHIPPING
MAYBE COMBINED.

materials
INCANDESCENT.

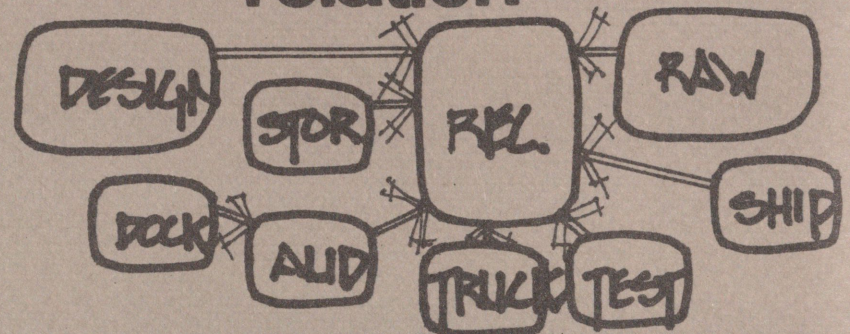
volume 10'-0

area 260 sq ft

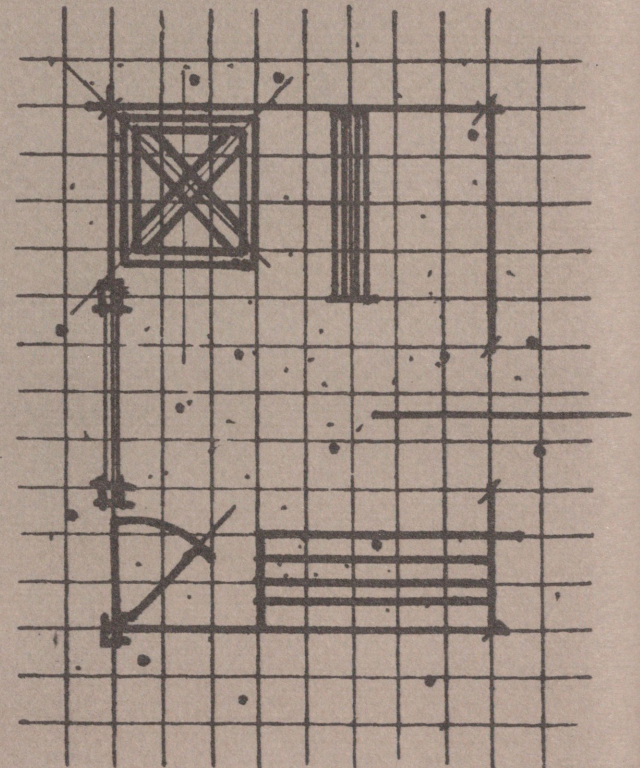
orientation



relation



requirements



space Foyer.

function GATHERING AREA, TRANSITION AREA, FOYER AREA, PROVIDING LIGHT AND SOUND LOCK.

access MAY BE USE AS A FIRE ESCAPE RECEPTIONIST.

comments MAY BE COMBINED AS A WAITING AREA OFF THE RECEPTIONIST. ALSO MAY BE DISPLAY AREA.

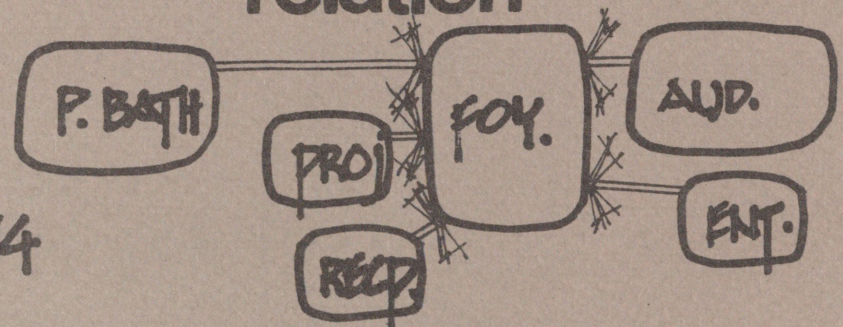
materials
FLUORESCENCE
TILE.

volume 8'9'
area 600 sq ft.

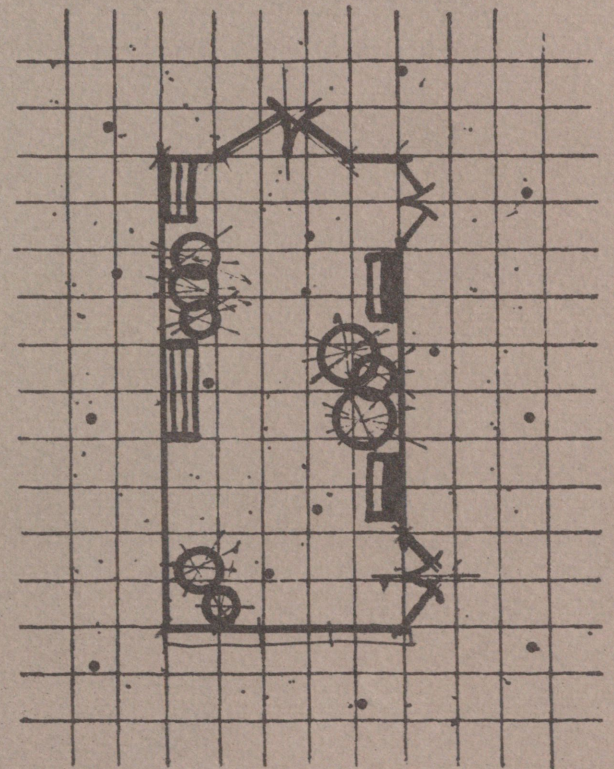
orientation



relation



requirements



space GARDENER

function EXTERIOR MAINTAINANCE,
STORAGE OF EQUIPMENT SUPPLIES
FOUR FOUR SEASONS.

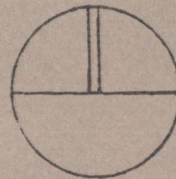
access EXTERIOR ACCESS THROUGH
GARAGE OR SHOP.

comments DRY AND LIQUID STORAGE

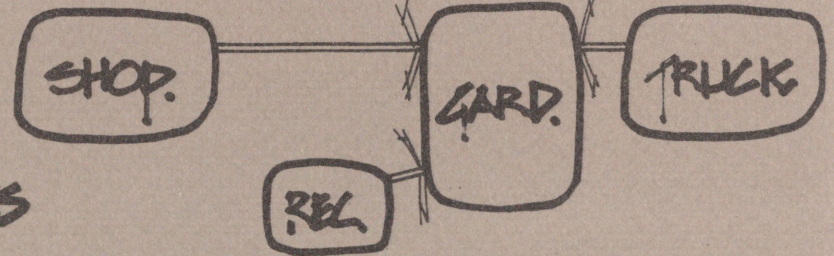
materials
CONCRETE
ABRAISION

volume 9'-0"
area 250 sq ft.

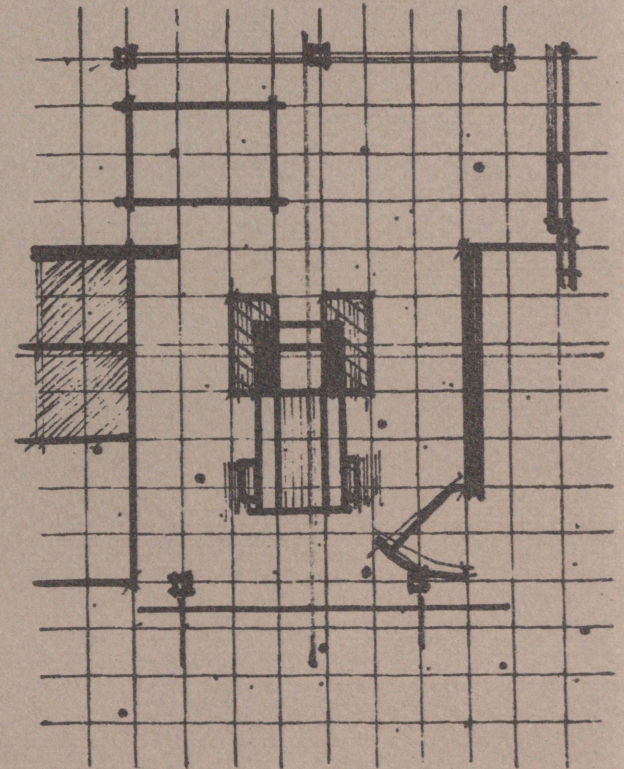
orientation



relation



requirements



space TEST AREA

function TESTING OF PRODUCTS
FOR FUNCTIONAL USE, LOADING
ABRASION, PRECISION.

access SHOP.

comments MAYBE CONNECTED
WITH MOCK UP AREA.

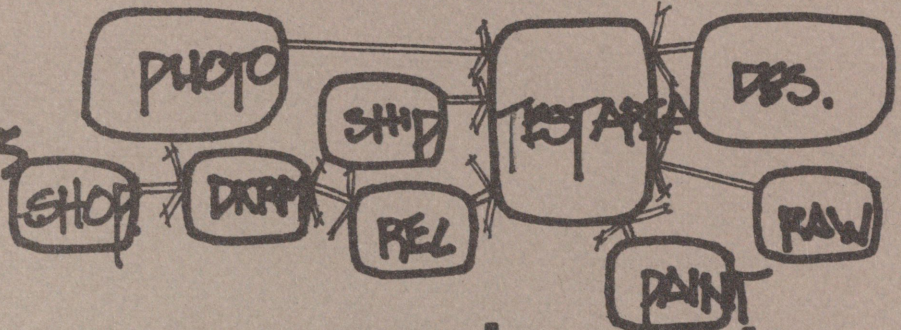
materials
INCANDESCENT.

volume 9' 10'-0" orientation

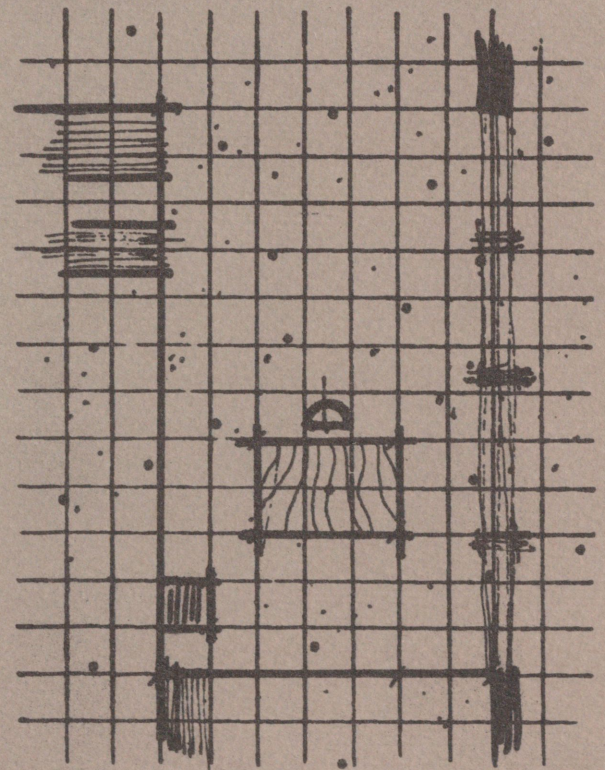
area 165 SQ FT



relation



requirements



the site

4



Since there is not an institute of this type in existence as of yet, site selection become an important factor. Ideally the location for the Institute is the area of the central states around Kansas. The building being a center for all information would be easily accessible by East and West as well as North and South. My first intents were of placing this institute there. Since Montana's future of being an industrialized state is still uncertain, I felt the need of placing the institute in Montana. First, it becomes a form of clean industry for Montana, yet still producing. Secondly, Montana has a setting that could be quite a physiological asset. An area so foreign to all forms of industry and institutes in general, that the building (architecture) does not have to take the form of a known institute.

In dealing with Montana, one has very little to work with in considerations of transportation, hospitals, shipping and access to manufactures. Choosing a location within Montana was centered around transportation. In evaluation of all major towns in Montana, Billings became a justifiable site for the institute. Billings is the county seat of Yellowstone County, southeastly located in Montana. It has an approximate population of 61,500 with the 2nd fastest population growth in Montana. Located within Billings is the State Nursing School which may be in relation to the institute. It has two colleges- Rocky Mountain College and Eastern Montana College.

Billings's average temperature in winter is . Winds are from the southwest with minor winds westerly-south. Latitude is $45^{\circ} 47'$ North. With summer solstice of $68 \frac{1}{2}^{\circ}$ and winter solstice of $22 \frac{1}{2}^{\circ}$. The geography of Billings is a fairly flat town with sandstone cliffs bordering the north. The Smokie Mountains are to the Southwest, the East has a fairly low horizon line.

In choosing the site, I felt a need that the institute should be easily located from incoming visitors foreign to Billings and to Montana. Also a connection with the Nursing School, hospitals, and homes for the elderly.

The site is located on the corner of Rimrock and 17th Avenue. Rimrock is one of Billings's major arteries of vehicular transportations and is connected by all other arteries of main transportation within Billings. 17th Avenue takes off of Rimrock and connects to Grand Avenue. These two streets, Rimrock and Grand, are Billings's routes of transportation.

Rimrock is connected by North 27th which is the access to and from the airport. North 27th is also the main access to Billings's business district.

Billings has a local bus transportation system running on both Rimrock and 17th connecting the site with a means of transportation rather than by private car.

The site in general, is a parcel of land 1250' + 750', with a site slope of 1 foot in 20. The slope runs downward from north to south. Approximately 250' north of Rimrock Avenue and a five foot berm runs approximately 100' East off of 17th Avenue. There are approximately 40 American Elm trees ranging in height from 12' to 40'. The trees in general, run in parallel with the existing roadways. The site is bordered by Rimrock Drive on the North and by 17th Avenue on the East. Both have a vehicular limit of 35 miles per hour. There is no pedestrian means of traffic on the site although Billings has a proposal of sidewalks or a bike path on Rimrock Drive.

The site is bordered by residential on the North and East and by Rocky Mountain College on the East. The South is generally open except for a residence approximately 1000' from Rimrock.

There is a 25 foot setback on building lines on both Rimrock and 17th. There is a height restriction that from within 25' of Rimrock the building height can not be greater than 25'. The residences across Rimrock Avenue start 8' above the Northern most of the site. From the center of the site are to the north a belt of cliff like sandstone called the Rimrocks. To the West a park like area containing a 32 unit housing structure for Rock Mountain College. To the South, Billings valley and a tree like

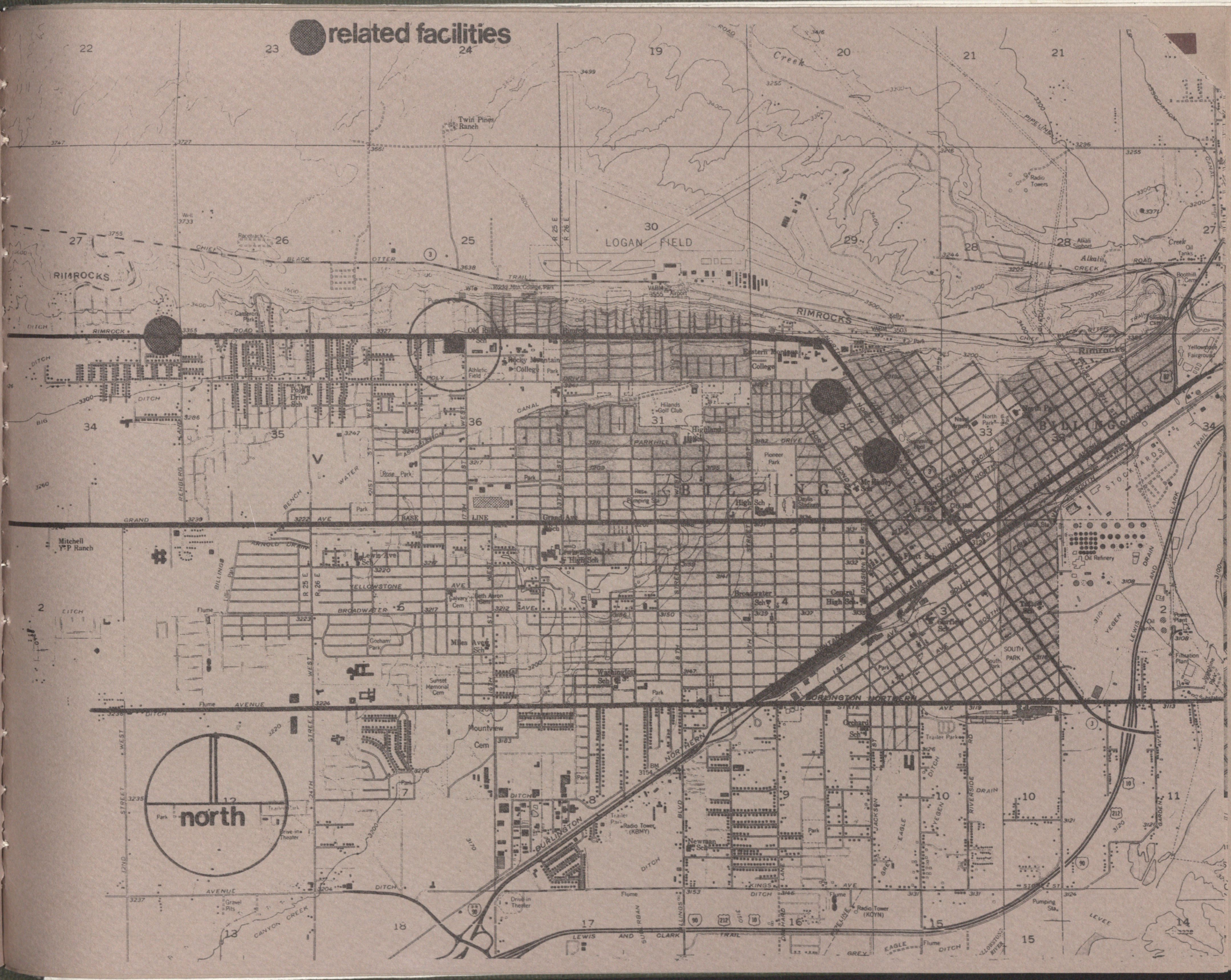
are to the Southwest. Easterly view is of residences boarded by elms.

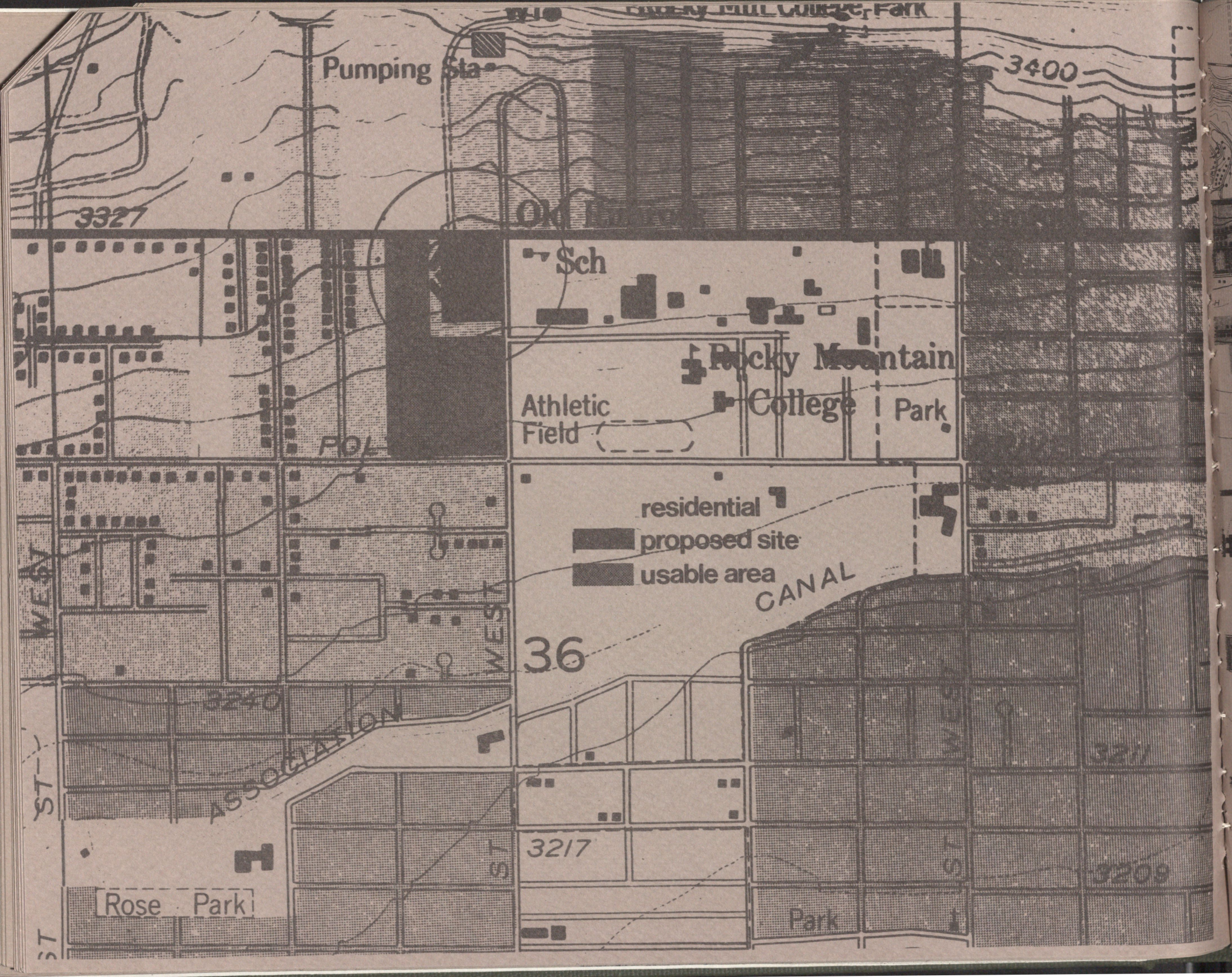
Water and gas hook up is located under 17th avenue. There are power lines running along 17th Avenue opposite side adjacent to site. There is one power pole used for support located approximately 25 feet West from 17th and 250 feet North of Rimrock. Other than the trees this is only other obstacle located on the site.

The previous use of the site was a trailer court from 1956 - 1963. When the trailer court was built they leveled the site creating the earth berm. Trailer sewage and water lines have been removed. There is no unusual drainage problems with the site. The justification for the physical site is that it has a general slope, is located in an established neighborhood, has a main route of access (easily found) and is bordered by an already institutionalized setting (Rocky Mountain College). On Rimrock Avenue is also located the Yellowstone Home for the Aged, St. Mary's Hospital Complex (also contains nursing school).

I feel that the site and the neighborhood can absorb this type of building without any difficulty.

related facilities





Pumping Sta

3327

Old

3400

Sch

Rocky Mountain

Athletic Field

College Park

POL

residential

proposed site

usable area

CANAL

36

3240

ASSOCIATION

WEST ST

WEST ST

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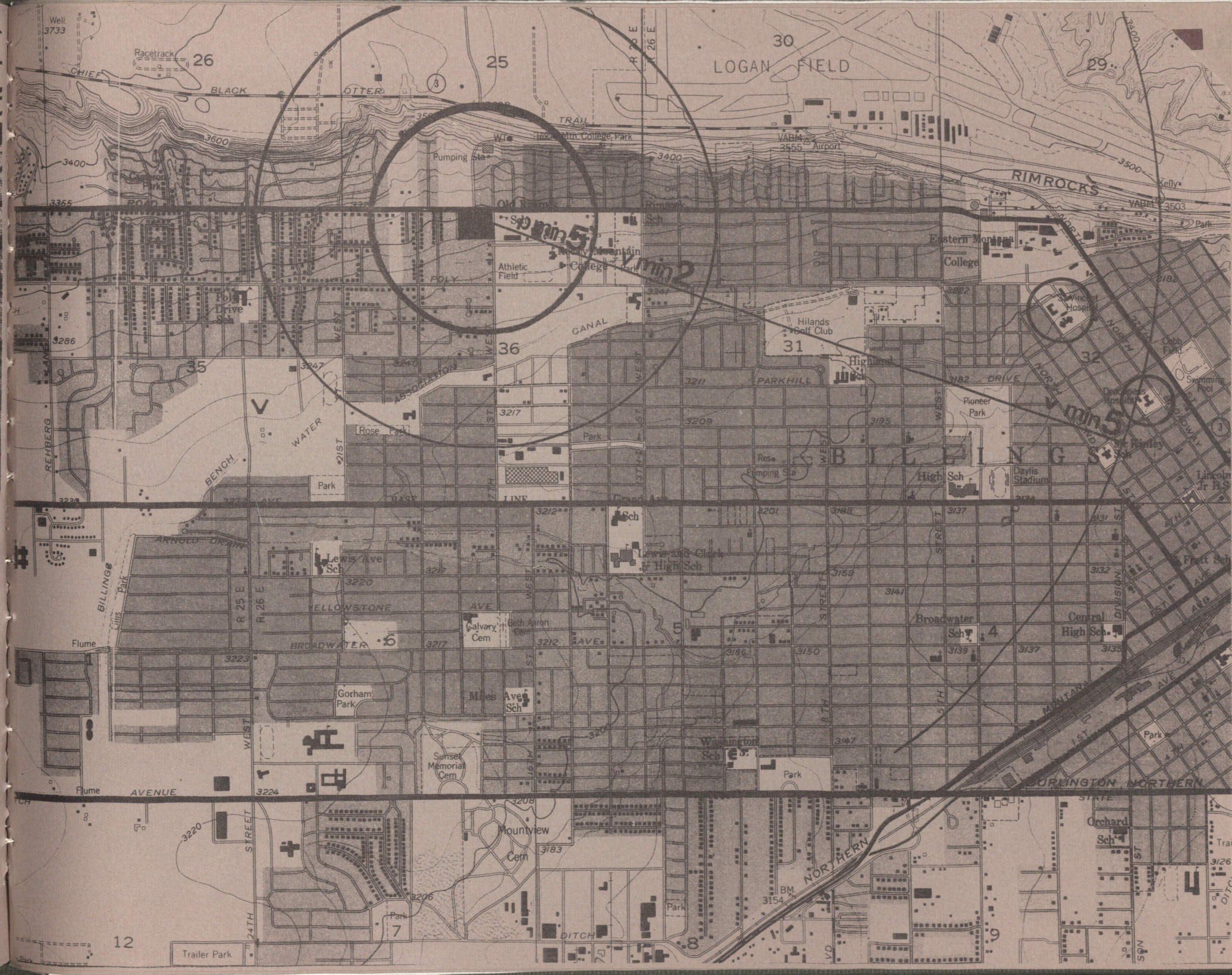
3217

3217

3209

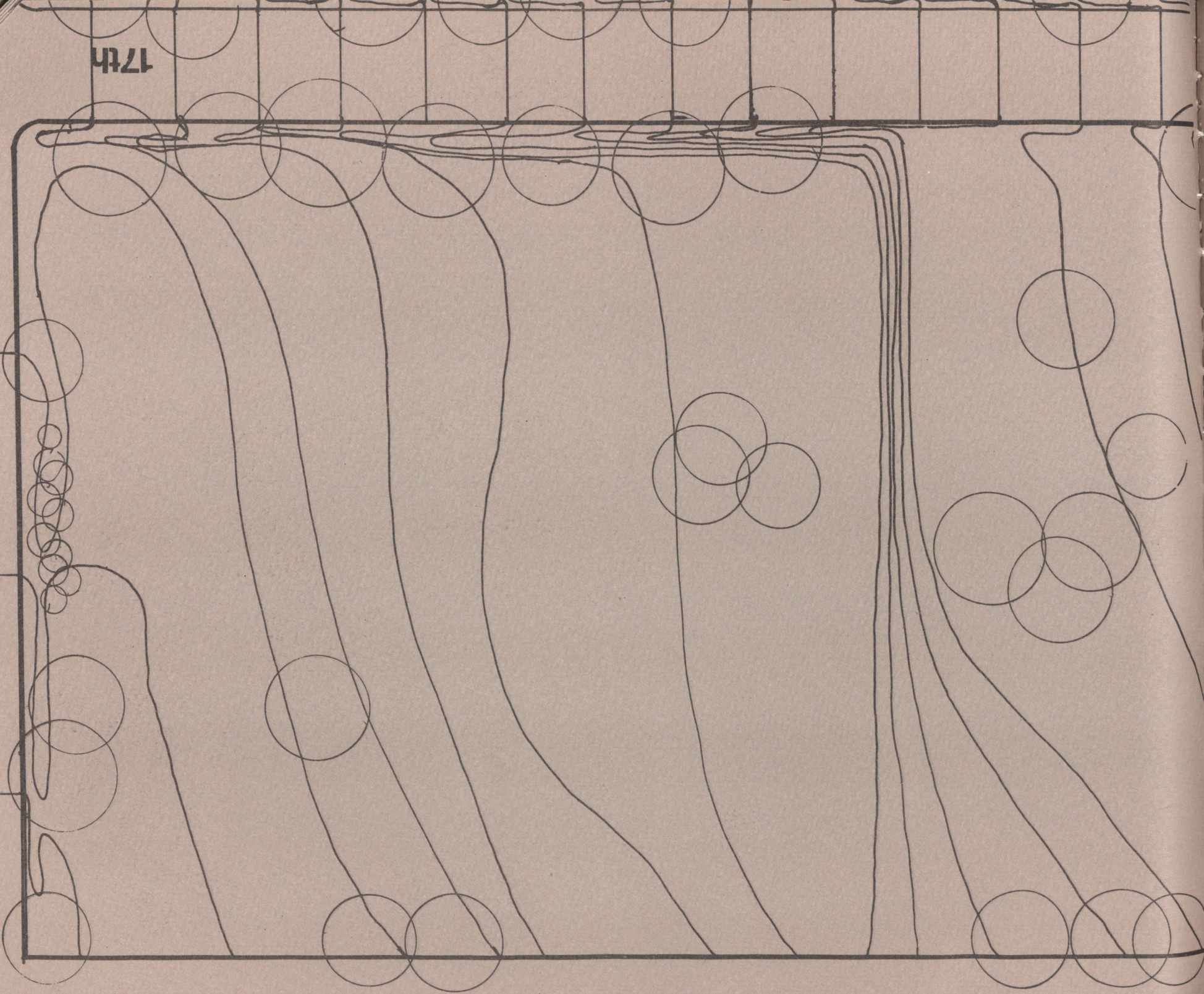
Rose Park

Park



17th

rimrock



the
concept **5**



The building is set back 100 feet from the north edge of the site. This is respecting the green band that runs from Rocky Mountain College to the institute along Rimrock Drive. Unlike the buildings of Eastern Montana College and Rocky Mountain College facing Rimrock Drive, the facade of the institute faces away from Rimrock and forms its own enclosure instead of having Rimrock Drive become its enclosing fence.

The facade faces into a courtyard or plaza much like the Venician Plaza. The bottom colonnade acts as the window into the shops and tells the story of the building by the placement of photo murals on the interior wall. The exterior colonnade separated from the main facade walls acts as a measurement to scale and as a reflection of interior walkway.

The facade acts as a sun screen and is also the structural wall for the joists. The two half arc windows emphasize the space within. The materials and form of the building do not relate to the neighborhood but to the site. The facade is concrete with sandstone or rock aggregate facing south as do the Rimrocks behind the building. The Rimrocks form a wall and so does the institute's facade. The sun will react on the facade as on the Rimrocks.

The space within the building is divided into 6 parts, 3 on the lower level and three on the upper. Administration is placed closest to the entrance, so personal or public do not have to go any further into the building. The library or data center is placed in the center for it is the heart of knowledge within the complex.

Shop is placed under Design for there are close ties of a designer working both two and three dimensionally.

The vines on the facade will work to keep sun out in summer and also create a pastel modeled light as well as let in winter sun. The two story space or circulation path is an inner courtyard with vines, small trees, etc. for year around physiological comfort.

The building contains 42 different design considerations for the physically handicapped but is not a building that accents them. It is a building that houses designers not a museum of gimmicks.

Since both Rimrock Drive and 17th have vehicular limits of 33 mph, the building was designed to make a statement to a person going at this speed. From Rimrock he can tell the building has separate functions by the set back of second floor. From 17th the facade is a giant trellis covered with vines. As a person approaches by foot or wheelchair he picks up the detailing of the paving pattern, detailing of copper trelase, exterior finish of concrete.

When approaching from Rimrock Drive you pass a small courtyard. This is a taste of what lies beyond. When coming from 17th you experience large circular courtyard and the pass small. A reflection of the large courtyard.

The central circulation corridor is lined on the north wall by photo murals which have no scale to a person in a wheelchair or to a standing person. They are in scale to two story corridor.

The central half circle interior courtyard is a reflection of the exterior courtyard and also acts as a foyer for the auditorium. All central located walls and court radiate at one point in interior courtyard also exterior facade. The main entrance is also placed on a line through this point. Staff parking is placed on southwest end to reach different parts of the building and they can travel through interior colonnade or exterior colonnade depending on the day.

The sloping of the roof towards the residential areas is a reflection of the gabled roofs.

Drawings and photographs are labeled.

bibliography

- Arbitare, "La cita e anche nostra", April, 1973.
- Ashihara, Yoshinoba, Exterior Design in Architecture, Van Nostrand Reinhold Co., New York, 1970.
- Damon, Albert; Stoudt, Howard; McFarland, Ross; The Human Body in Equipment Design, Harvard Univ. Press, Cambridge, Mass., 1966.
- Industrial Design, "Should America Have a Design Council? Part 4: A Question of Values."
- Making Facilities Accessible to the Physically Handicapped, State Univ. Construction Fund, Albany, New York, 1967.
- McCormick, Ernest J., Human Factors Engineering, McGraw-Hill Book Co., New York, 1970.
- Propst, Robert, The Office - A Facility Based on Change, Business Press International Inc., 1968.
- Salmon, Cuthbert & Christine, Sheltered Workshops, Oklahoma State Univ., Stillwater, Oklahoma, 1966.
- Whittick, Arnold, European Architecture in the Twentieth Century, Crosby Lockwood & Son, Ltd., London, 1953.
- Wittkower, Rudolf, Architectural Principles, Alec Tirant, London, 1967.
- Venturi, Robert, Complexity & Contradiction in Architecture.

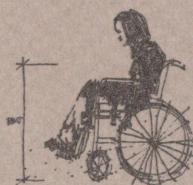
special conditions



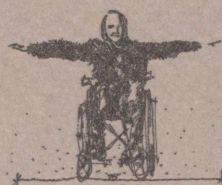
efficiency reach



width of wheelchair



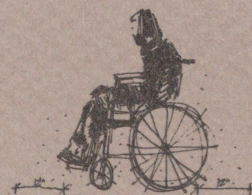
counter heights - desks



max. reach efficiency zone



locomotion



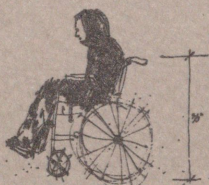
comfort zone



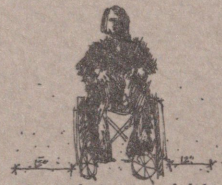
comfort zone - maximum side reach



security grabbing



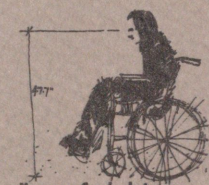
push handle height



wheelchair width transition areas



easy forward reach



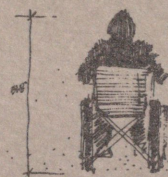
line of sight



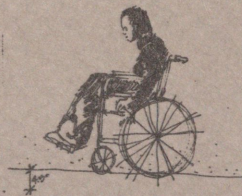
length of wheelchair



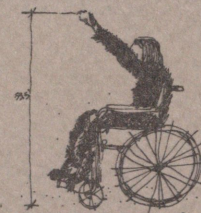
kick and scuff area



height of person



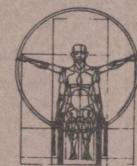
maximum slope

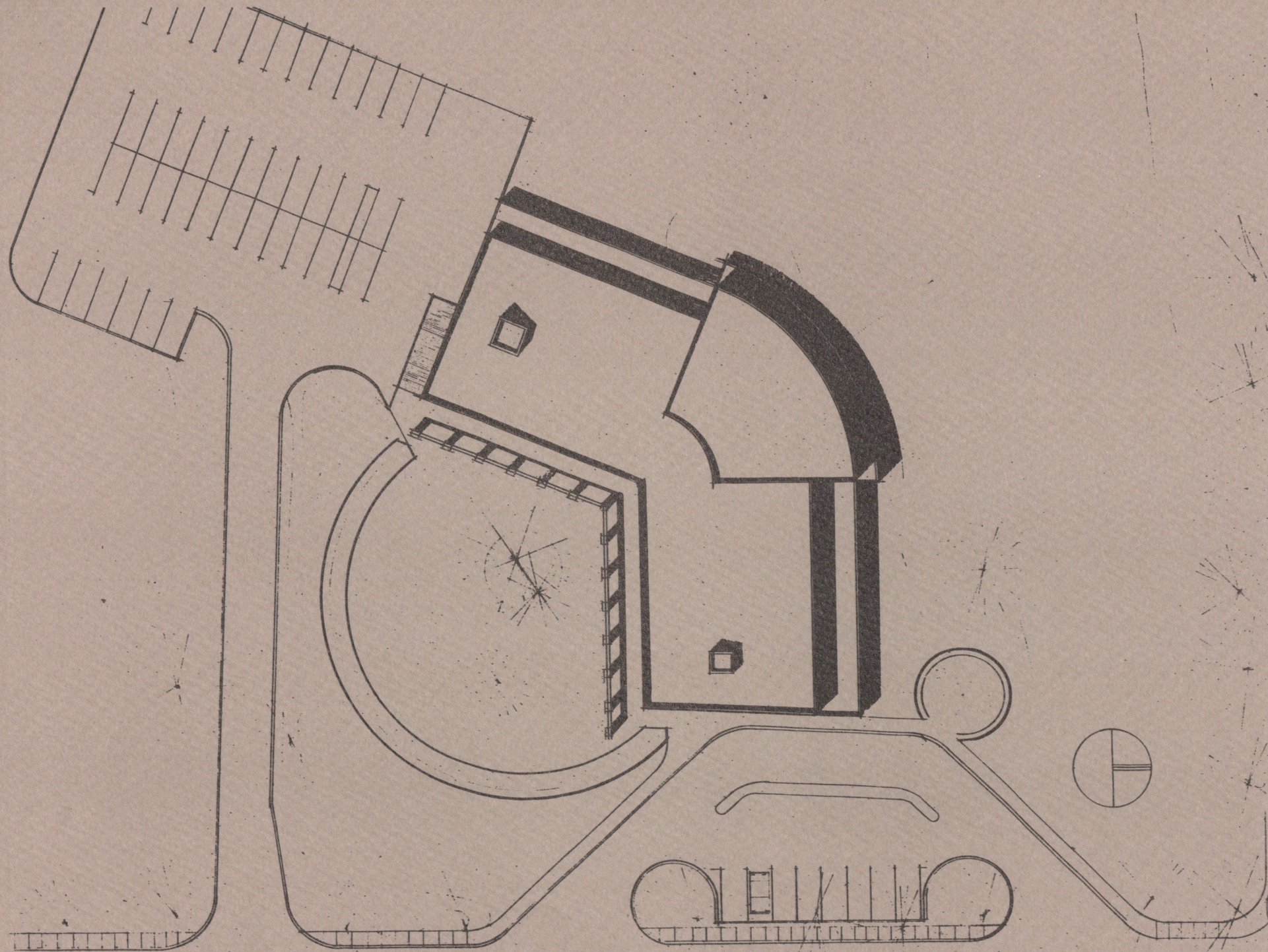


max. vert. reach



two way passage

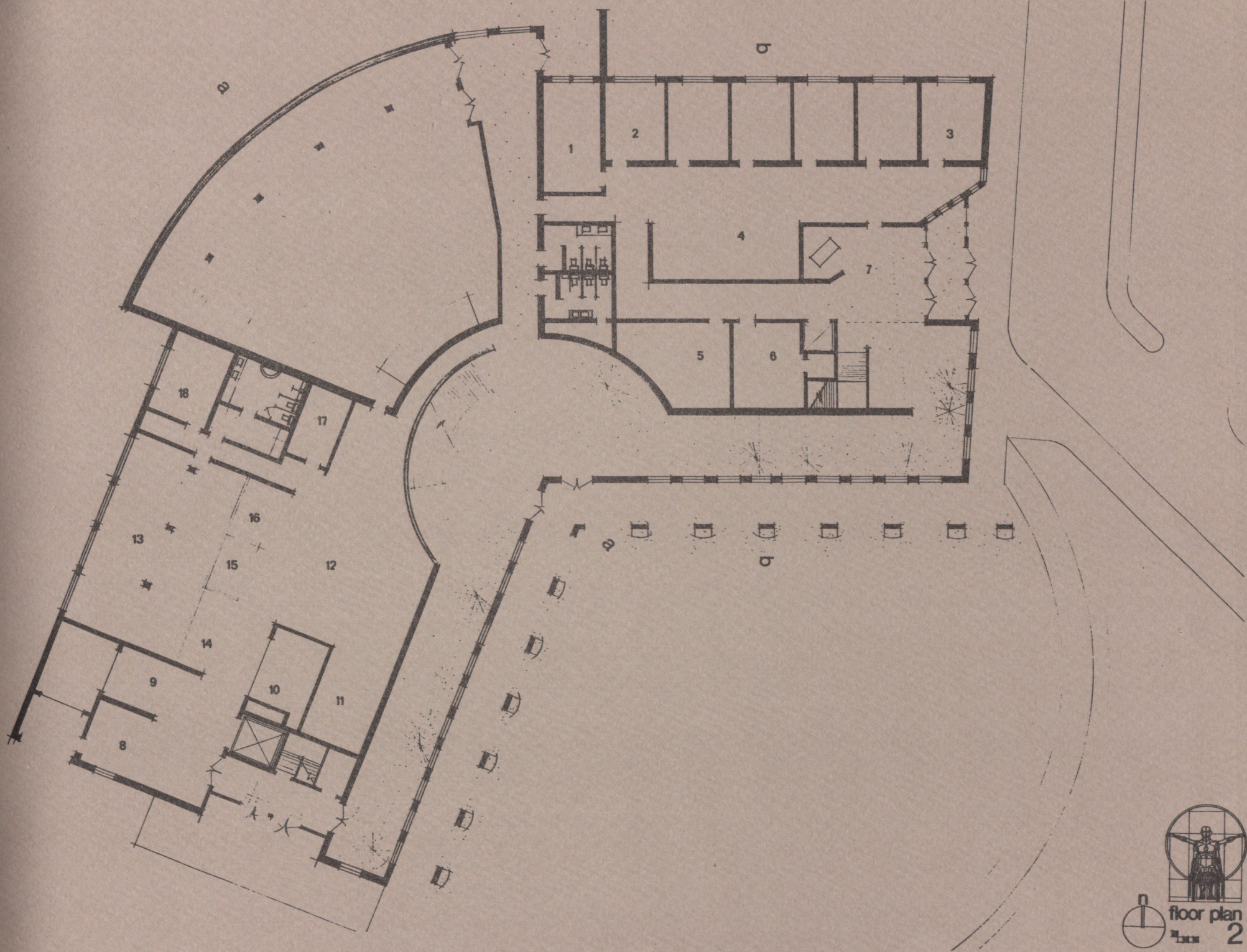


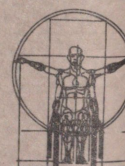
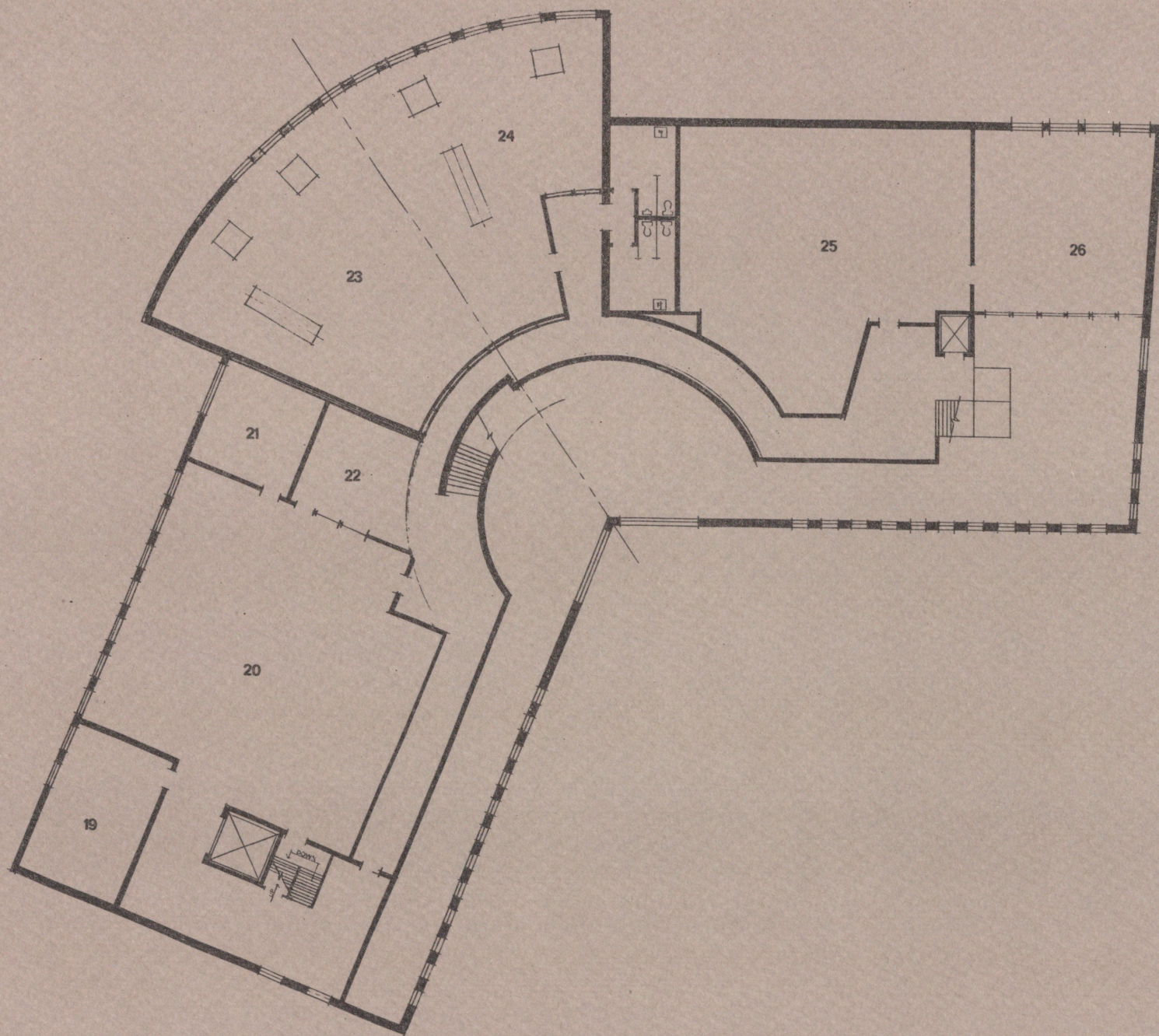


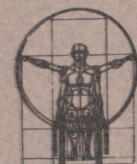
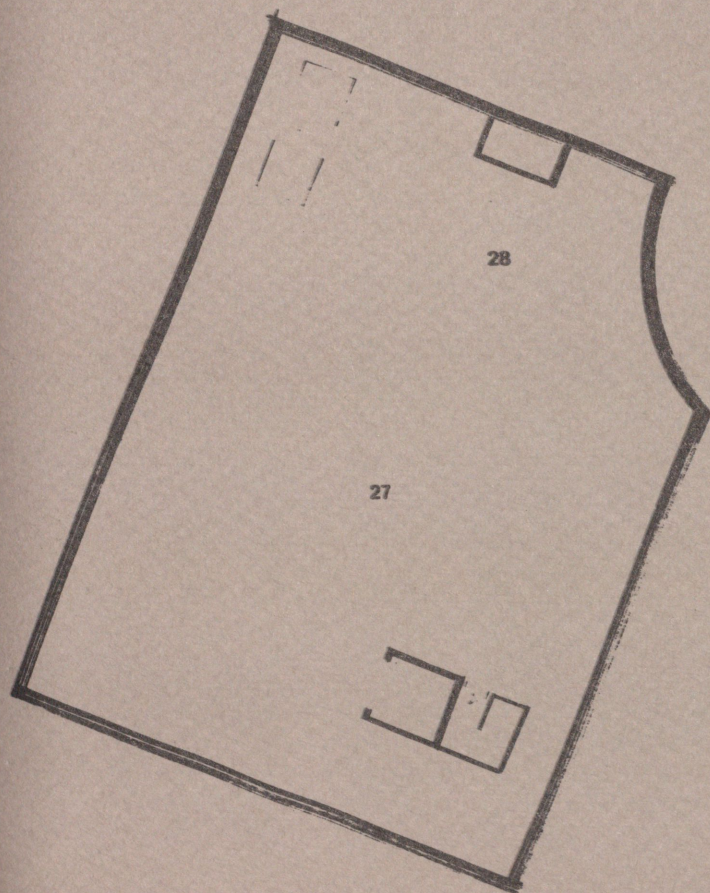
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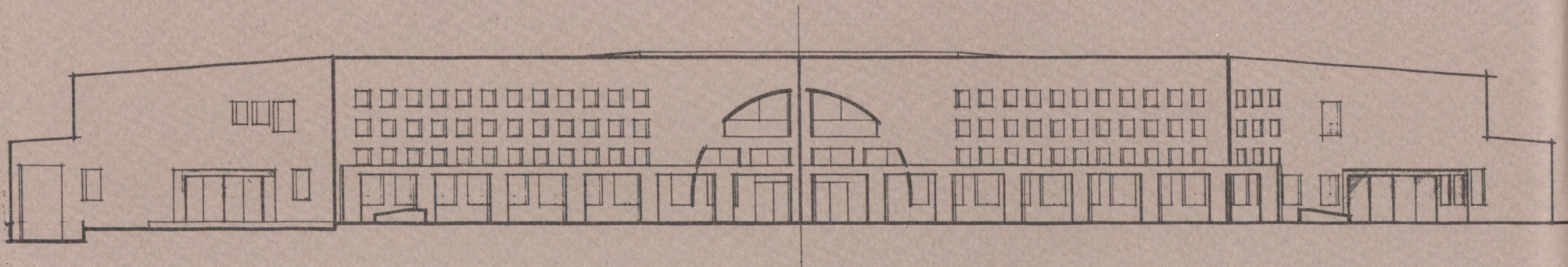
rimrock



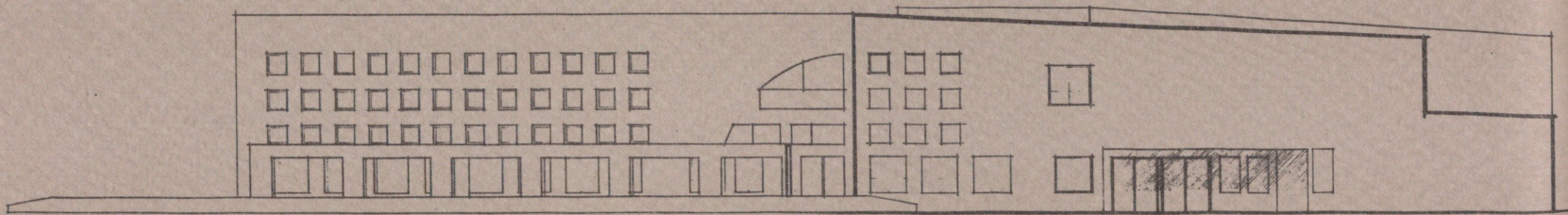








south

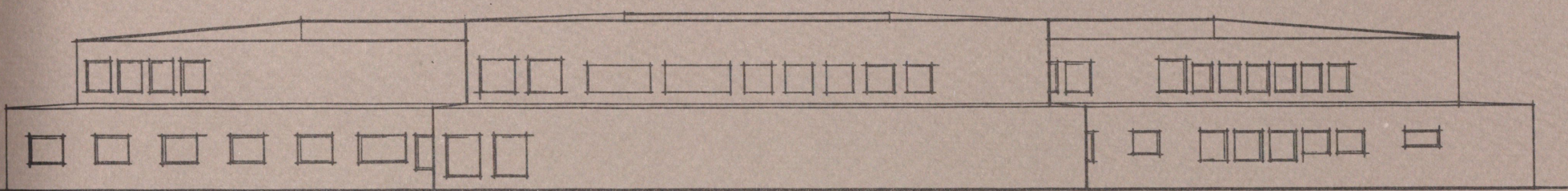


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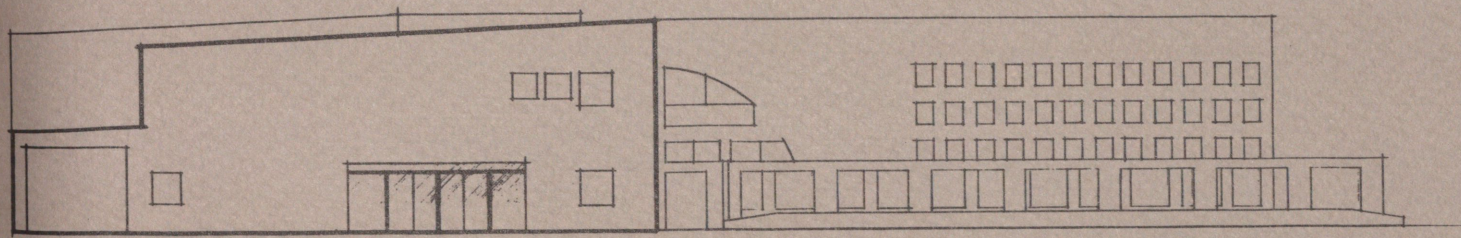


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4

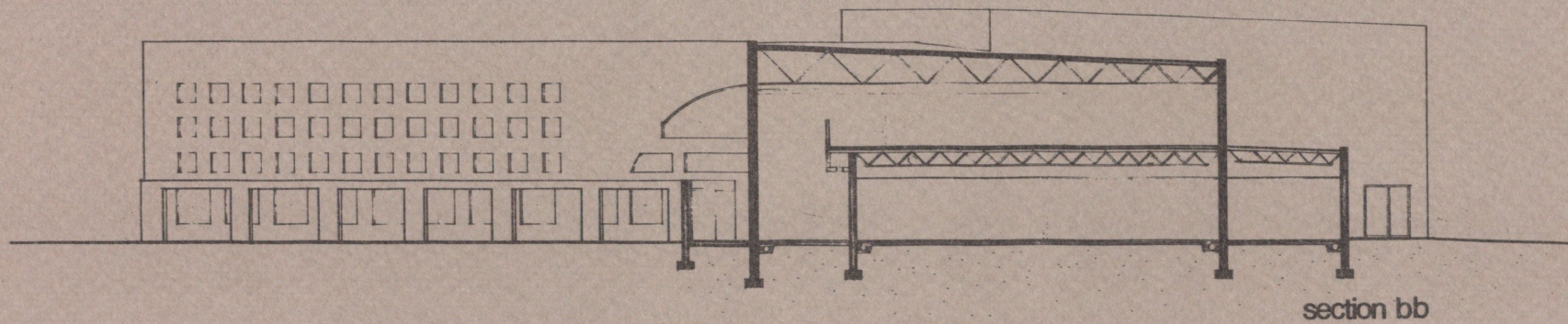
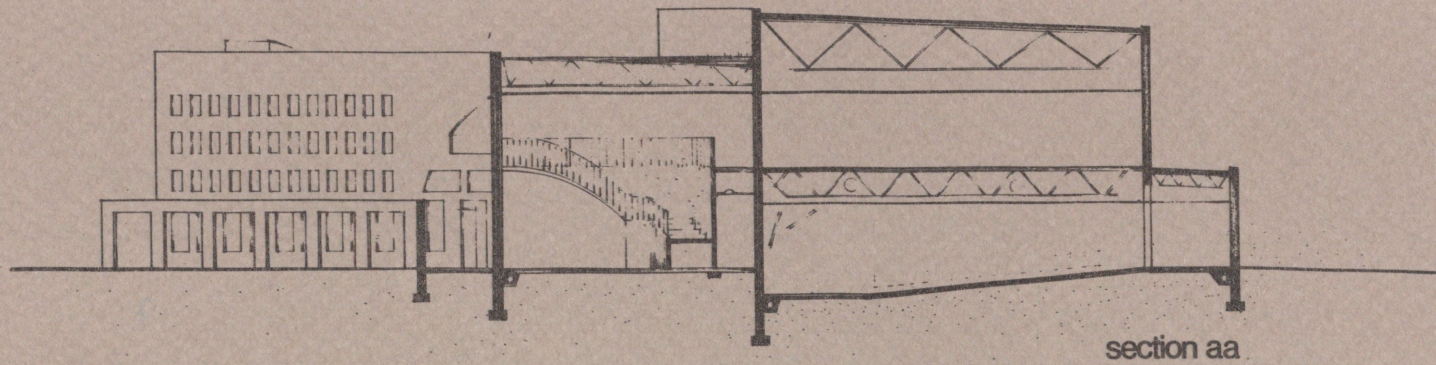
THICK

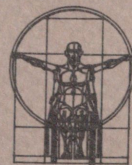
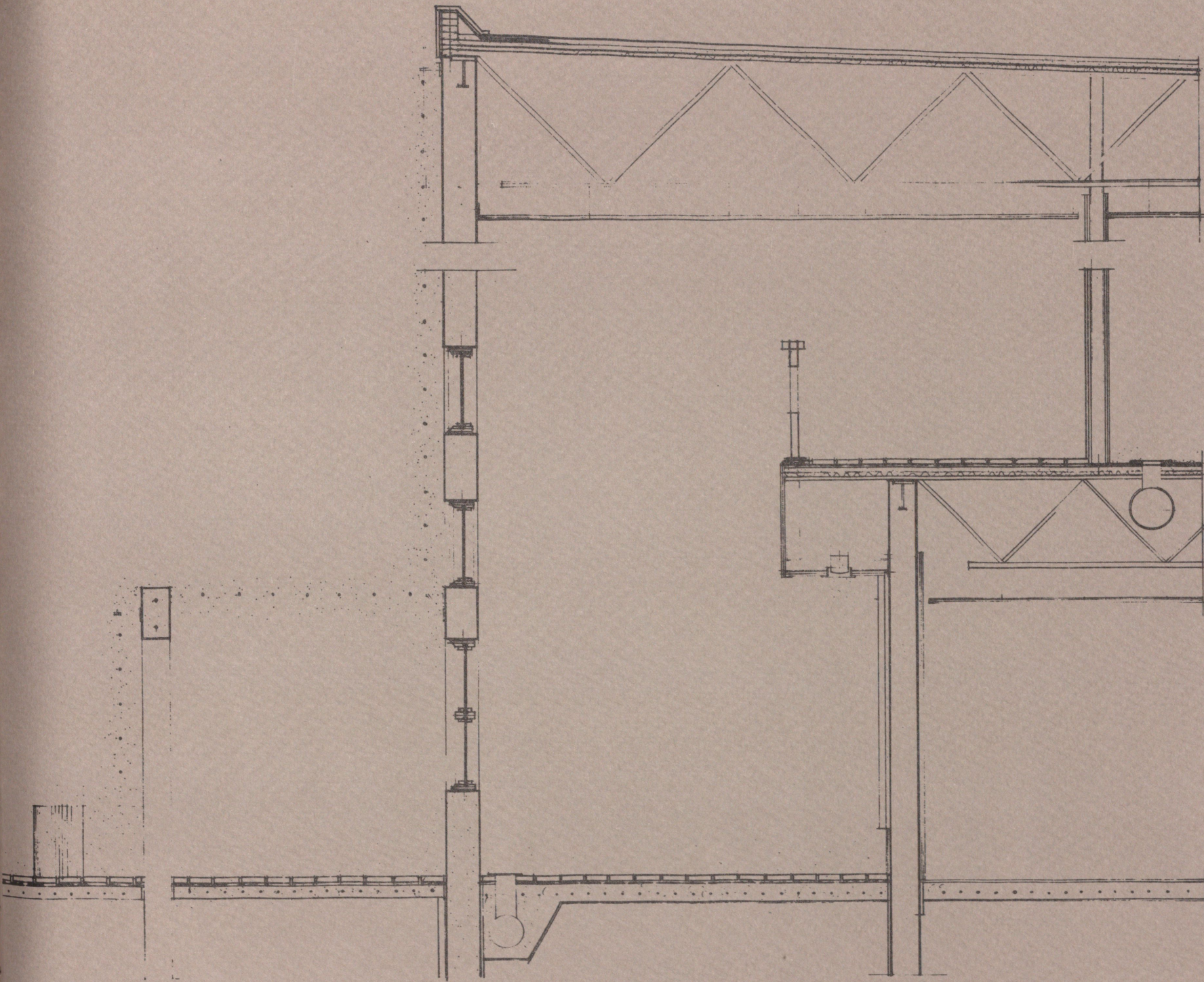


north

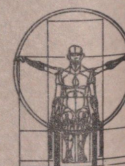
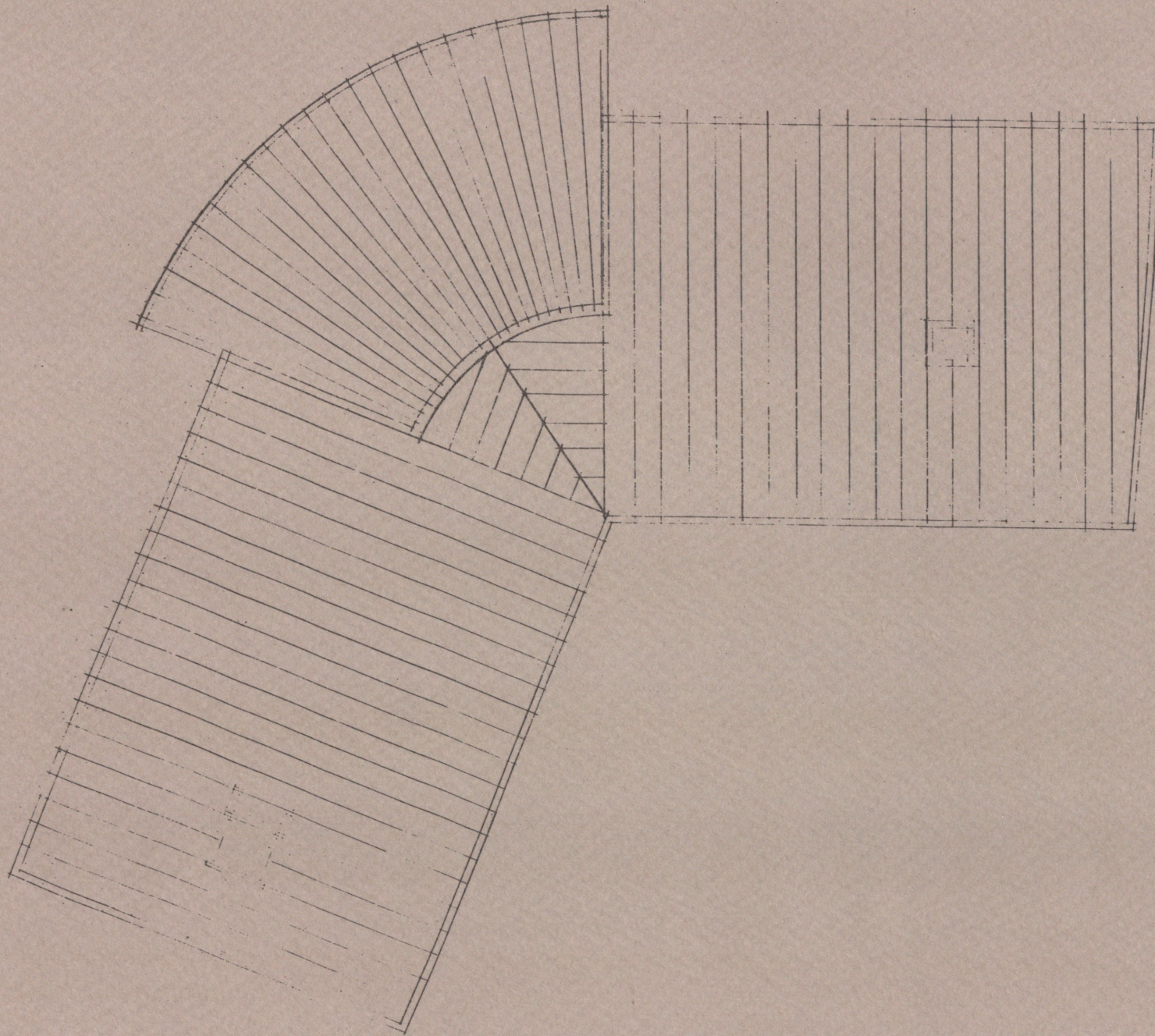


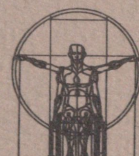
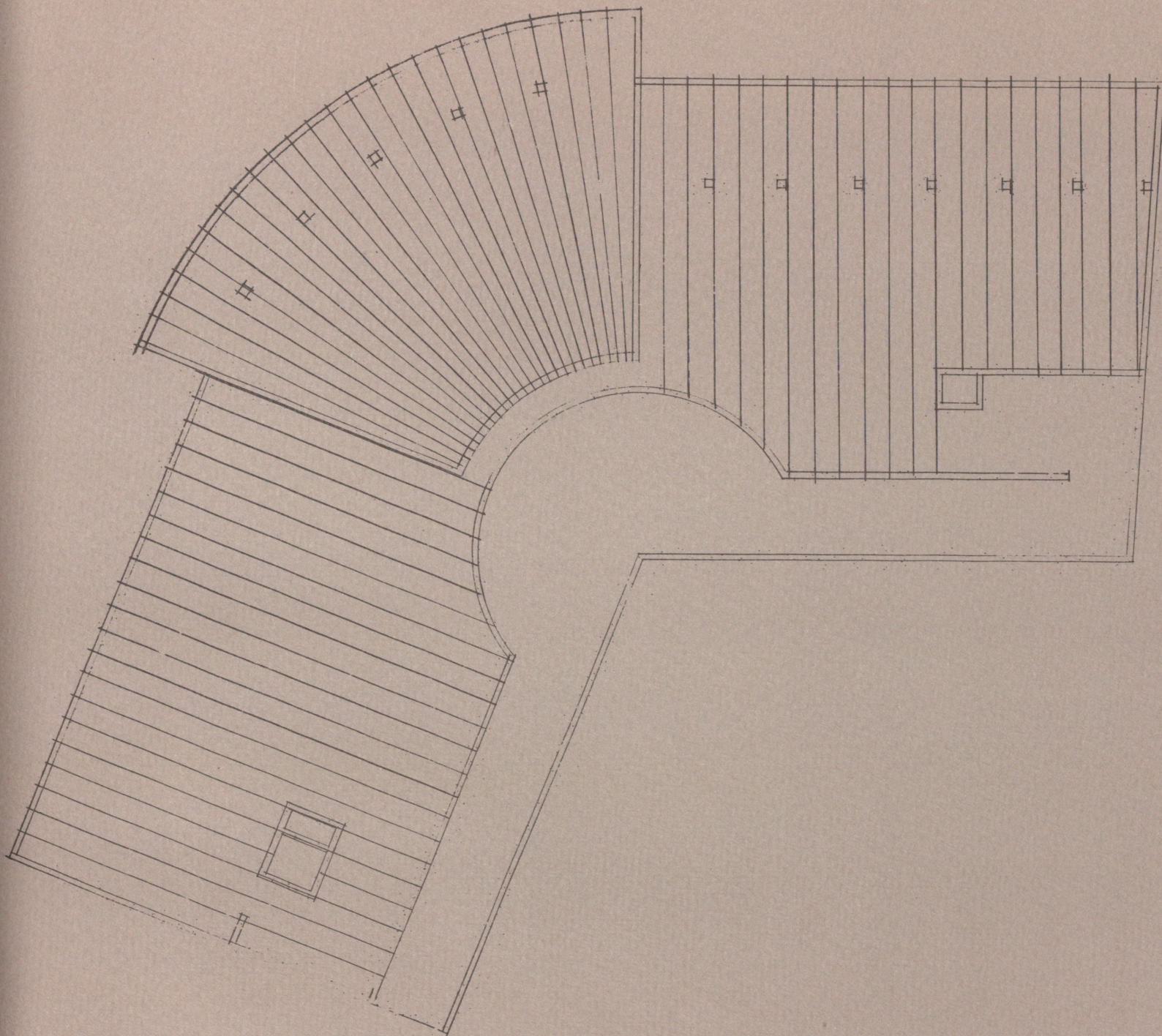
southwest





section
6



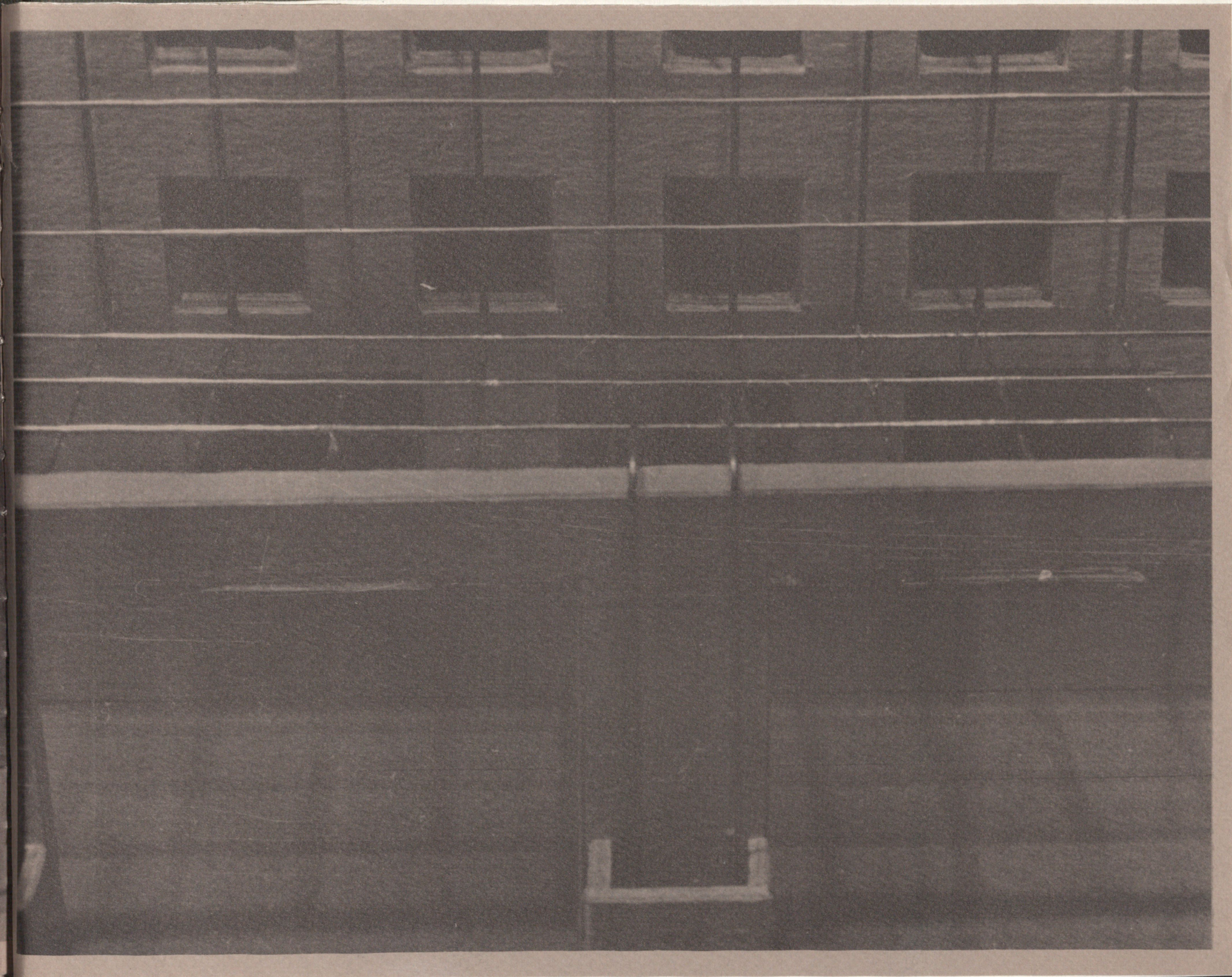












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