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HIGH RISE OR LOW RISE. A STUDY OF DECISION FACTORS IN RESIDENCE HALLS PLANNING.

UNIVERSITY FACILITIES RES. CTR., MADISON, WIS.

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THE PURPOSE OF THIS REPORT IS TO SERVE COLLEGE OFFICIALS, HOUSING ADMINISTRATORS, PLANNING GROUPS AND ARCHITECTS BY FOCUSING ON THE DECISION FACTORS WHICH RELATE TO HIGH-RISE AND LOW-RISE STUDENT HOUSING. DECISION FACTORS INCLUDE--(1) LAND USE IMPLICATIONS, (2) SITE REQUIREMENTS--BUILDING CODES, SUB-SOIL CONSIDERATIONS, NATURAL TERRAIN, ACCESSIBILITY, OUTDOOR AREAS, CAMPUS PLAN, GROWTH PATTERN, (3) COST IMPLICATIONS, (4) OPPORTUNITIES FOR CUMULATIVE SAVINGS, (5) TECHNICAL CONSIDERATIONS--BUILDING MATERIALS, SUCH MECHANICAL SERVICES AS PLUMBING, ELECTRICITY, (6) TRAFFIC REQUIREMENTS, (7) COMMON FACILITIES AND SERVICES, (8) OPERATIONAL FACTORS--MANAGERIAL SUPERVISION, HOUSEKEEPING, MAINTENANCE AND REPAIR, (9) SIZE AND INSTITUTIONAL BIGNESS, AND (10) SOCIOLOGICAL IMPLICATIONS. APPENDICES DISCUSS--(1) COMPARATIVE EVALUATION OF HIGH-RISE VS. LOW-RISE DESIGN, (2) HEIGHT OF HIGH-RISE, (3) PROGRAM STATEMENT FOR ST. OLAF COLLEGE, AND (4) CHECKLIST FOR RESIDENCE HALL PLANNING. (HH)

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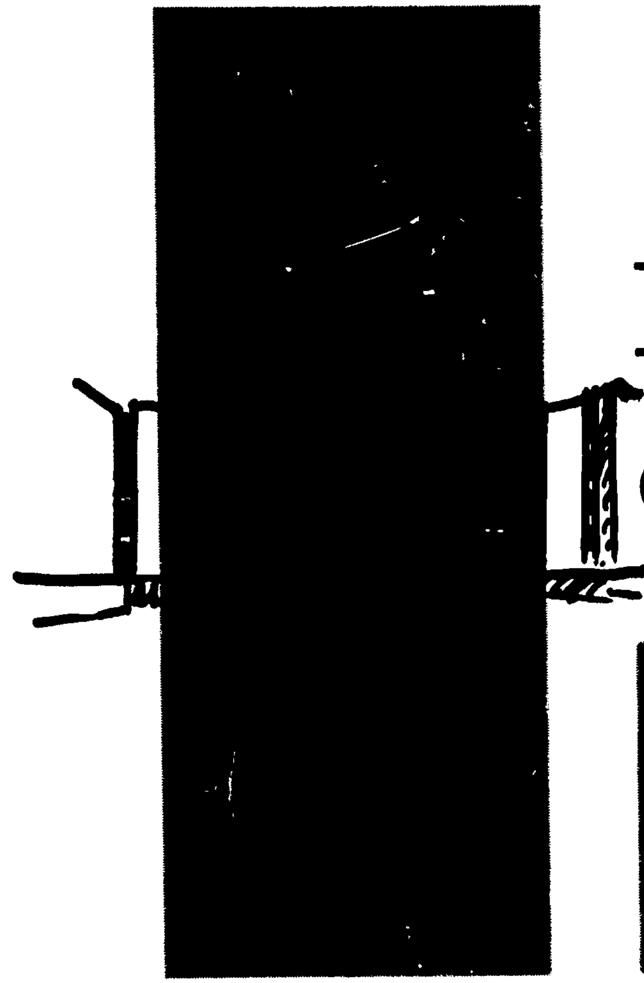

HIGH RISE or LOW RISE?

A Study of Decision Factors in Residence Halls Planning

EF 000251

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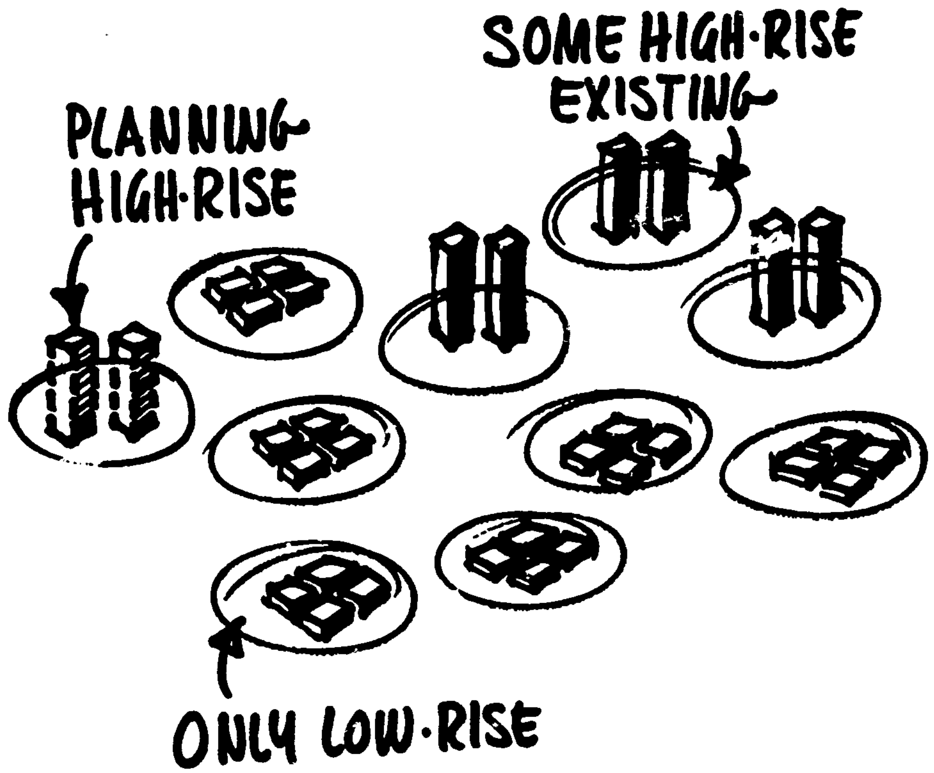

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- Central Food Stores Facilities

H[redacted] RISE
O[redacted]OW RISE?

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A Study of Decision Factors for Residence Halls Planning

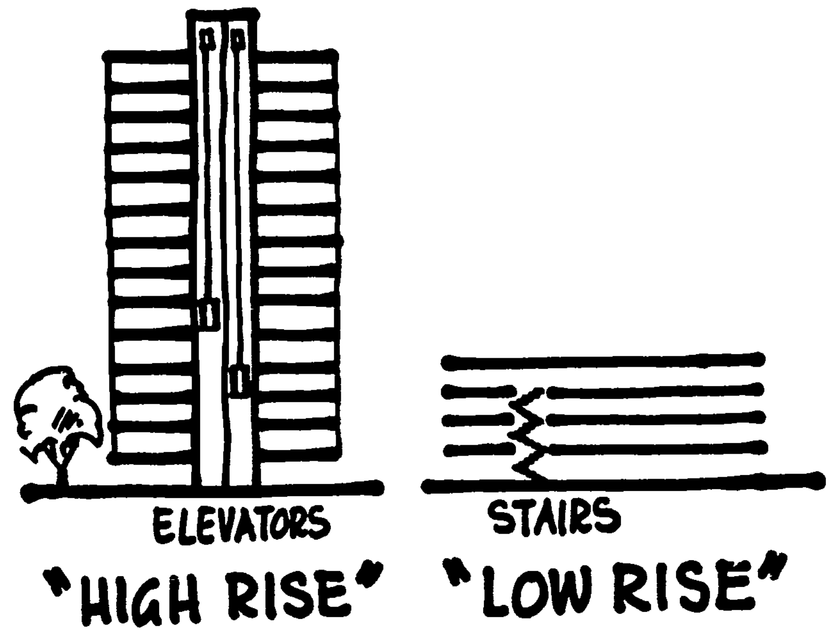
The appearance of high-rise residence halls on an increasing number of campuses has given a new dimension to the basic consideration of how students shall be housed. The old questions of type of student room accommodations, required facilities, size of unit, location, and budget still remain. The new question of whether a proposed unit should be of *high-rise* type or the more traditional *low-rise* type now confronts housing directors, administrators, university architects, and campus planners.

Recognition of the need for more definitive information about this basic question was first formalized by the Research Committee of the Association of College and University Housing Officers. Unanswered questions such as the following led to financial as well as member participation of ACUHO in the study: *What are the advantages of high-rise construction? Are high-rise residence halls merely a fad or perhaps a current type of status symbol? Can they offer satisfactory qualities of student living? What are the differences economically, operationally and sociologically? How high should a "high-rise" be? What actually constitutes a high-rise residence hall?*

These questions and the growing importance of this type of residence hall led to formulation of a procedural approach by the University Facilities Research Center. Major financial support needed to execute the study and publish the findings was granted by the Educational Facilities Laboratories, Inc. Three members of ACUHO served as manuscript participants and a fourth fulfilled the ACUHO–UFRC coordination needs. Two members of the architectural and planning firm of Perkins & Will prepared the architectural considerations portion of the study and integrated the manuscript text and illustrations into its final form.

Project procedure for the study was based on an initial survey of colleges and universities having an enrollment of two thousand or more. Returns showed that nearly *thirty percent* of these institutions were presently operating high-rise residence halls. Another *ten percent* were currently planning or building residence halls of the high-rise type.

Predicated on the premise that housing directors experienced in operating existing high-rise units as well as comparable low-rise residence halls could supply answers to the basic questions, a meeting was held to explore as many details as possible. Fourteen such housing directors participated in the two-day conference, representing geographic coverage of the entire United States as well as a variety of sizes of schools. As a means of protecting against possible omission of important considerations, the list of participants also in-



cluded housing directors of institutions currently evaluating the possibilities of building their first high-rise residence halls.

The representative administrators participating in the sessions were able to discuss intangible as well as tangible factors of student housing and evaluate low-rise and high-rise residential units. Their comments effectively supplemented factual data and experience factors obtained from a detailed questionnaire completed and returned by 41 universities presently operating high-rise residence facilities.

For the purpose of this study "high-rise" residence halls are defined as units in which primary reliance is on elevators for access to student rooms. "Low-rise" residence halls rely on stair access to student rooms and elevator service, if provided, is limited to use by custodial personnel and handicapped students.

The decision as to whether future housing should be high-rise or low-rise, or a certain proportion of both, can only be made after consideration of all relevant factors at each campus. Each project should be studied in relation to the overall program of the school, so that the determination of the appropriate building type will have a sound basis.

It is the purpose of this report to serve college officials, housing administrators, planning groups, and architects by focusing on the decision factors which relate to high-rise and low-rise housing. These factors are made more specific by exploring the differences of the two types in the areas of planning, economics, operation and use.

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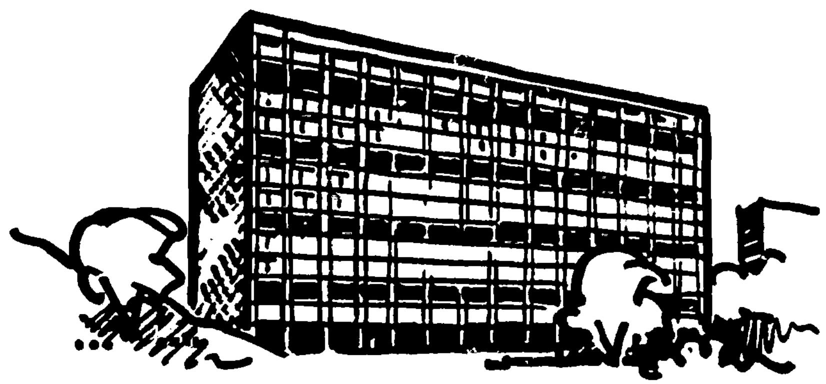
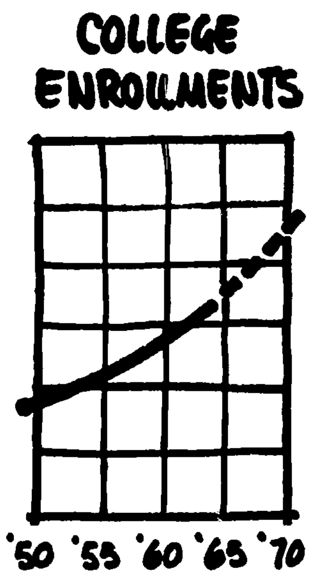
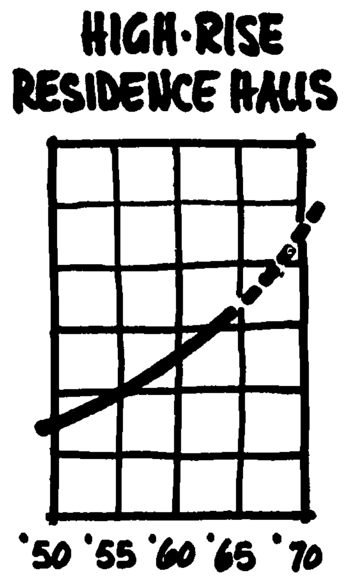
Conference and study work session
Participants identified on Page 47.







THE RISE OF HIGH-RISE

Originally, high-rise residence halls appeared at colleges in metropolitan centers where every new building required purchase of new land and land costs were extremely high. Subsequently, high-rise units have appeared at other campuses for other reasons. The use of high-rise residence halls on an increasing number of campuses is symbolic not only of the great volume of residence halls construction underway, but also of the land shortages which are developing on many campuses.

College and university enrollments have increased steadily for many years, and even more rapid increases are foreseen in the years immediately ahead. Colleges which may have already undertaken and completed a series of projects are finding that unfilled needs for student housing are greater than when they began. As a result, the trend is toward larger and larger units or groups of units. Very often these larger units are taking the form of high-rise residence halls.

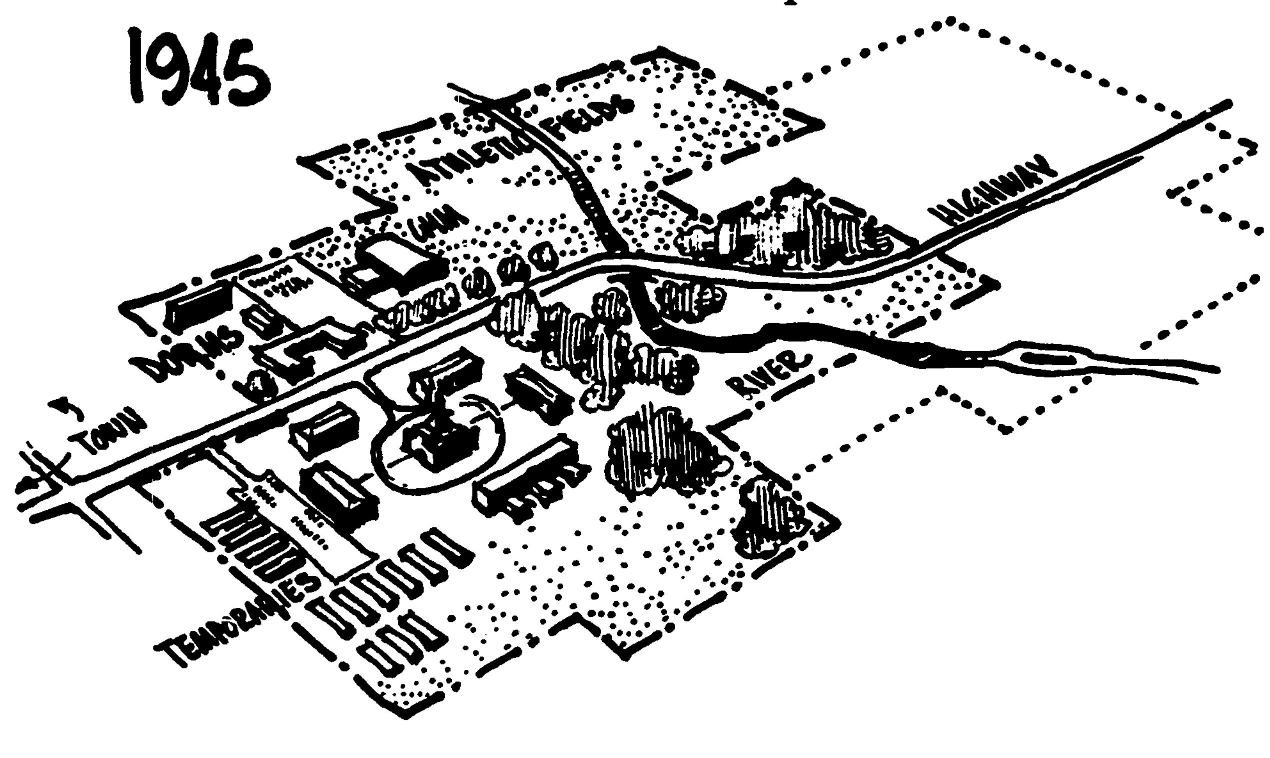
Up to now, most campuses, except in urban locations, have had adequate open areas to accommodate additional student housing. However, academic facilities have been built at a rapidly increasing rate. As a result, even large campuses with relatively small enrollments are developing land shortages. Competition for the remaining campus building sites is creating new pressures in short-range as well as long-range planning. Considerations of maximum use of available land, costs of new land acquisition, and practical limitations of distances between student housing and other campus facilities, have caused many colleges and universities to construct the high-rise type of residence halls.

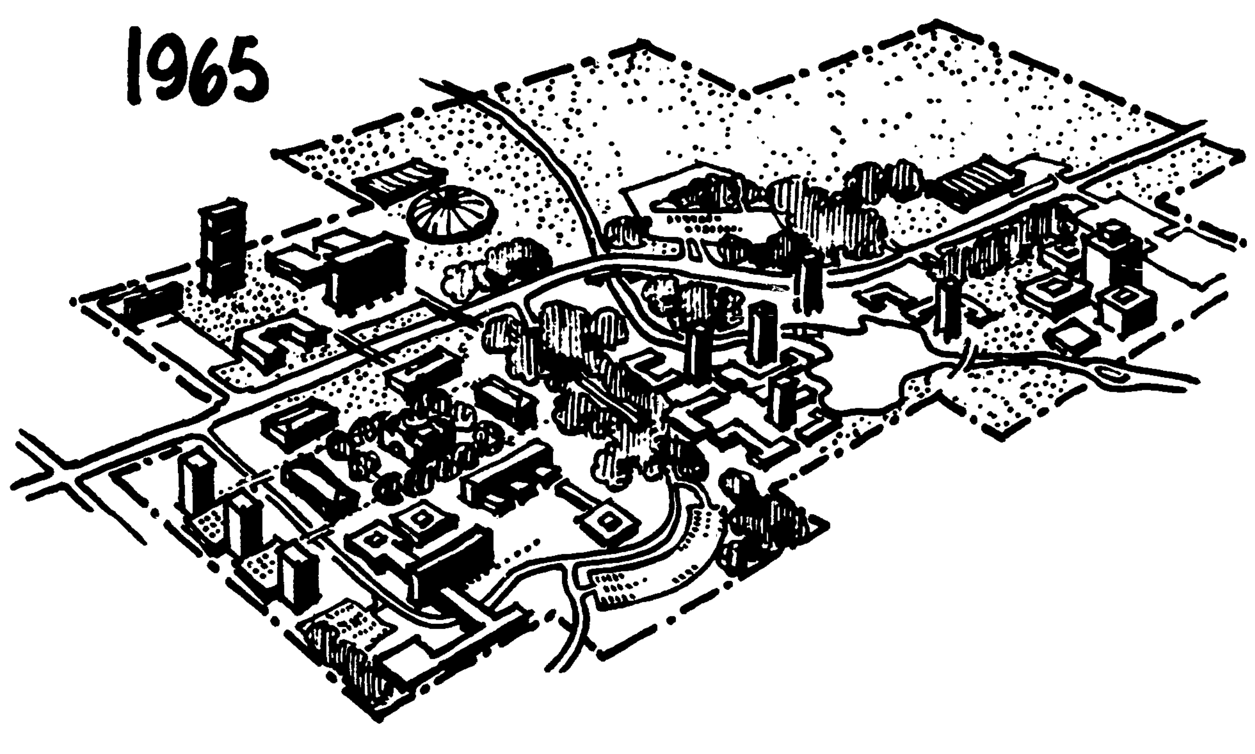
LAND USE IMPLICATIONS OF HIGH-RISE CONSTRUCTION

The basic advantage of high-rise construction is obviously the small area of land required in relation to the number of students housed. Low ground coverage may be important, or even be a determining factor, for any one of several reasons:

1. High Land Cost
2. Small Site Area
3. Need to Conserve Valuable Land

Where land must be purchased and land values are high, the number of students to be housed must be set high in relation to land area,

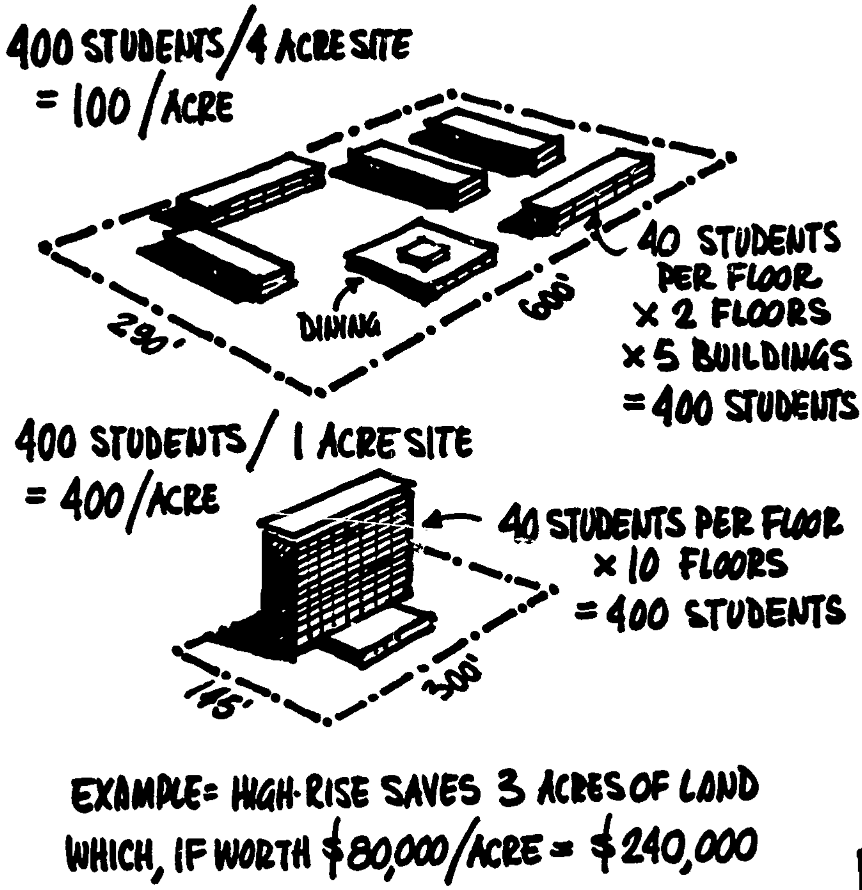




so that the purchase cost, *per student*, will not be an excessive burden on the economy of the project. Land value may be high even if the site is already owned. The intrinsic value of the site to the university for other buildings or as needed open area should be considered, as well as its value in terms of replacement cost for equivalent land elsewhere. A thorough understanding of the real value or intrinsic worth of a site is a necessary starting point in determining the number of students which should be housed on it.

It would be most helpful to have a magic formula which would indicate the proper housing potential and student density for a given site on any campus. However, as with most short-cut methods, such a formula would be too good to be true. Gauging the value of a site and determining the concentration of students that is appropriate for it, are largely matters of informed judgment, based on the circumstances of a particular campus. Reference data on these two points may, however, be useful as a general guide.

A study made at The University of Illinois by the architectural and planning firm of Richardson, Severns, Scheeler & Associates is included in the appendix. It shows that equivalent buildings designed as low-rise and alternatively as high-rise, tend to differ in cost by the added amount spent in the high-rise for elevators and the area they occupy. The amount of added cost for the high-rise unit is then compared with the related land area. The study finds that under the conditions of time and place of the comparative evaluation, high-rise buildings constructed on sites exceeding $2.14–$2.85 per square foot would result in a savings of total costs per student housed. The study further indicates that with a building construction cost of $15 per square foot, it would be well to evaluate total cost comparisons when the land value is as low as $1.50 per square foot. The



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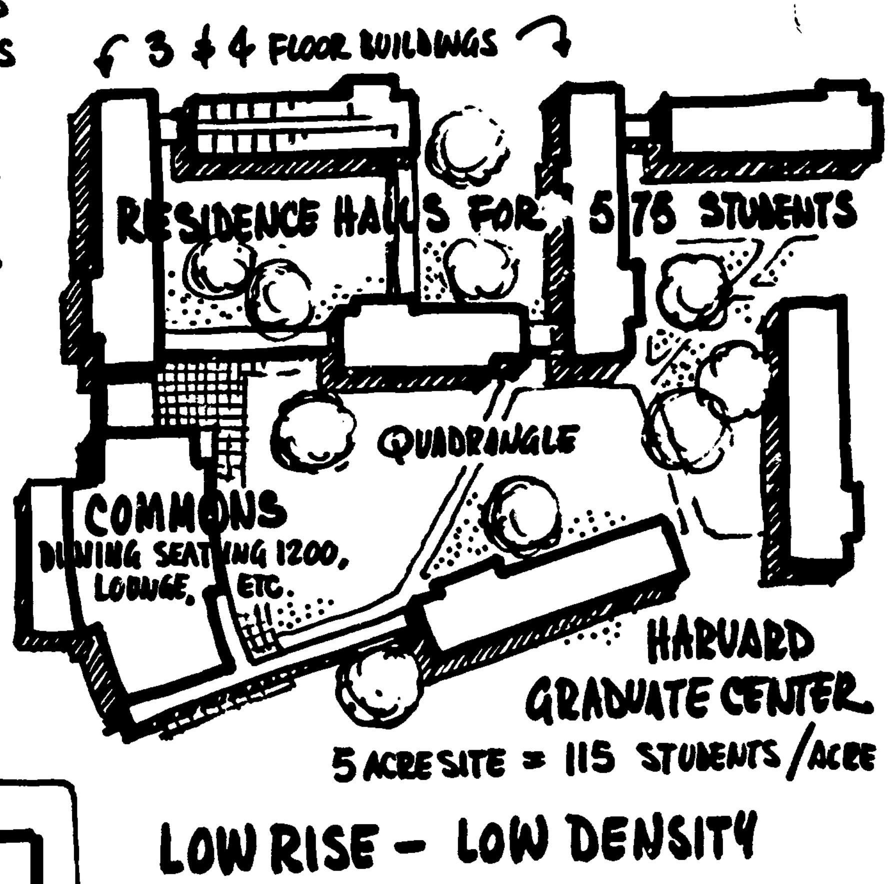

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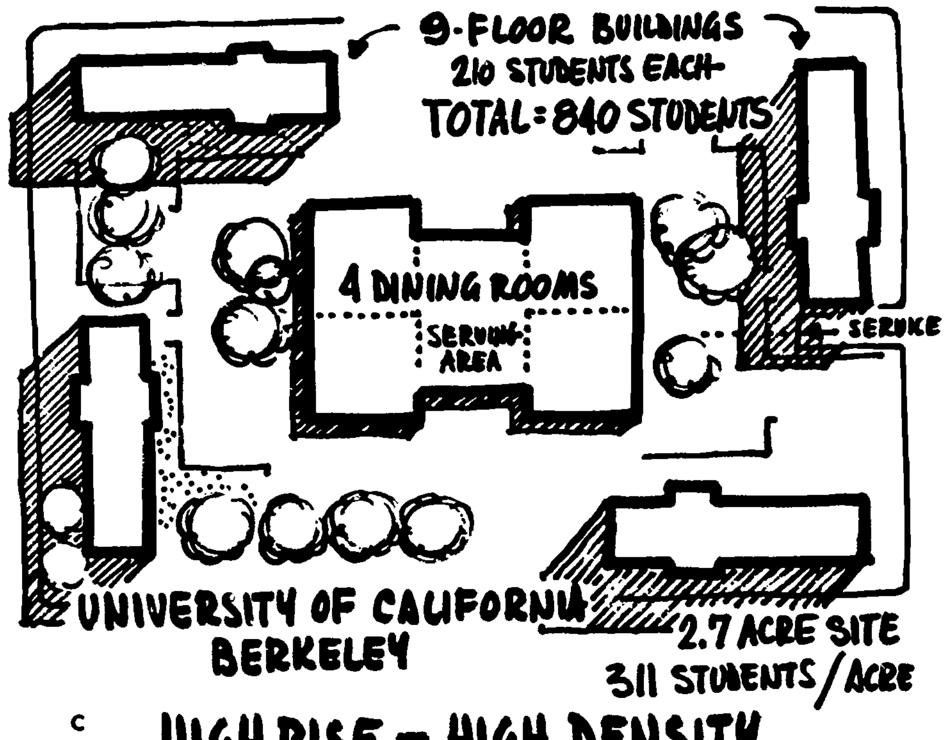

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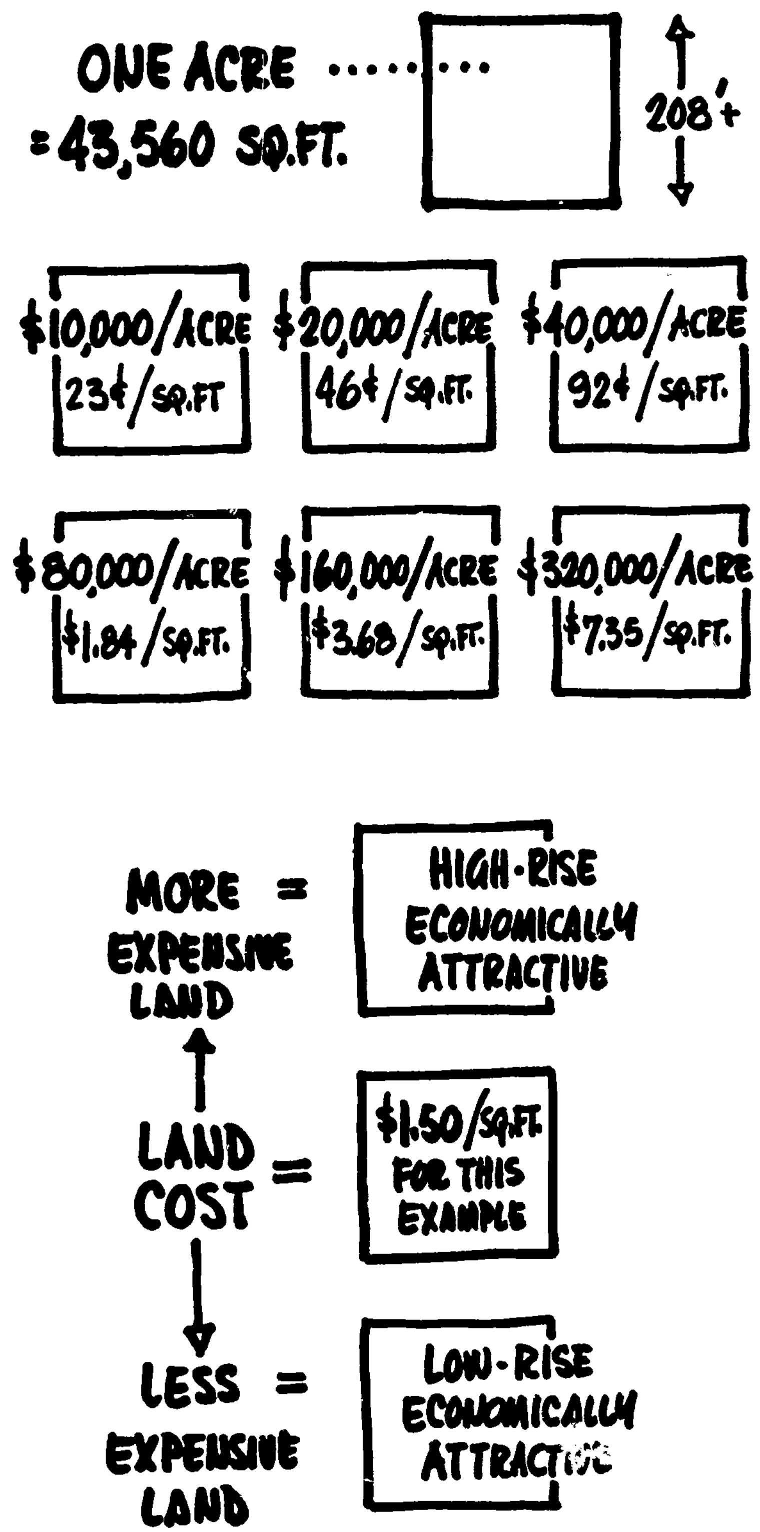


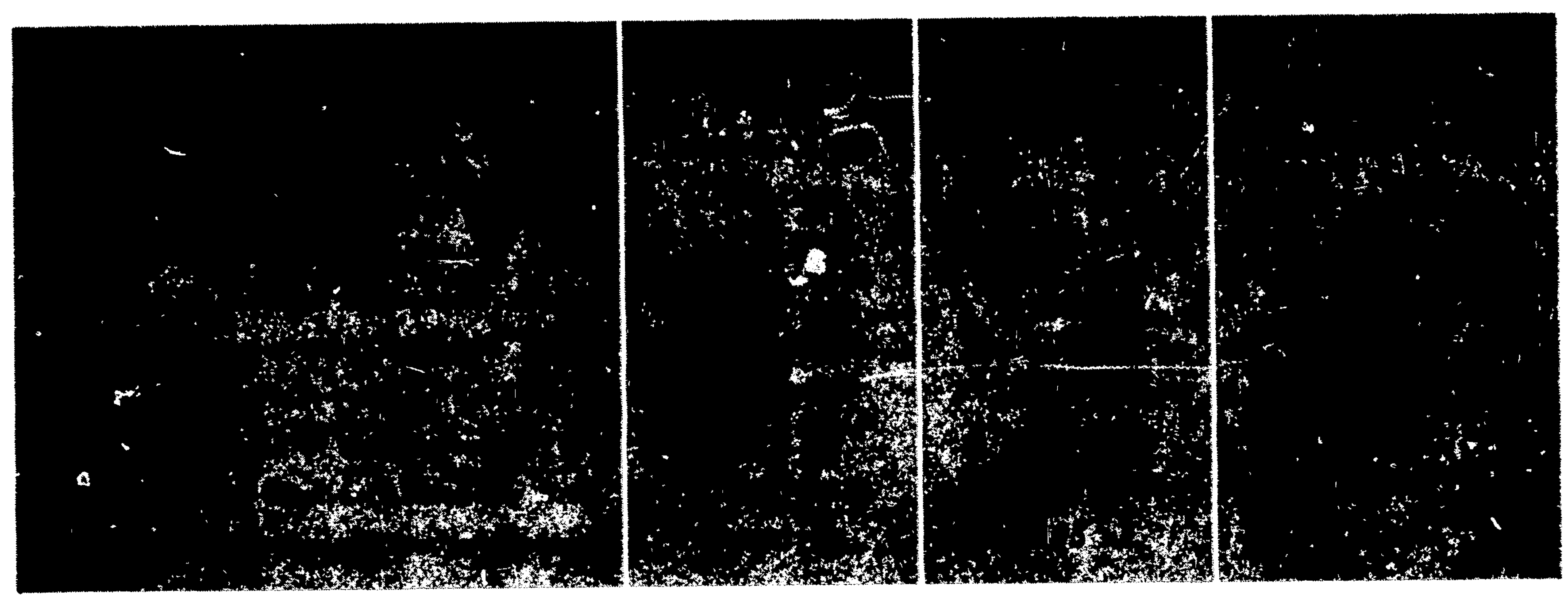
study assumes a relatively level site adjacent to improved streets and basic utilities. Special costs such as grading, demolition, or extension of campus roads and utilities should be included as part of the total land cost if these apply in a given case.

Appropriate concentrations of student housing for a given site depend a great deal on local factors. Requirements for outdoor recreational space, for parking and for pedestrian or vehicular traffic vary greatly from campus to campus. The following table lists data for three representative universities with differing land situations and differing requirements for residence facilities. In each case auxiliary wings or buildings provide dining and service facilities which are included in area totals:

Although this sampling is too limited to establish reliable standards of reference, various land use implications may be derived from it. The young university (Column A) was undertaking its first major group of residence halls and desired to place not more than 1,500 students on a rather generous site with ample opportunity for outdoor recreational areas. It is interesting to note that this university has since found it is rapidly using up some of its best land area and is now making use of high-rise construction in subsequent housing projects. The state university (Column B) with a residential tract only slightly larger than used in (A) was able to house more than twice as many students with slightly less ground coverage by using high-rise buildings. In the urban situation (Column C) there were two thousand students to be housed and very little land to put them on. High-rise provided the only possible solution and ground coverage ratio was necessarily greater.

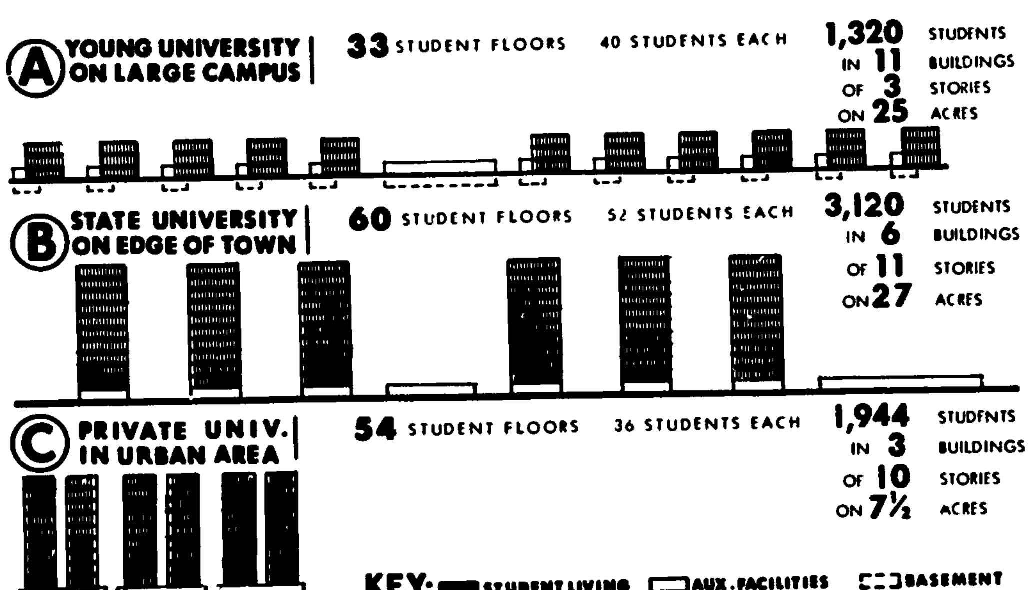
It should be noted from the table that land savings are not necessarily in direct ratio to the number of stories in the typical building. The high-rise examples (B and C) each have about three and one-half times as many stories as the low-rise example. Yet the capacity of (B) is only two and a half times (A) with about the same ground floor area. The number of students housed in (C), using two-thirds the ground floor area of the others, is about one and one-half times the number housed in the low-rise example.

Much of the variation from the expected ratio between number of floors and capacity can be understood by consideration of the ground floor area. In the low-rise project all three floors of each building have typical student floors. Conse-



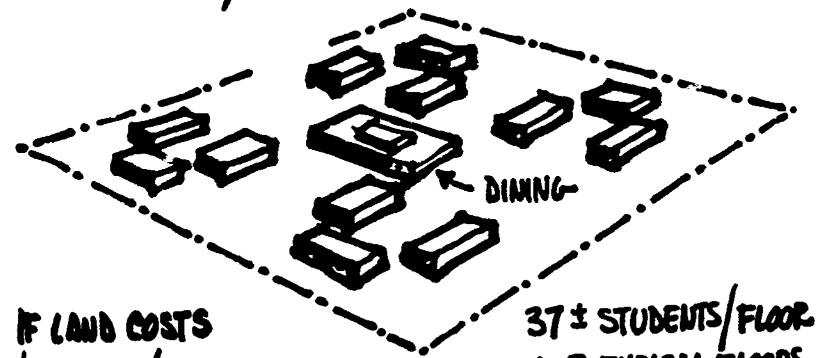
quently, the ground floor area includes one-third of the student living area plus one-story wings with lounge and counselor apartment and a one-story central dining hall. The high-rise projects have student living on upper floors only. The ground floor area of each high-rise unit is devoted to central facilities for that unit, with additional space for central dining and student services in an auxiliary wing or separate building. The accompanying diagram illustrates these relationships in graphic form.

Such phrases as "intensity of land use" and "increased concentrations of students" suggest undesirable trends which might be thought of as a necessary evil. However, concentration has its advantages. It produces conveniences and social relationships which are the essence of communities, whether for students or the general public. Areas such as Nob Hill and Telegraph Hill in San Francisco or Greenwich Village in New York are not without renown as pleasant places in which to live, yet they have a density of one hundred to two hundred dwelling units per acre, much greater than the number of student rooms per acre on most campuses.



ACCEPTABLE CAPACITIES AND LAND USE RATIOS VARY WITH LOCAL NEEDS AND LIMITATIONS

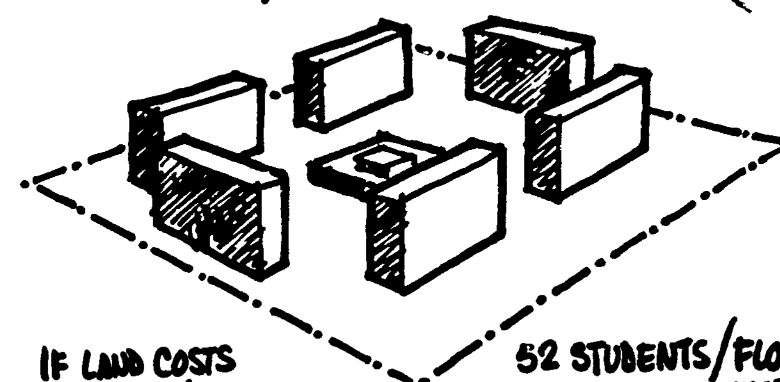
1320 STUDENTS/25.8 ACRES = 51 STUDENTS/ACRE



IF LAND COSTS $80,000/ACRE, LAND COST PER STUDENT = $1563

37 ± STUDENTS/FLOOR × 3 TYPICAL FLOORS × 12 UNITS ... = 1320 STUDENTS

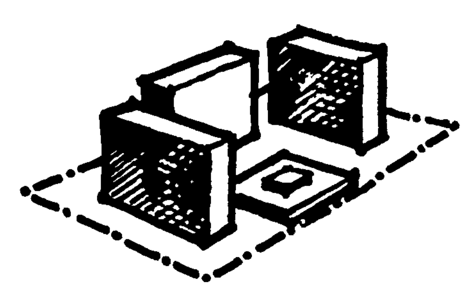
3120 STUDENTS/26.5 ACRES = 118 STUDENTS/ACRE



IF LAND COSTS $80,000/ACRE. LAND COST PER STUDENT = $679

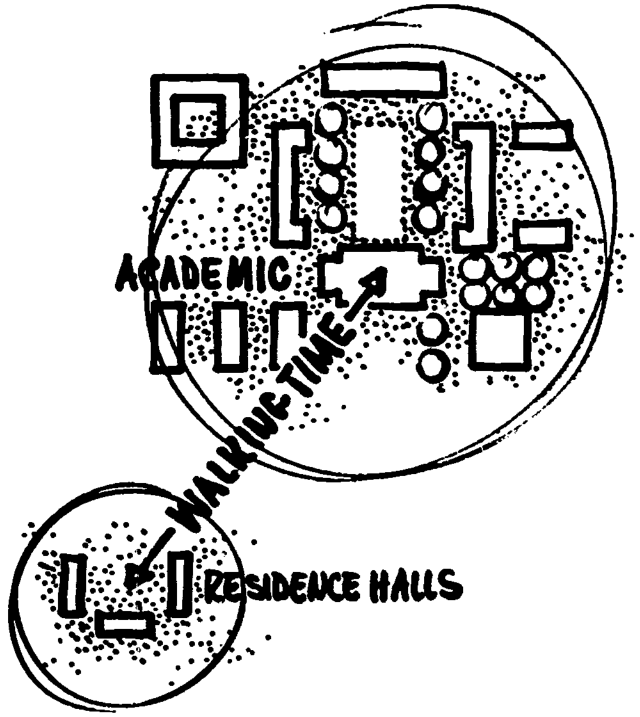
52 STUDENTS/FLOOR × 10 TYPICAL FLOORS × 6 UNITS ... = 3120 STUDENTS

1940 STUDENTS/7.6 ACRES = 254 STUDENTS/ACRE



IF LAND COSTS $80,000/ACRE, LAND COST PER STUDENT = $313

72 ± STUDENTS/FLOOR × 9 TYPICAL FLOORS × 3 UNITS ... = 1940 STUDENTS



SITE REQUIREMENTS FOR HIGH-RISE UNITS

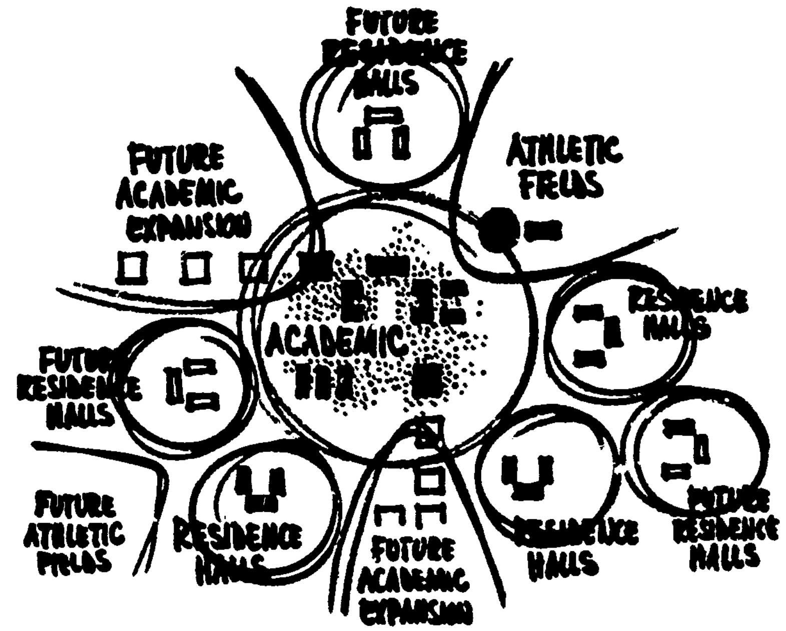
Careful budgeting of construction dollars is traditional in residence halls construction. Equally careful budgeting of land is becoming essential on most campuses. As a result, the site proposed for housing a given number of students may be small by former standards. In other cases, the site selected may be ample or at least adequate to house the required number of students in low-rise units. Even then, considerations of future growth may require the limitation of the project to a portion of the site so that the area may later develop its full potential for the housing of students.

If student population is small and available land ample, low-rise construction will be logical and appropriate economically and aesthetically. If student population is large or is increasing rapidly, pressures for more efficient land use will point to at least some use of high-rise construction. It then becomes of prime importance that the following site factors be given due consideration:

a. **BUILDING CODES**—In many areas codes limit the number of stories or fix a maximum building height. Campuses which may be exempt from the requirements of local building codes or capable of obtaining a code variance may need to consider whether local attitudes and traditions might tend to oppose high-rise buildings and whether such potential opposition can be satisfactorily countered or will be a major obstacle.

b. **SUB-SOIL CONDITIONS**—A thorough investigation and report should be obtained from qualified soil mechanics engineers. A site with average soil conditions which would present no problem for low-rise buildings may be unsuitable for high-rise construction. In other cases the level at which proper bearing is found may vary greatly in different parts of the site. Particular locations can then be determined at which foundation costs would be least.

c. **NATURAL TERRAIN**—A topographical survey should be made to record natural features of the site. Existing tree growth may have an important bearing on the size and shape of areas which can be cleared for building without denuding the landscape. Contour levels may suggest spacings of buildings, with appropriate intervening areas for recreational use. Good site planning will arrive at an optimum relationship between the use of natural terrain and landscape resources as opposed to regrading the new plantings. The fifty year and up life-span of residence halls suggests long-term consideration of site development.

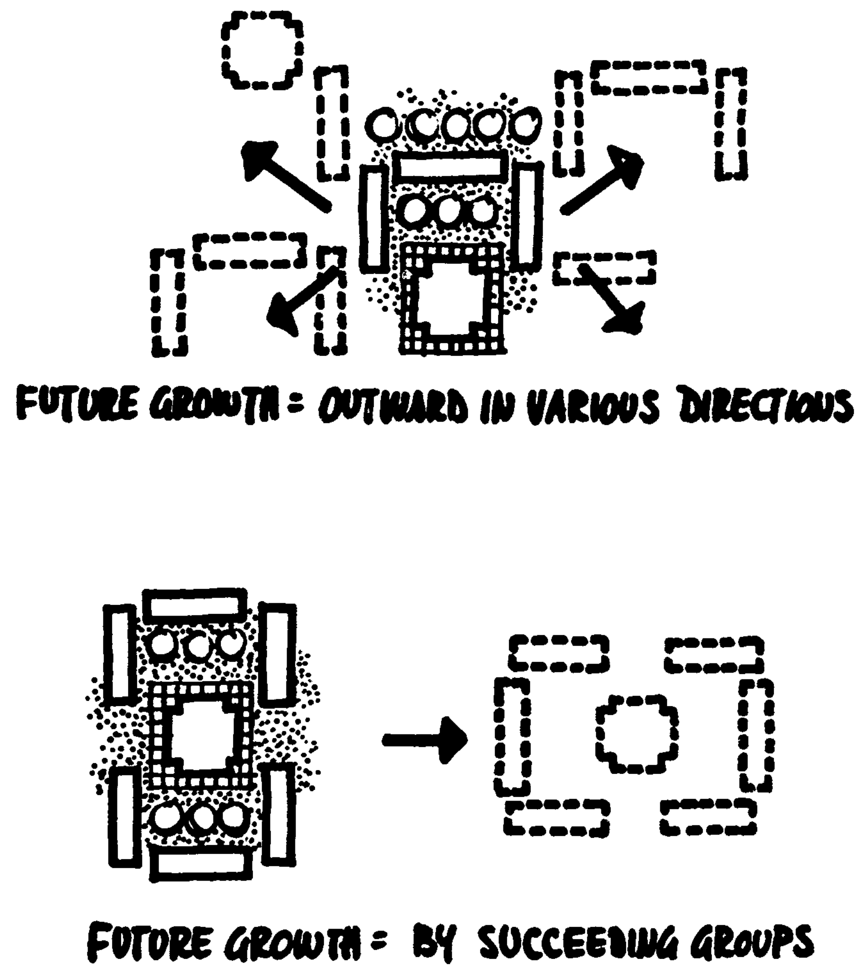


d. **ACCESSIBILITY**—Many characteristics of a site can be changed, but not its location. Relationships to the academic campus must be considered and distances in terms of walking time to major campus points must be checked. A study of patterns of campus movement will establish measures of acceptable distances for a particular campus. If these intervals are stretched unduly to use a poorly located site for housing, the project will risk becoming a campus orphan and thus become relatively unsuccessful.

e. **OUTDOOR AREAS**—Adjacent areas will be needed for parking and for outdoor recreation. These needs become more urgent with high-rise construction. With increased concentration of students, parking along driveways and informal recreational use of lawn areas between buildings will no longer suffice. Adequate campus facilities for these purposes may be available near the site. If not, they will need to be developed. The cost of such facilities, as well as the value of the land set aside for these uses, should be chargeable to general university development rather than being an extra burden on the residence halls budget.

f. **CAMPUS PLAN**—A review of campus plan and long-range development policies should be made as part of planning any residence halls project. Directions of growth and suitable locations for future residence groups should be tentatively determined. Since even a single residence hall can be expected to acquire neighbors, thought should be given to later expansion into a group and later expansion of the group.

g. **GROWTH PATTERN**—Site conditions and campus planning will determine whether the group should be conceived as a closely related



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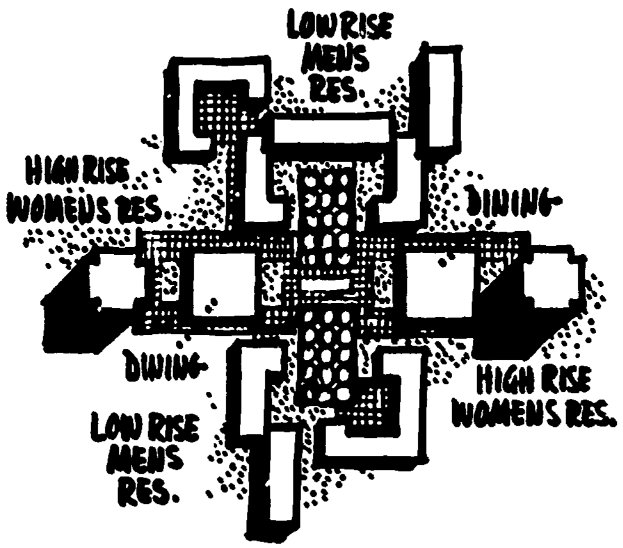

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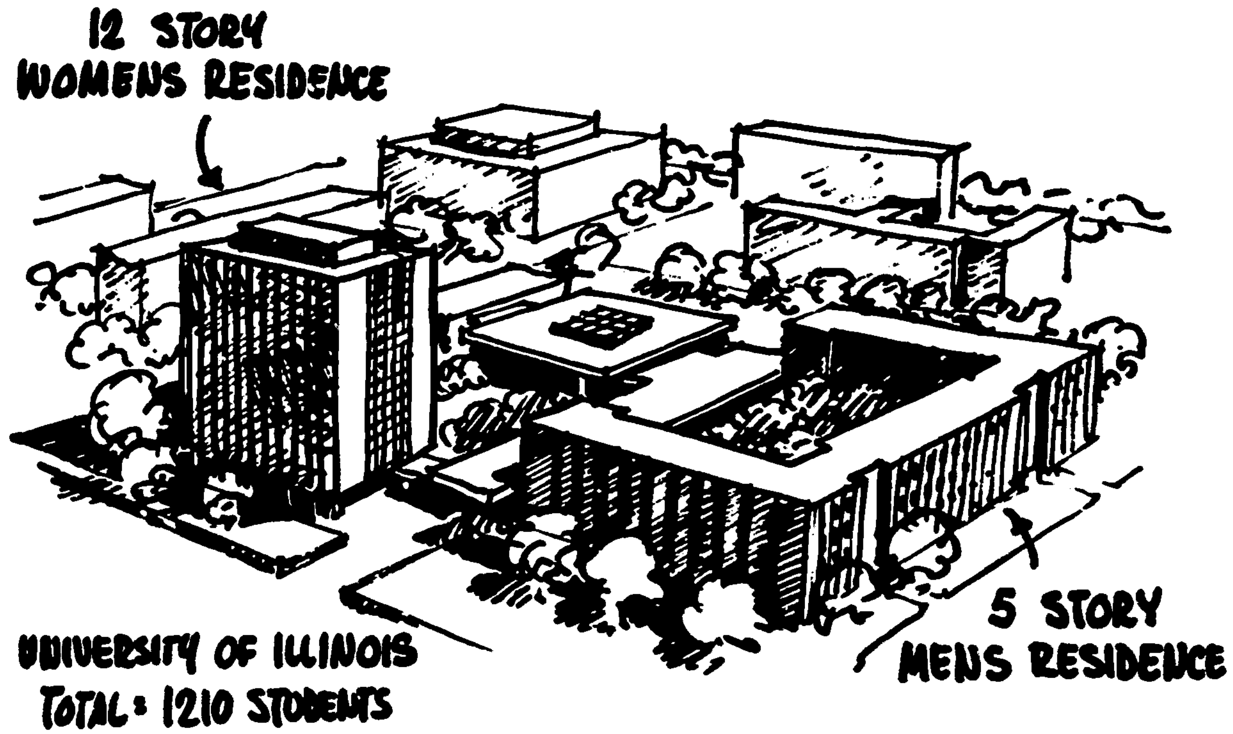
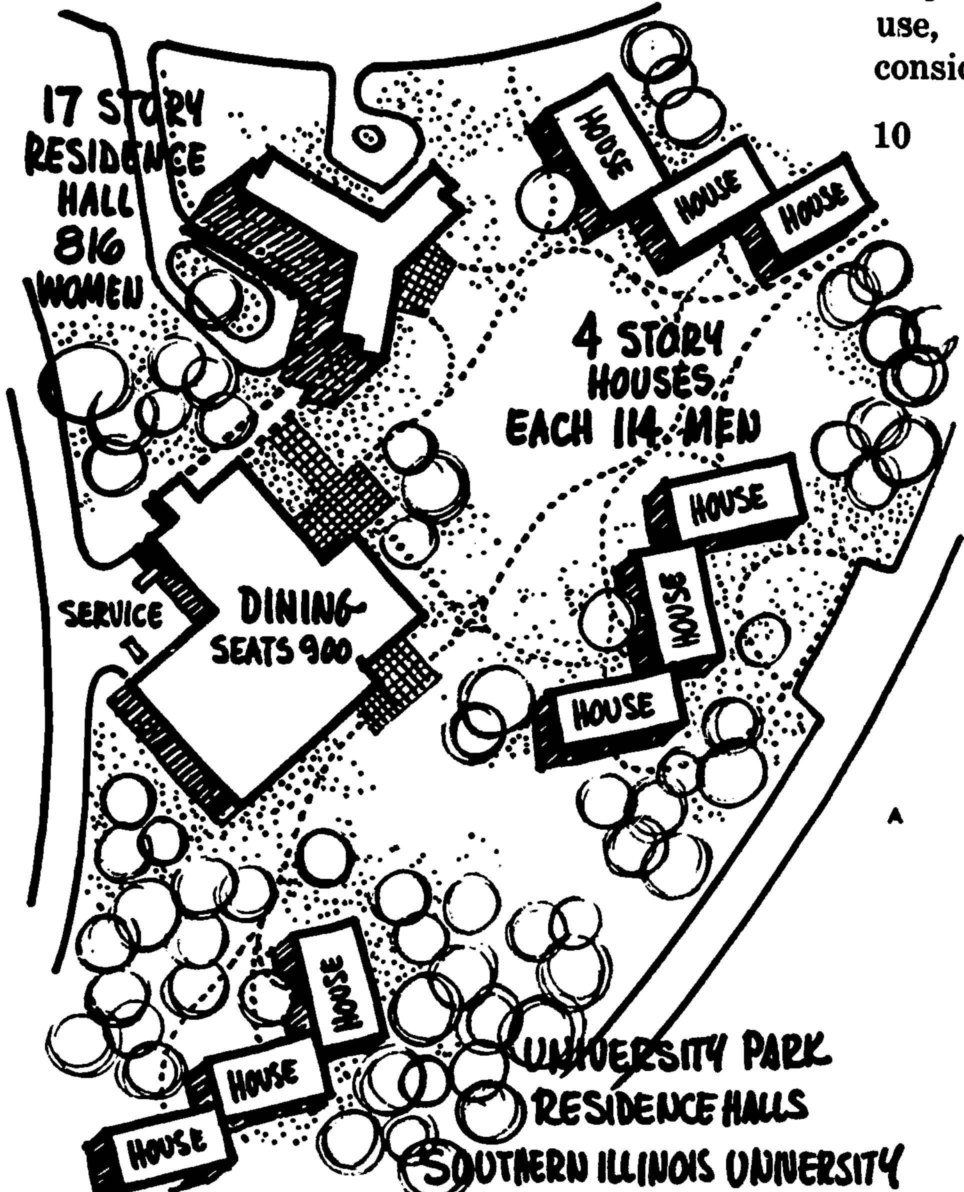


C

cluster which may expand outward in various directions, or as an inward facing group around a central area in a pattern which will be repeated in varying manner by succeeding groups. The kind of student community which will eventually be developed in the area should be considered. Even with the adoption of the high-rise concept for student housing, it may be desirable to intermix some low-rise housing units for practical or aesthetic reasons. Some universities have used high-rise units for women's residence halls with adjacent low-rise units for men students.

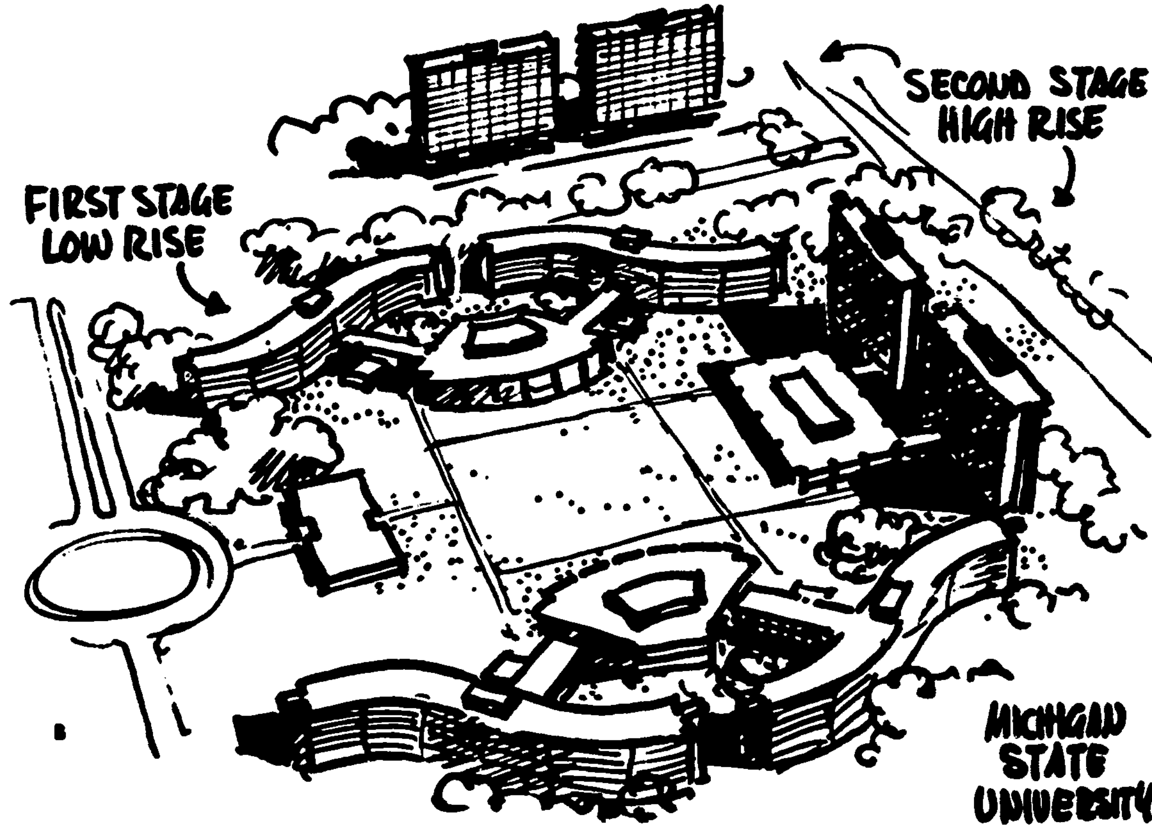
One or more of the above determinants may establish whether the high-rise concept can be employed. Land cost or intensity of land use, discussed earlier, may be secondary considerations.



COST IMPLICATIONS OF HIGH-RISE CONSTRUCTION

Saving land by use of high-rise construction may mean direct savings in money or indirect savings in benefits of various kinds. However, if high-rise construction is allowed to increase the building cost unduly, savings or benefits from intensive land use will be reduced or lost entirely. We need to determine where the cost of differentials occur in high-rise and low-rise construction so that by minimizing those factors which tend to add cost, and capitalizing on cost saving factors, suitable economy can be achieved.

Analysis of the costs reported for high-rise projects in the questionnaire survey shows that construction cost per square foot for these projects varied from \$13.05 to \$23.45, for an average

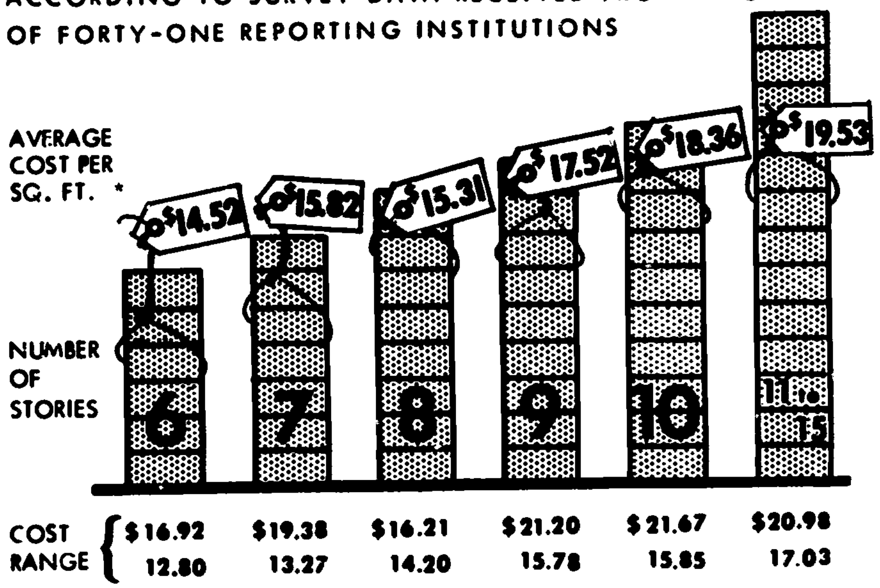


cost of $16.35 per square foot. Analysis of costs for a comparable group of low-rise projects large and small in various parts of the country showed a range from $12.95 to $22.50 and an average cost of $15.55 per square foot. These figures tend to confirm the findings of the study at The University of Illinois which showed an added cost of roughly 5% for high-rise construction.

Since construction costs are affected by regional and local factors, and by the market level at the time of bidding, these figures were reviewed and adjusted by use of Boeckh's cost conversion factors to eliminate cost variations due to location or time of construction. These adjusted figures were then related to building story height with the results shown in the accompanying diagram.

AS BUILDINGS INCREASE IN HEIGHT AVERAGE CONSTRUCTION COST/SQ. FT. TENDS TO BE SOMEWHAT HIGHER

ACCORDING TO SURVEY DATA RECEIVED FROM A TOTAL OF FORTY-ONE REPORTING INSTITUTIONS



* COST PER SQUARE FOOT REPORTED FOR BUILDINGS IN EACH HEIGHT CATEGORY WAS ADJUSTED TO ELIMINATE REGIONAL VARIATIONS IN BASIC CONSTRUCTION COST

The range of costs in each category represent cost variations resulting from character of design and degree of building finish. It should be noted that this range is greater than apparent increments relating to number of stories or differentials in building cost between low-rise and high-rise construction.

It would appear that the savings inherent in highrise construction tend to cancel out many of the added costs entailed. The differential of slight added cost for high-rise can be established, as shown in The University of Illinois study, to be *approximately equivalent* to two added factors:

(1) Cost of Elevators
(2) Area Factors for Elevators and Vertical Services

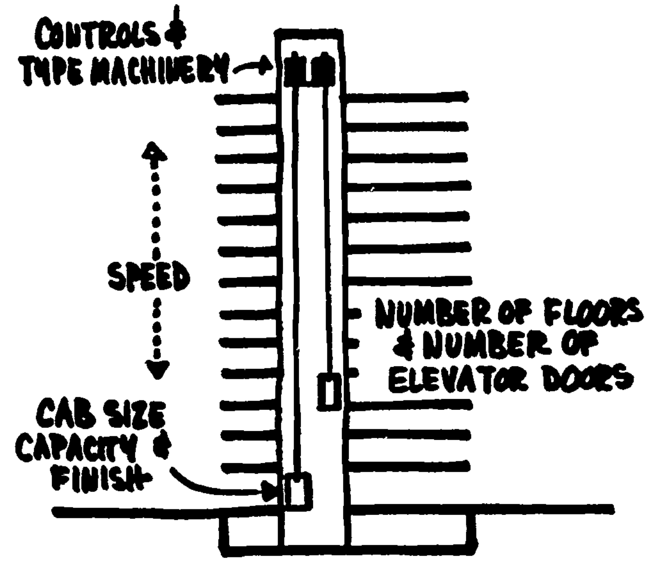
ELEVATOR COSTS

The cost for elevators in a high-rise residence hall is a resultant of the number of elevators, the speed, the number of stories, the type of cab and the controls. Approximate costs are listed in the following tabulation. Basic cost shown represents manufacturer charges per elevator for hoisting equipment, guides, doors to shaft, minimum finishes and basic controls. Special finishes, accessories, operating controls, and elevator cars are priced separately.

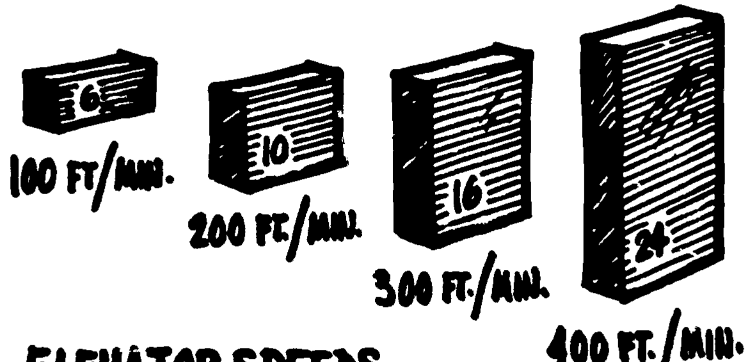
a.

Building Height	Recommended Speed	Basic Cost Per Elevator
Up to 6 Floors	100'/minute	$25,000
7 to 12 Floors	200'/minute	40,000
12 to 20 Floors	300'/minute	55,000
Over 20 Floors	400'/minute	85,000

b. For an intermediate number of stories, subtract $1.200 per floor from the basic ele-

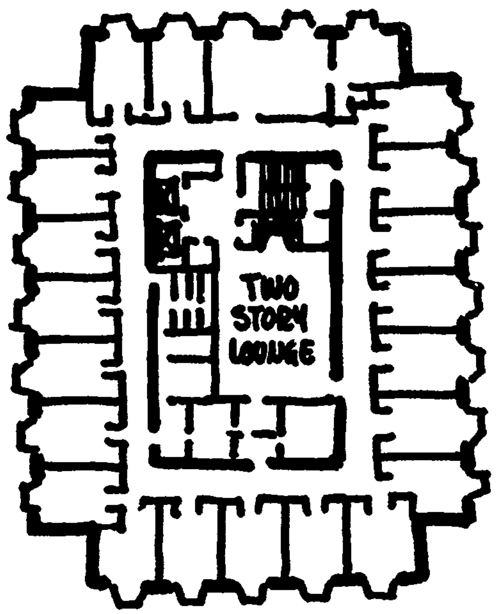


ELEVATOR COST FACTORS



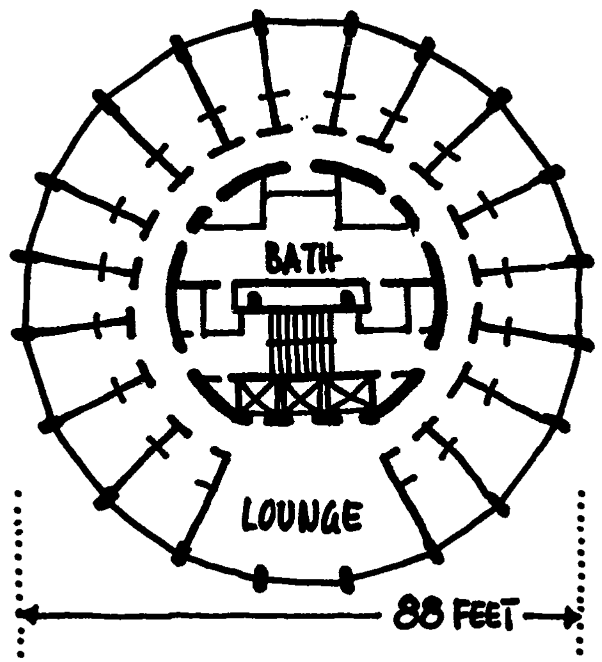
ELEVATOR SPEEDS

ONE FLOOR OF A TWO FLOOR HOUSE
FOR 83 MEN STUDENTS



UNIVERSITY OF CHICAGO
10 STORY STANLEY R. PIERCE HALL
FOR 332 STUDENTS

34 STUDENTS/FLOOR
THREE TOWERS – 15, 18, & 21 STORIES



UNIVERSITY OF PITTSBURGH

vator cost, for the number of floors less than the maximum number listed for a given speed.

c. Cost range is from $2,500 to $4,000 for an average sized car (5′ x 7′) accommodating twenty people for a load capacity of 2,500 lbs. to 3,000 lbs. Cost per car within that range will depend on finish and accessories.

d. Operating controls of the duplex "collective" type suitable for a pair of elevators will cost $1,000 per car.

e. Controls for three or more elevators should be of the automatic type, which coordinate car movement and cost $3,000 per car.

Knowing the number of floors, the probable costs for a proposed elevator installation may be approximated by assuming recommended speed for the story height under consideration, adjusting the basic cost per elevator (a) for this height and speed as appropriate for an intermediate number of floors (b), adding allowances for car cost (c) and controls (d) or (e) and multiplying the resultant figure by the number of elevators needed. There are many possible variations in elevator specifications and often there are special requirements which need to be recognized. When the needs and the desired results have been projected, competent elevator technicians should be called in to make recommendations and supply technical details related to the particular requirements. As in every other aspect of residence hall planning, local circumstances and needs must be used to form the final basis for determining elevator requirements and actual costs.

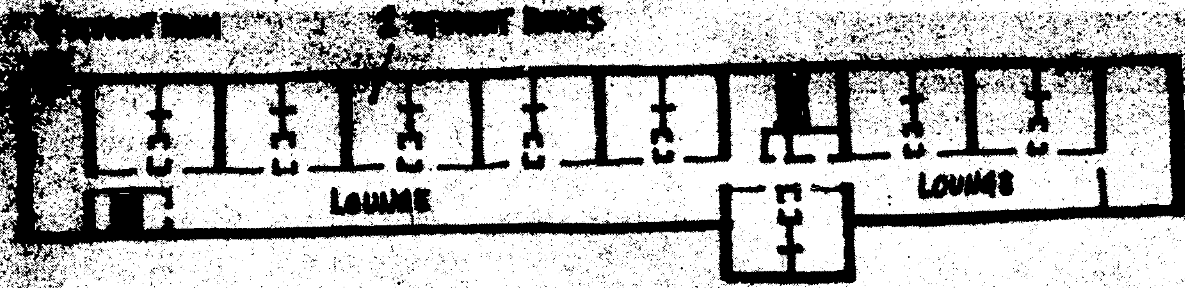
Since elevator costs are a sizable portion of the total building cost, it is natural that a residence halls administrator or planner will be anxious to keep elevator costs in perspective. He will quite properly wish to check the recommendations of the elevator consultant with the experience of others. In doing so, he must recognize that the opinions of service personnel and maintenance men, or of students (some of whom may have missed a class while waiting for an elevator) may be quite at variance with the evaluation of another administrator. Above all, he should keep in mind that elevators are basic to a high-rise residence hall, that the number of elevators or type of service cannot be readily changed, and that sensible and wise design in this critical matter is mandatory.

AREA FACTORS

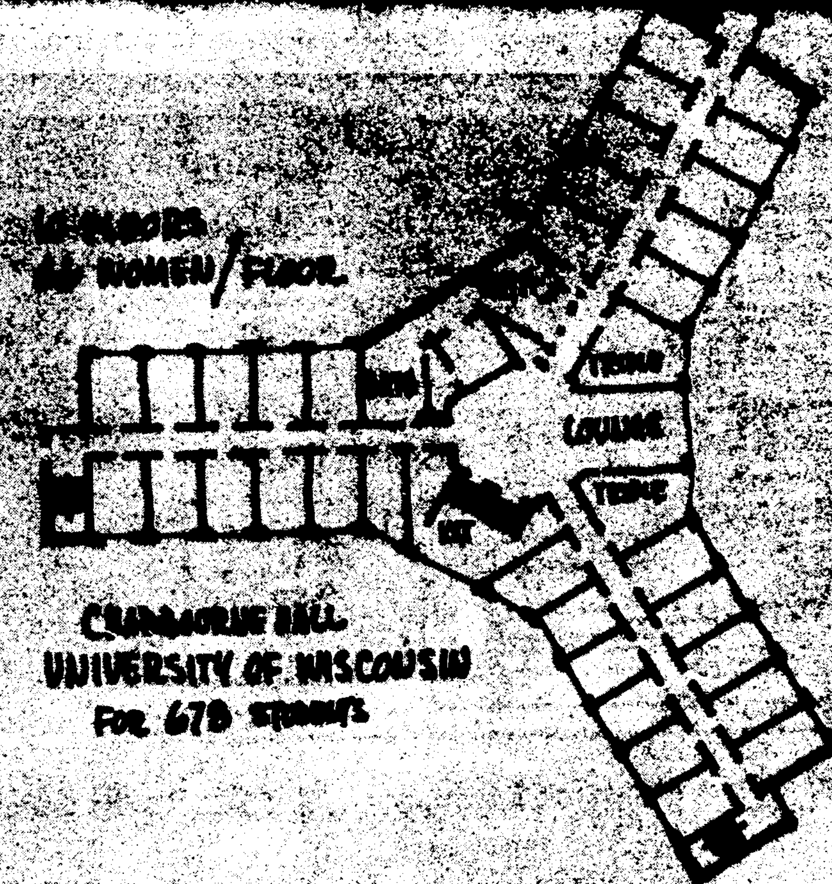
The installation of elevators necessarily adds area to each floor of a high-rise building. Although elevator cars normally have an inside area of thirty-five square feet, the shaft area, including enclosing walls, is usually about eighty feet per car. In addition, elevator lobby area should be provided on each floor, preferably separate from the corridor system, to avoid congestion and disturbing noise. Mechanical area for the hoisting equipment and control devices will always be needed. Although a general index cannot be reliably established and the area added by elevators will vary in different buildings, it can be expected to be roughly equivalent to an allowance of one-hundred fifty square feet per floor per car.

Gross area of high-rise buildings also tends to be increased by space required for larger risers of mechanical systems, larger ventilating ducts and larger structural column sizes. Although these increments are not readily obvious, since they add area on each floor of a multistory building, the total added area becomes more than a negligible factor.

The area increase factor for elevators and vertical services is difficult to isolate for measurement. Comparison of completed buildings is unsat-



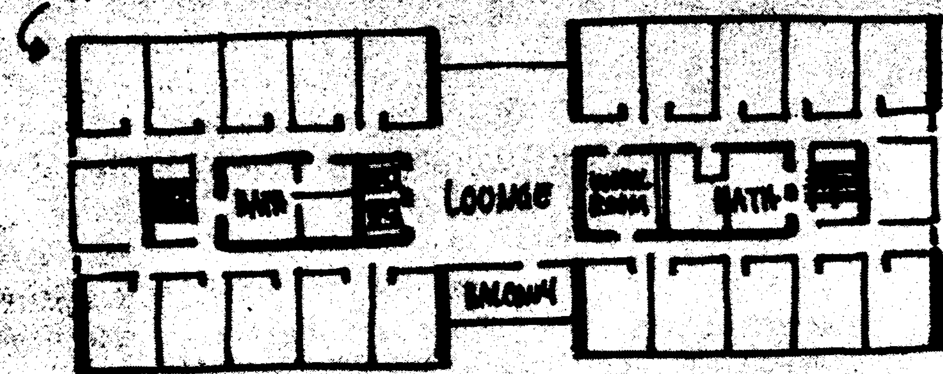
SOUTHERN ILLINOIS UNIVERSITY



WOMEN/FLOOR

CHADBOURNE HALL
UNIVERSITY OF WISCONSIN
FOR 678 STUDENTS

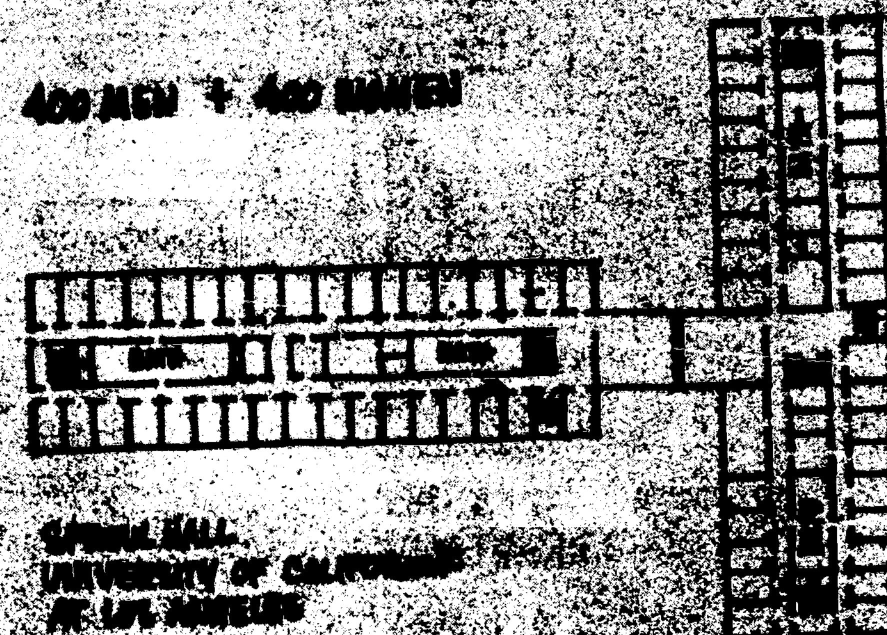
ONE FLOOR OF A TWO FLOOR HOUSE FOR 88 STUDENTS



9 STORIES

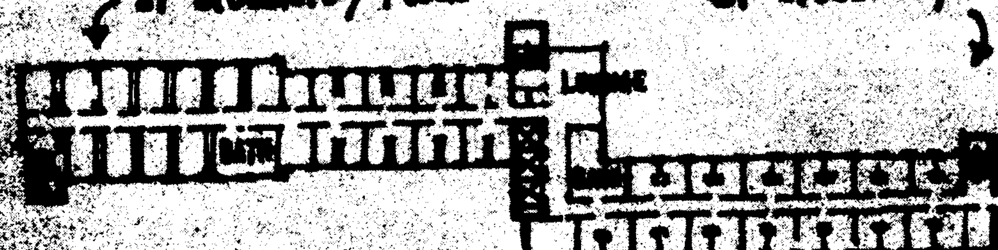
UNIVERSITY OF MISSOURI
FOR 552 WOMEN

400 MEN + 400 WOMEN



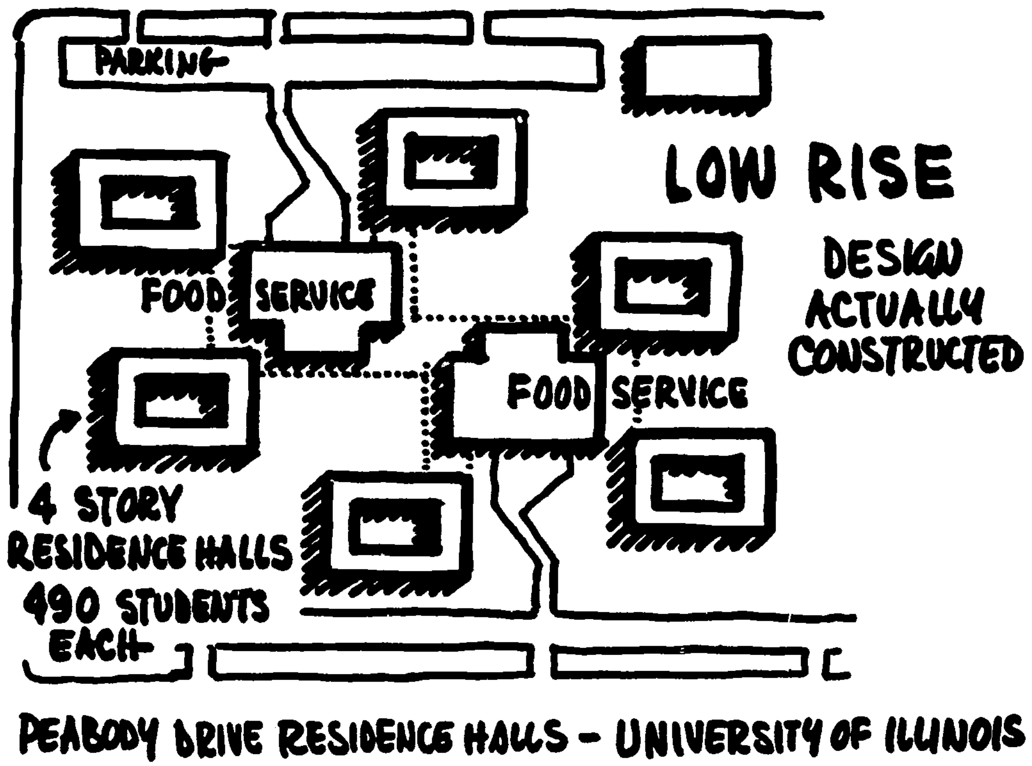
SPROUL HALL
UNIVERSITY OF CALIFORNIA
AT LOS ANGELES

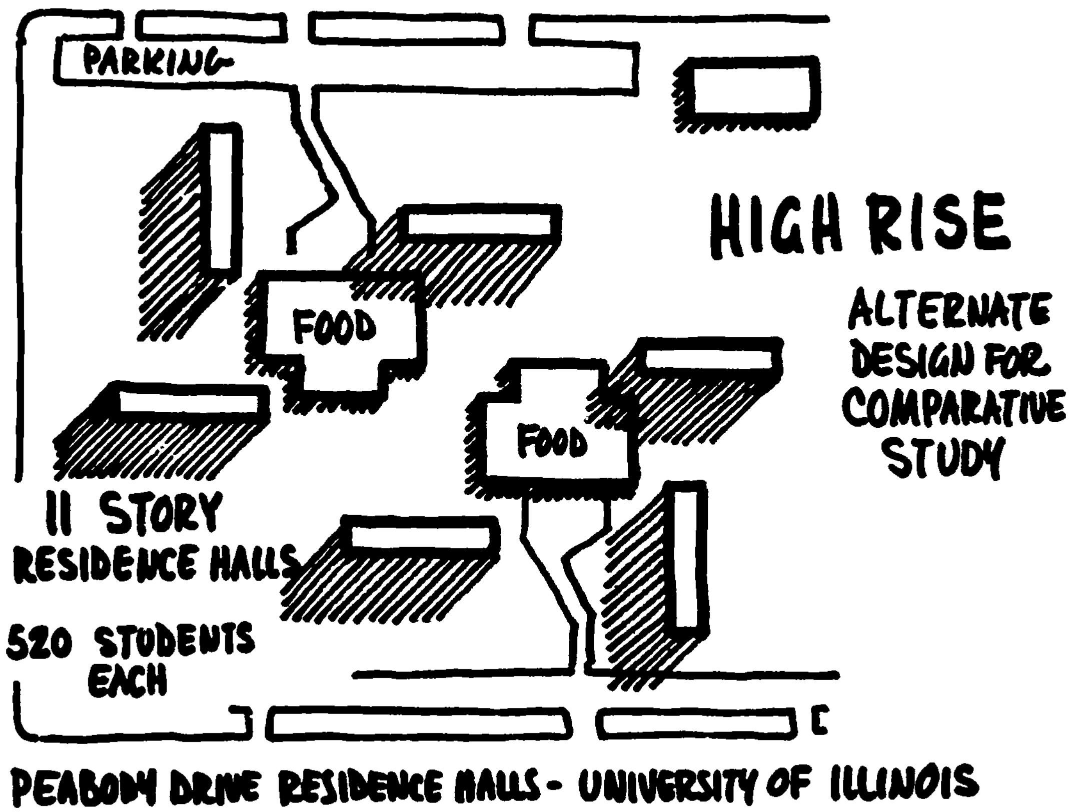
UNDERGRADUATE WING
37 STUDENTS / FLOOR
+
GRADUATE WING
27 STUDENTS / FLOOR



9 FLOORS

SADLER HALL
SYRACUSE UNIVERSITY
FOR 498 MEN





isfactory and misleading because the buildings usually vary conspicuously in ways not related to the question of high-rise construction. Again, the study at The University of Illinois, published in the appendix, provides a useful reference. That study uses data relating to an existing residence halls group of six four-story buildings for a control and for comparison with a projected high-rise development of six eleven-story buildings. Drawings were prepared in which materials, construction, area relationships and facilities were kept as closely identical as the shift from low-rise to high-rise would permit. It was found that the gross building area per student had to be increased a little more than 7% in the high-rise solution, even though net area per student remained the same.

In actual practice, the added area differential for high-rise residence halls will often be less than indicated by the analysis made for The University of Illinois. With careful design study it is possible to develop efficiencies in room groupings and corridor relationships which will reduce total floor area and tend to offset some of the area increases which are unavoidable in the high-rise building. Some of these possibilities will be explored in the next section.

OPPORTUNITIES FOR CUMULATIVE SAVINGS

"Cheaper by the dozen" is a principle that operates effectively in reducing construction costs for any type of residence hall. Standardization of basic items and repetition of appropriate details can do much to control costs. If an item is itself economical, the more it is repeated the greater are the relative savings. Even more expensive items tend to cost less if used in greater quantities. In general it can be said that the more times a building element is repeated, the lower its unit cost becomes.

Repetition takes many forms, from typical windows and doors to typical room detailing or typical floor plans. Variety and interest need not be ruled out. The repetition of basic elements provides an orderly background which gives the occasional accent or special feature a greater significance and effectiveness.

The high-rise residence hall, by its very nature, tends to have a larger number of typical floors than its low-rise counterpart. As a result, the opportunities for cumulative savings are greater in number and significance. A minor saving in required materials for a typical story or a small reduction in required area for a typical floor, can multiply through repetition into a major cost reduction.

For maximum economy through cumulative savings, the design of a typical residence floor—especially in a high-rise unit—should incorporate as many as possible of the following disciplines:

1. Relate typical floor plan to an appropriate structural system which lends itself to the kind of space arrangement desired.

2. Be consistent in the use of the structural system by regularity of bay spacings, similar loadings and uniformity of structural elements.

3. Locate openings for elevators, stairs, risers and ducts to relate to the structure with a minimum of disturbance.

4. Determine mechanical requirements early so that distribution systems may be economically related to the structure and the building design.

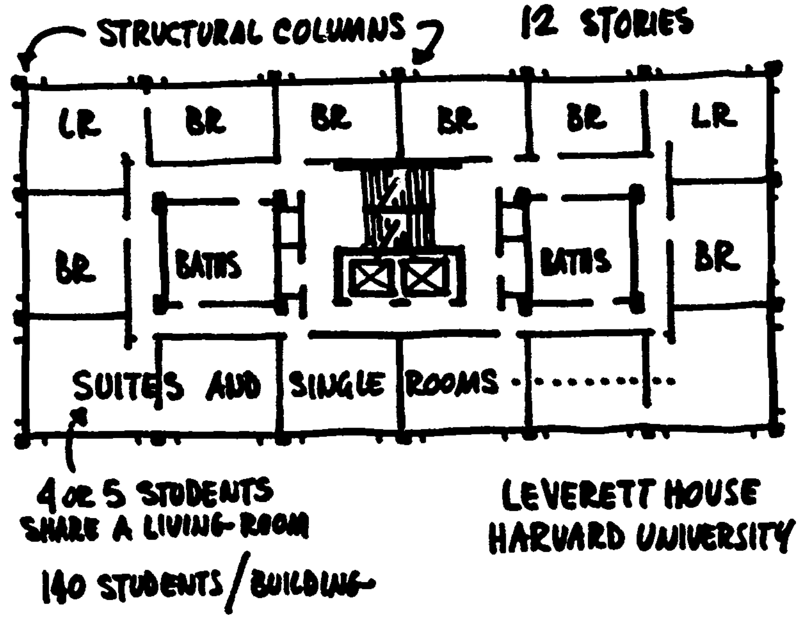
5. Use a limited number of materials to serve similar functions in a similar manner.

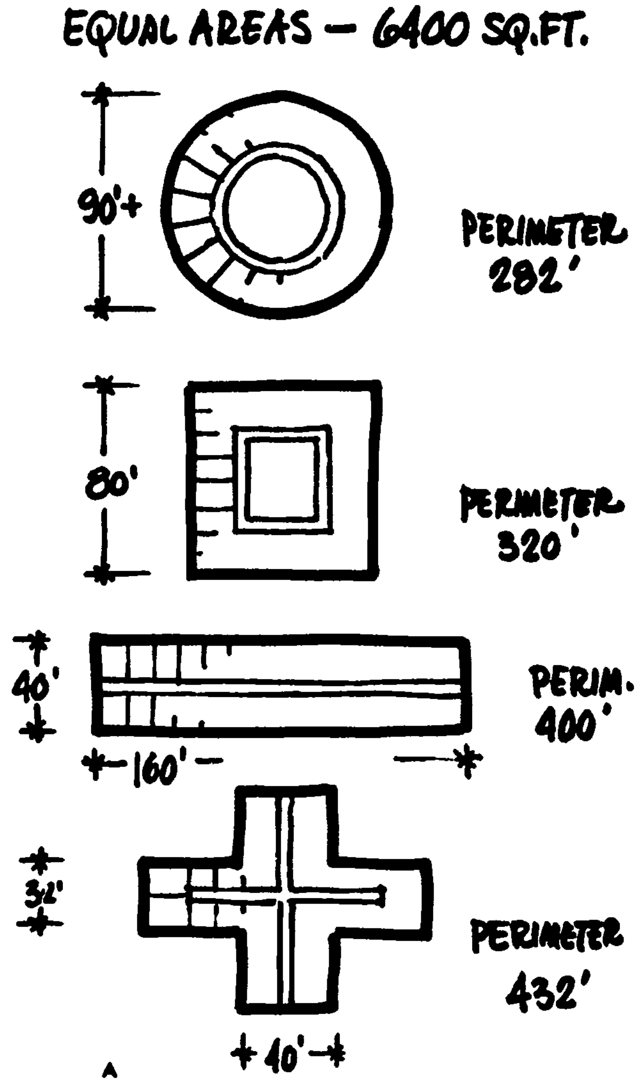
6. Select basic building components carefully and then use them generally so that a minimum number of types of windows, doors, plumbing fixtures, light fixtures, etc. will be called for.

In seeking maximum economy for a typical floor, it should be borne in mind that the overall shape and size have a bearing on the construction cost per square foot. Shape and size are primarily determined by elements of the basic program of requirements. To the extent that the flexibility of the program permits the typical floor plan to be developed toward an economical shape and size, the cumulative savings possible in a multi-story building may become a significant economy.

The shape becomes a cost factor by its ratio of exterior wall to enclosed space. As in the geometry of rectilinear shapes, the square is highly efficient, the oblong next, and the irregular shape has the highest ratio of exterior wall. In a residential building, it is not practical to exploit these efficiencies fully. Most of the spaces on a residence floor are living spaces which should be on an exterior wall. The short dimension of the typical floor is usually established by this consideration. A square having this dimension in two directions might be too small in area to provide for the desired number of students. An oblong shape results if one dimension is lengthened enough to provide the desired area and facilities per floor. If this dimension becomes excessive, an irregular shape of articulated units or wings is usually adopted.

The size of the typical floor is also a cost factor to some degree. The area of the floor is largely determined by decisions as to the number of students to be housed and the auxiliary facilities to be provided on the typical floor. If it is decided to house a relatively small group of students on a typical floor, some premium of added cost can be expected. In a group of high-rise apartment buildings at Riley Center in Indianapolis, it was found





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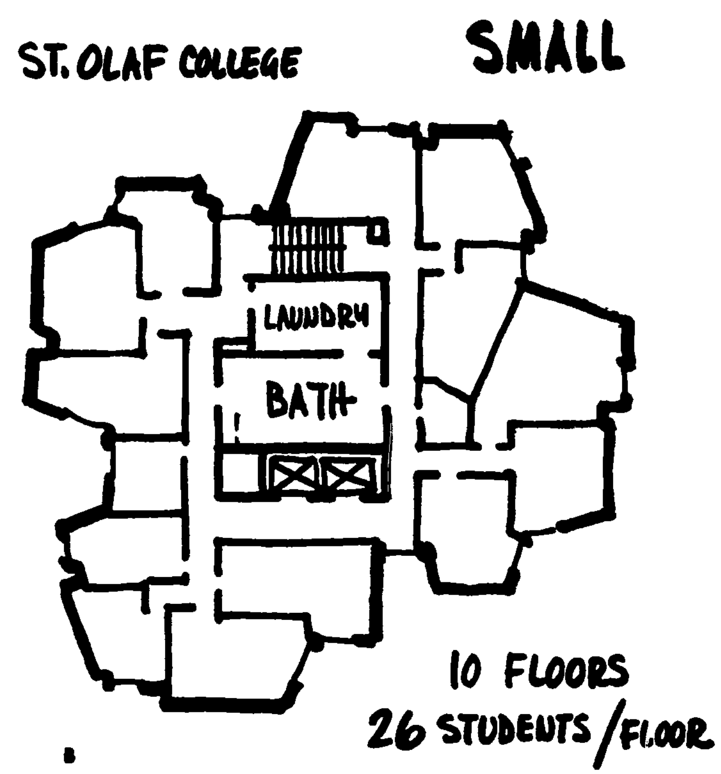

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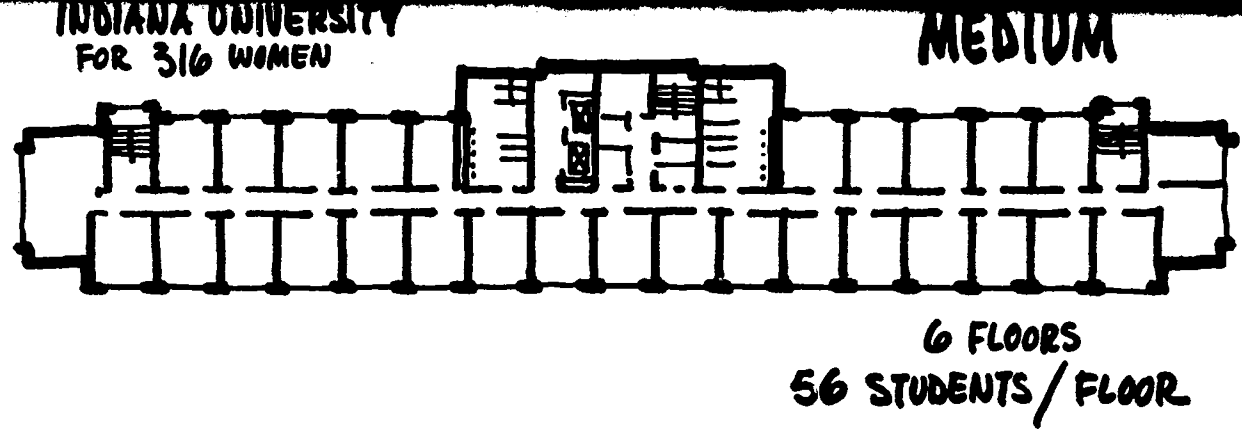

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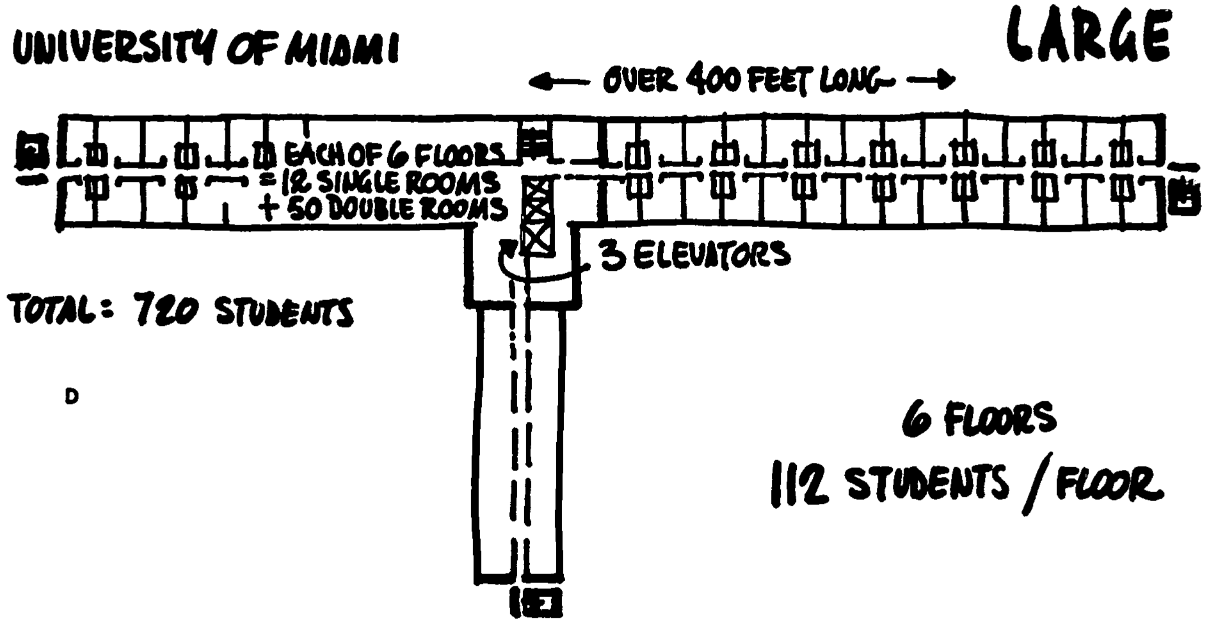

D

that a thirty-story unit with five thousand square feet per floor cost nearly fifteen percent more per square foot than another building of seventeen stories having an area of twelve thousand square feet per floor. Specifications, materials, and facilities were identical in both buildings. Although extra height and added elevator costs accounted for some of the difference, it was demonstrated that the smaller floors inherently cost more per square foot.

TECHNICAL CONSIDERATIONS IN HIGH-RISE BUILDINGS

Since the high-rise building was originally made practical by development of the steel frame structural system, it might be assumed that a key distinction in high-rise residence halls would be the structural system employed. Today's building technology offers a wide variety of structural systems which are used in high-rise construction. However, each of these, whether steel frame, reinforced concrete, pre-cast, lift slab or tilt-up, are also commonly used in low-rise construction. In some cases, low-rise residence halls still make use of masonry bearing wall systems which are not applicable to high-rise construction.

The selection of the basic structural system for a given residence halls project will be based on various considerations relating to particular circumstances and characteristics of the building design. Whatever system is recommended, it should be expected to meet the requirements of the following categories:

a. Economy of materials and/or labor.

b. Time period available for construction.

c. Appropriateness to the space requirements contemplated and sub-soil conditions of the site.

d. Availability of contractors and labor experienced in the use of the system.

e. Compliance with prevailing standards and code requirements.

One of the cost factors in high-rise construction has been the expense of lifting great quantities of building materials up to the levels required. This cost differential has been minimized by the development of new types of materials handling equipment.

Ground-traveling crawler cranes are available with booms capable of lifting materials to the top of a seventeen-story building. Climbing cranes, which lift themselves two or three stories at a time, can go to unlimited heights. Rotating jibs can be attached which are capable of reaching the entire work area of an upper floor.

These and other items of special equipment for high-rise construction are expensive to purchase. However, they are generally available on a lease basis, so contractors have ready access to the type of equipment best suited to a particular project and the potential savings are reflected in their bid proposals.

BUILDING MATERIALS

Exterior materials have the primary function of enclosing a building and protecting it from the

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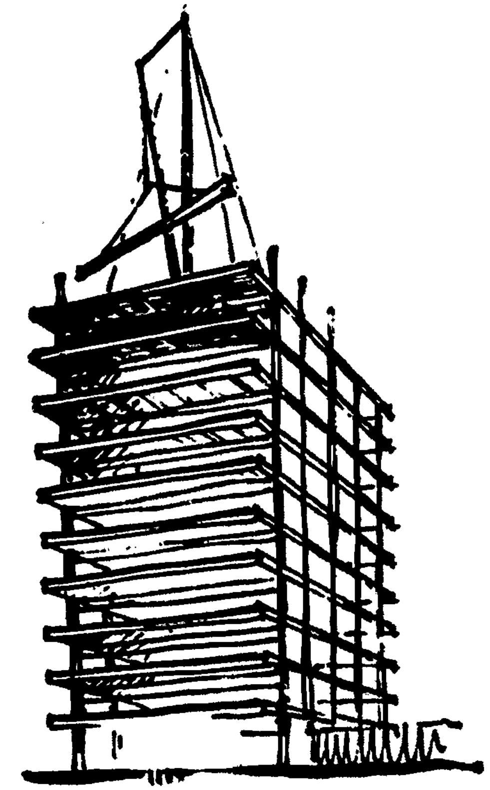
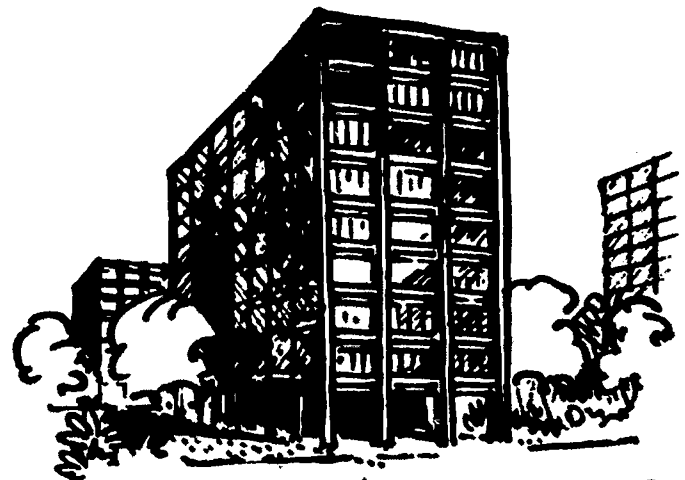


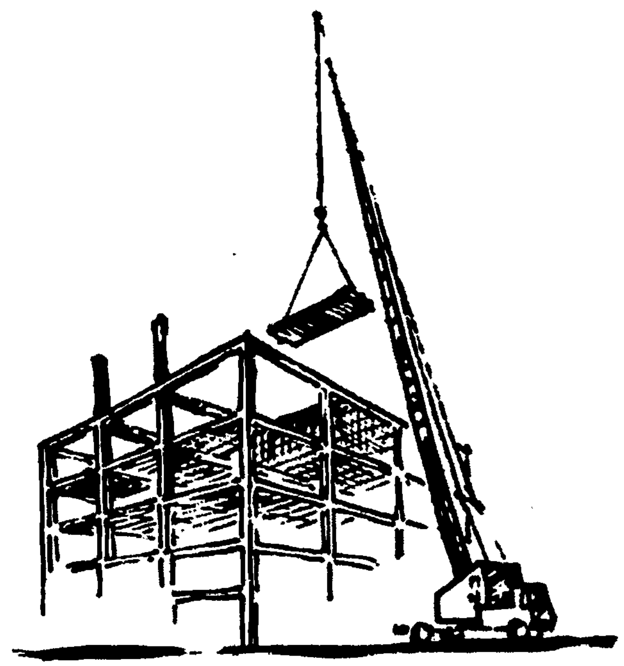
STEEL FRAME CONSTRUCTION

B



MARRIED STUDENT & FACULTY APARTMENTS
ILLINOIS INSTITUTE OF TECHNOLOGY
CONCRETE CONSTRUCTION

C



PRE-CAST CONCRETE CONSTRUCTION

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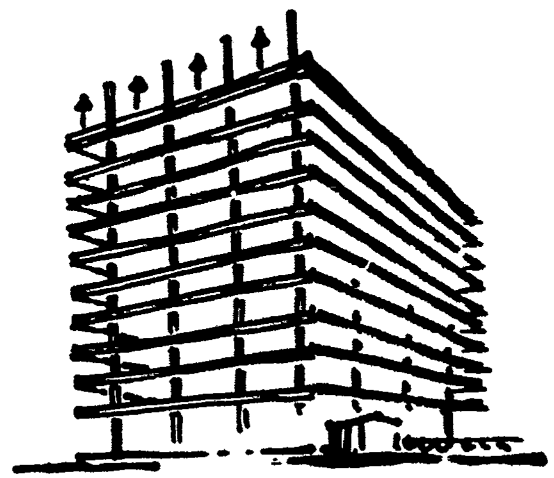
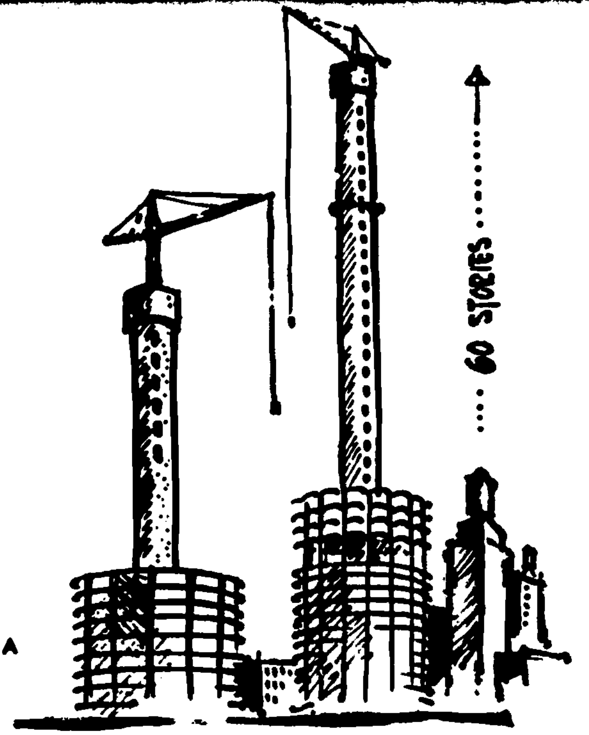
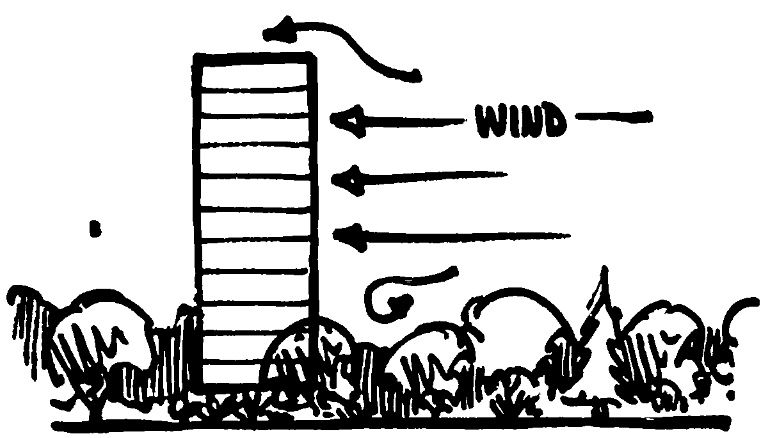


LIFT SLAB CONSTRUCTION



CLIMBING CRANES WITH ROTATING JIBS
BUILDING - MARINA CITY, CHICAGO



weather. A high-rise building has relatively greater exposure to the weather than a low-rise structure. With greater height, shielding from nearby trees and buildings is lost, and the upper portion of the building is exposed to much greater wind forces than normally occur near ground level.

Elements of the exterior wall, such as glass, window panels and sash, must be selected on the basis of their resistence to wind stresses likely to occur in a given locality. Related to this is the excessive wind infiltration which can occur through closed windows exposed to strong wind pressures. Because of this factor, sash for high-rise residence halls need to be of better than average quality, with effective weather seals and protection against infiltration.

Since weight accumulates downward floor by floor, weight of exterior wall materials becomes a factor of added cost in the structure and foundation of highrise buildings. One result has been the introduction of curtain wall systems in place of less expensive, but heavier, masonry wall areas. Some curtain walls have presented serious maintenance problems. Walls of metal and glass do not absorb water as masonry walls do. Rain builds up as it runs down these surfaces, picking up grime on the way and acting with abrasive force on the curtain wall. Improved detailing and sealants have been developed to cope with this problem, but in the process curtain wall systems have tended to increase in cost to the point where intended savings are lost.

Window washing becomes a more acute problem in high-rise buildings. Some of the complicated measures provided logically in commercial buildings are beyond the scope of residence halls budgets. Usually this problem is best met by selecting sash which can be washed from inside the building.

Interior materials which have been found desirable and economical in low-rise housing generally have a similar application in high-rise residence halls. However, some differences may be pointed out. Low-rise residence halls have often made effective use of rather humble materials. By painting certain materials and leaving others unfinished, color and texture combine to provide delightful and inexpensive interiors. Some tendency has been noted in high-rise residence halls toward the use of more highly finished materials. Usually this has resulted not from a decision to use more expensive finishes but from the need to use lighter weight materials.

Because of the weight factor, brick and painted concrete block are not commonly used for interior walls or partitions in high-rise construction. Plastered partitions of light weight construction are usually called for. Plaster finish and the protective materials, such as ceramic tile, which may need to be applied to it in special areas, tend to give a more highly finished appearance which may not be significantly greater in actual cost.

MECHANICAL SERVICES

The high-rise concept may introduce special problems in some localities. Available utilities must be investigated in detail to determine whether existing capacities are sufficient for the requirements of the high-rise unit. Available water reserves and adequate water pressure for upper floor fixtures are obviously necessary. Sewer capacities to accommodate the new building are also critical. Available fire-fighting equipment and requirements of the fire department may place limitations on the building or result in provision of special standpipe facilities in or near the building.

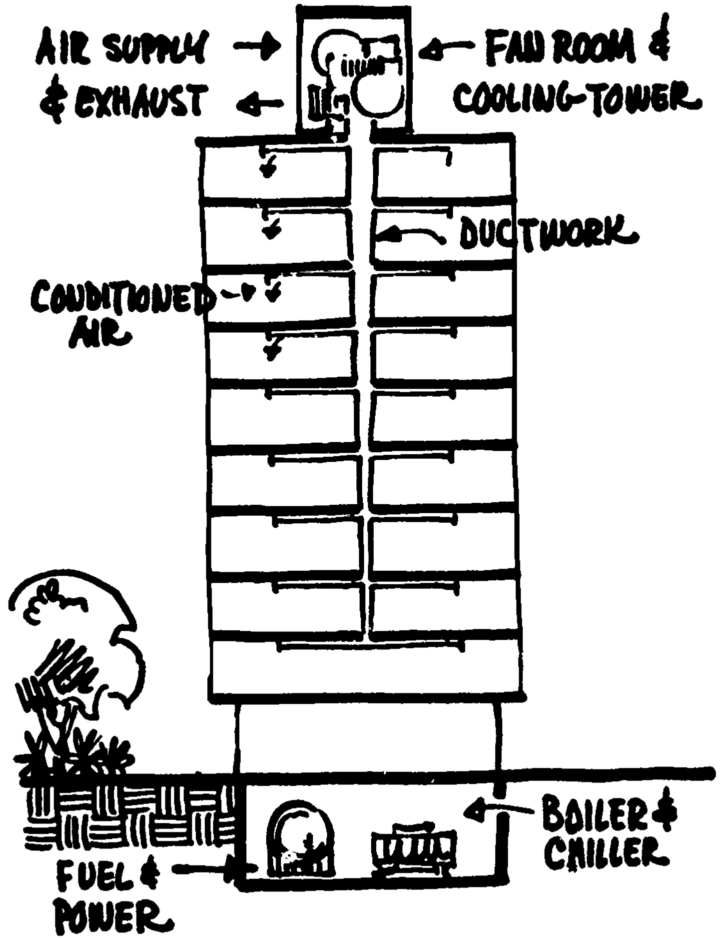
From comments of housing directors, there appears to be some feeling that mechanical systems for high-rise residence halls tend to be more sophisticated and complex than in the traditional walk-up type. This observation may result from the fact that high-rise buildings are often the newest as well as the largest of campus residence halls and incorporate current refinements in equipment and controls. One of the advantages of high-rise construction is the concentration of mechanical services which becomes possible with reduction in duplications of equipment. Control valves, pumps and fans tend to be fewer but larger. They may be more elaborate in appearance, but do not necessarily cost more than the several units which they replace.

In high-rise buildings, plumbing, electrical and mechanical distribution systems usually have fewer but higher vertical risers and correspondingly less horizontal runs. However, since the systems are a direct function of building size and total requirements, the high-rise principle has little effect on the aggregate amount of piping, conduit and duct work required for a given total area of building.

The placement of major common use facilities on the lower floors of a high-rise unit often necessitates intensive utilization of interior or basement space. As a result air-conditioned space is more apt to be required in high-rise residence halls.

Greater power demands and reliance on elevators tend to warrant provision of an emergency power source, usually by means of standby motor generators.

The advantages of orderly repetition are especially significant in achieving efficient distribution systems and minimizing tendencies toward complexity. In locating plumbing fixtures and heating or ventilating elements, the advantages of vertical alignment have an obvious greater importance in high-rise construction.



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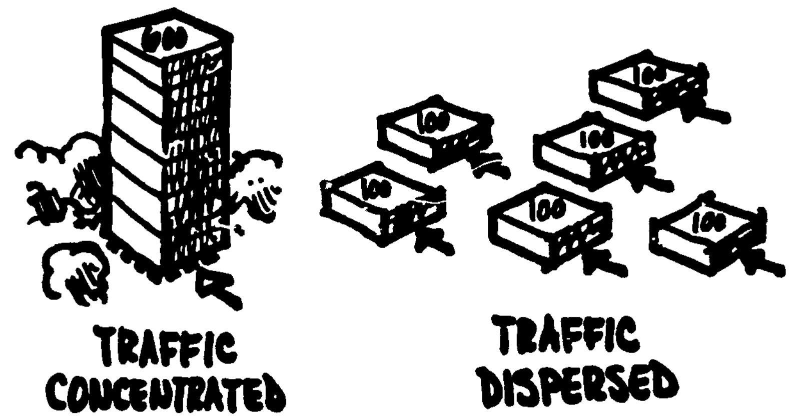

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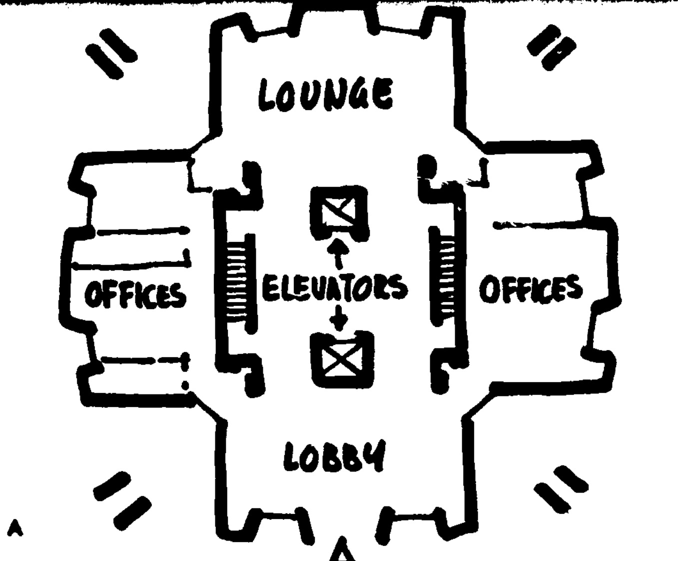
TRAFFIC REQUIREMENTS AND ELEVATORS



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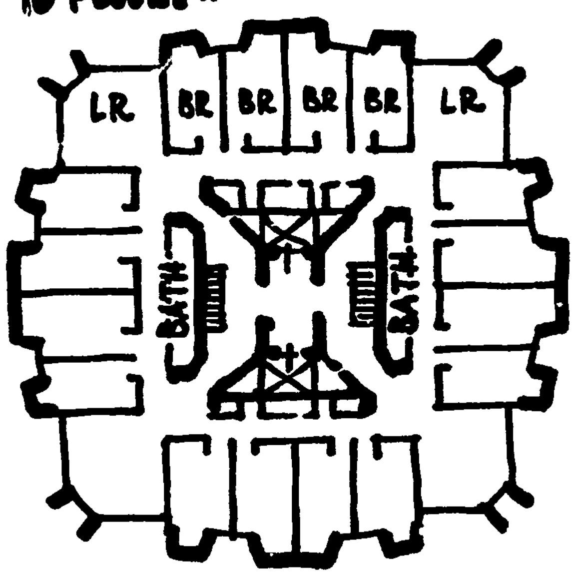
GROUND FLOOR PLAN OF 16 STORY TOWER

BOWDOIN COLLEGE SENIOR CENTER

16 FLOORS ...



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BOWDOIN COLLEGE SENIOR CENTER

Peak traffic periods for residence halls usually occur seasonally, rather than daily or weekly. At the beginning as well as the end of the school year or the school term, the number of students moving about in the residence area, the number of parents and visitors, and the number of cars arriving and departing—all these are at a maximum. Although some congestion can be accepted at these brief periods, planning designed to minimize problems at these peak periods will insure a smoother handling of normal traffic.

By its very purpose of housing more students on a smaller area of land, the high-rise residence hall concentrates more traffic at fewer entrances. The site of the building should be in an area that can accommodate the resultant traffic, with building entrances and approaches designed to handle traffic at peak periods. If the site is small, approach walks tend to be short and therefore need generous width to provide adequate walk area for pedestrians. If automobile traffic is brought near the residence hall, circulation problems become more acute and careful planning of walks and drives is required to avoid congestion, to make appropriate provision for parking and to minimize conflicts with pedestrian traffic.

Interior traffic in a high-rise unit will also require special consideration, especially at the ground floor level. Direct access of ample width is needed between the main entrance and the elevators. Additional free area is needed to provide lobby space for those not immediately going to the elevators or leaving the building. Since services and other first floor facilities should be apart from the main stream of traffic they are usually adjacent to this lobby area. Entrance to the dining area, if located on the first floor, should be sufficiently remote that students lining up at meal hours will not block normal traffic.

STAIRWAYS

Although elevators are the principal means of vertical circulation in high-rise residence halls, stairways are still essential and should be arranged to play a useful role in traffic between floors. Stair requirements will be much the same as in low-rise buildings although their location may differ, since they are primarily intended for emergency exit. Usually a minimum of two exit stairways is required and no space is allowed to be more than seventy-five or a hundred feet from a stair. Since a third stair adds needless expense and since dead end corridors beyond stairways are not allowed, stair locations have a direct effect on the plan of the high-rise unit.

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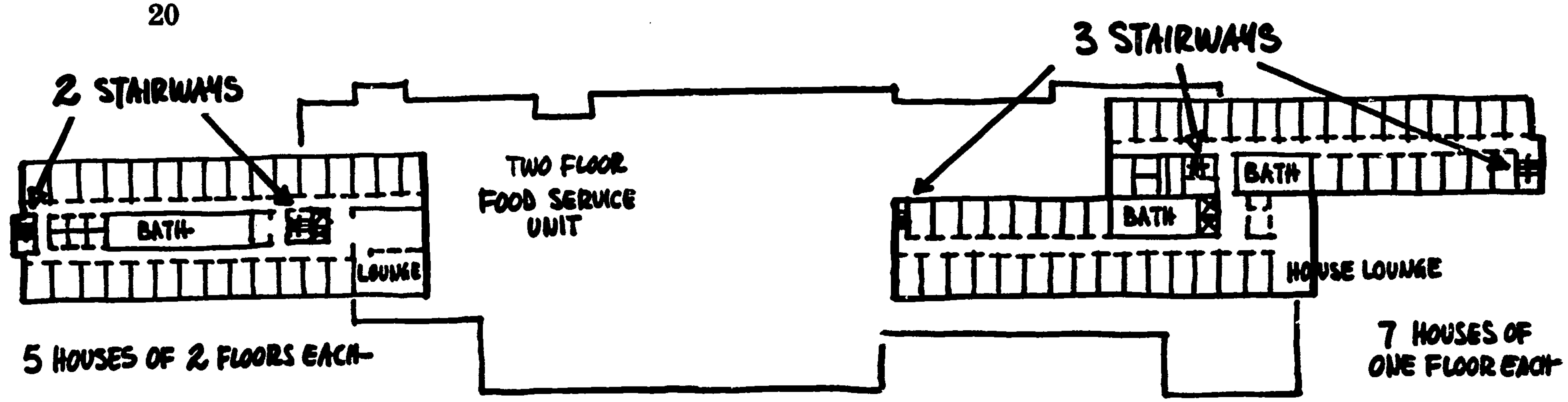


5 HOUSES OF 2 FLOORS EACH—

TERRY HALL — 11 FLOORS, 593 MEN
UNIVERSITY OF WASHINGTON

7 HOUSES OF ONE FLOOR EACH—

LANDER HALL — 8 FLOORS, 679 MEN
UNIVERSITY OF WASHINGTON

Since stairways can be a great convenience in desirable traffic between floors, reasonable attention to finish and appearance will encourage this use. If common use facilities are located on more than one of the lower floors, additional open stairways of generous dimensions may be desirable to handle traffic between these areas and provide greater freedom of movement.

ELEVATORS

Although elevators were properly discussed as a factor in high-rise construction cost, separate consideration of the number of elevators, their placement and their operation, is warranted. In the following table typical elevator installations, as reported in the survey made of residence halls, are grouped by number of students housed and by number of elevators installed:

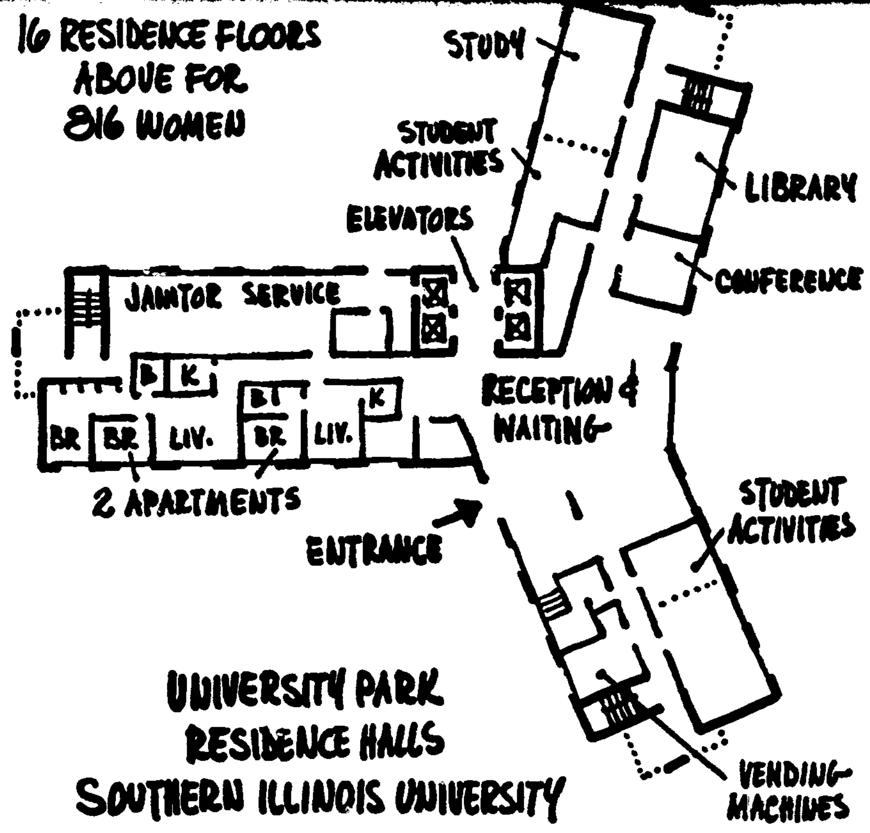
Wide variations reflected in the table confirms the observation that no fixed ratio or general rule can be relied on and that local circumstances and needs must form the final basis for determining elevator requirements.

When factual material listed in the summary is related to data obtained in the individual residence halls reports, several significant points emerge. The buildings which are listed as having three or more passenger elevators are from six to ten stories in height. These tend to have large typical floors with elevators in more than one location. Buildings with typical floors housing thirty

SUMMARY OF ELEVATOR INSTALLATIONS AND SERVICE

NUMBER OF STUDENTS HOUSED	NUMBER OF PASSENGER ELEVATORS	STUDENTS PER PASS. ELEVATOR	REPORTS OF ACCEPTABLE SERVICE	REPORTS OF VERY GOOD SERVICE
200–250	1*	235	0	1
300–350	1*	325	1	0
300–350	2	140–175	5	0
400–450	2	200–225	4	1
500–550	2	250–275	2	1
600–650	2	300–325	3	0
[illegible]–400	2*	190	1	0
450–500	2*	225–250	2	0
500–600	2*	275–300	1	1
700–750	2*	360	1	0
450–500	3*	198	1	0
600–650	3	300–325	0	2
900–950	3*	329	1	0
1200–1250	3*	420	[illegible]	[illegible]
500–550	4*	125–133	[illegible]	0
800–850	4	208	1	0
1100–1150	4*	280	0	[illegible]
1000–1050	6*	174	0	[illegible]

* Indicates another elevator is provided, primarily for service use



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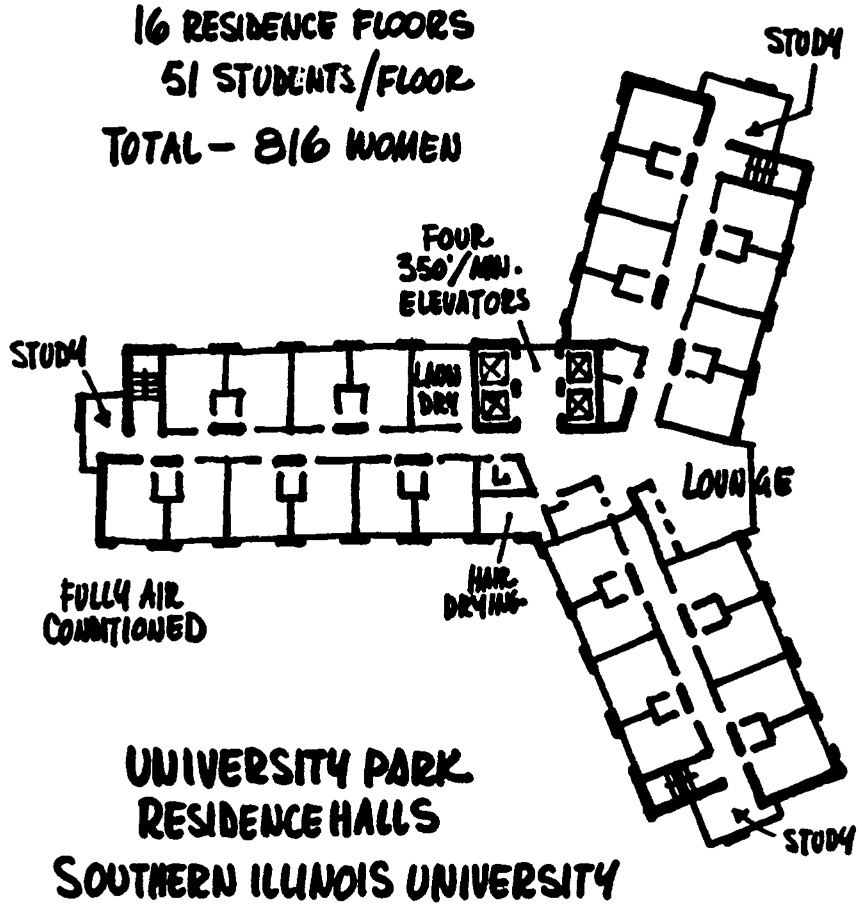

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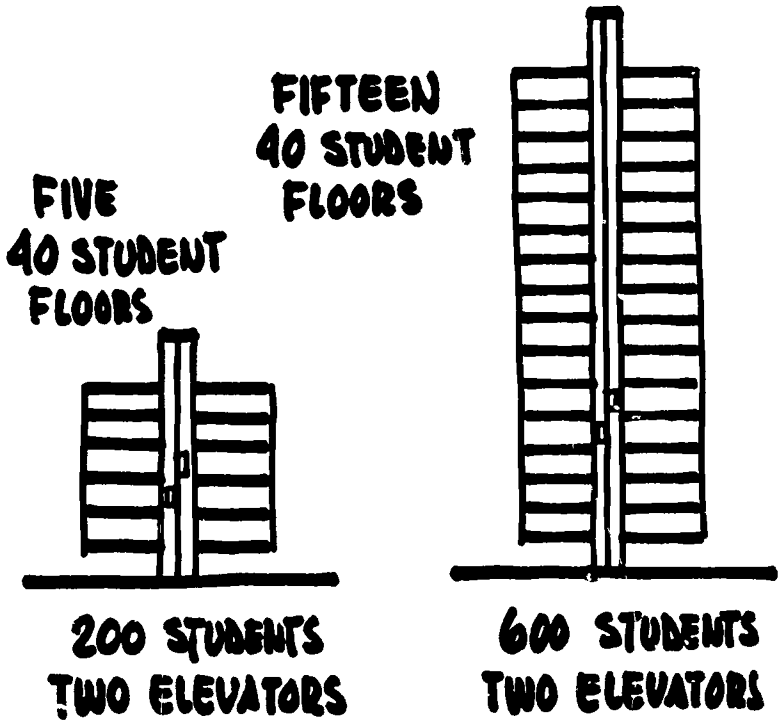


to fifty students apparently have satisfactory service with two elevators whether there are six floors or as many as sixteen. Questionnaire answers did not make evident the reasons as to why, in some cases, service was rated as very good, even though the number of students per passenger elevator was unusually high. However, it was noted that among those reporting very good elevator service, some were using speeds of 300 feet per minute and fewer cars while others were using a speed of 100 feet per minute and relatively more cars. From information gained by the survey, by discussions with administrators and by conference with elevator consultants, the following conclusions and recommendations are made as a general guide:

1. There is general agreement that elevator operation should be of the non-attendant type. Elevators should be designed as foolproof as possible with tamperproof screws and fittings as well as a minimum number of special accessories.

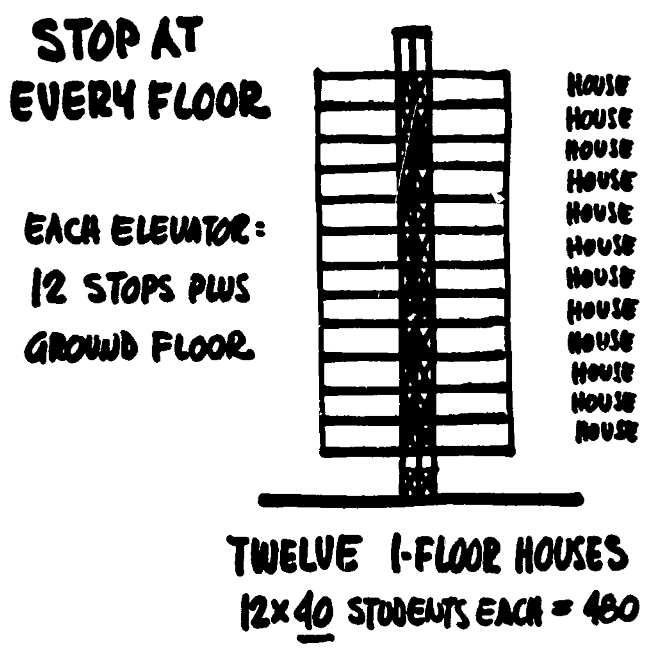
2. Two elevators are virtually a minimum number, since elevator service needs to be maintained even if one elevator is out of operation.

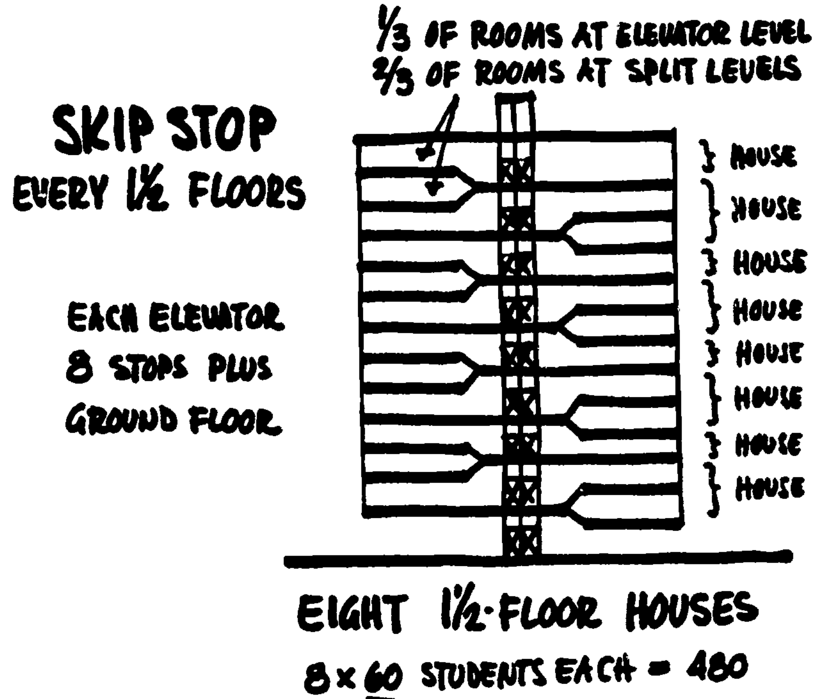
3. Unlike office buildings or classroom buildings, peak traffic periods are rather diffuse. Often the number of elevators which are required in relation to student capacity will not exceed the minimum number of cars desired for maintenance of service.

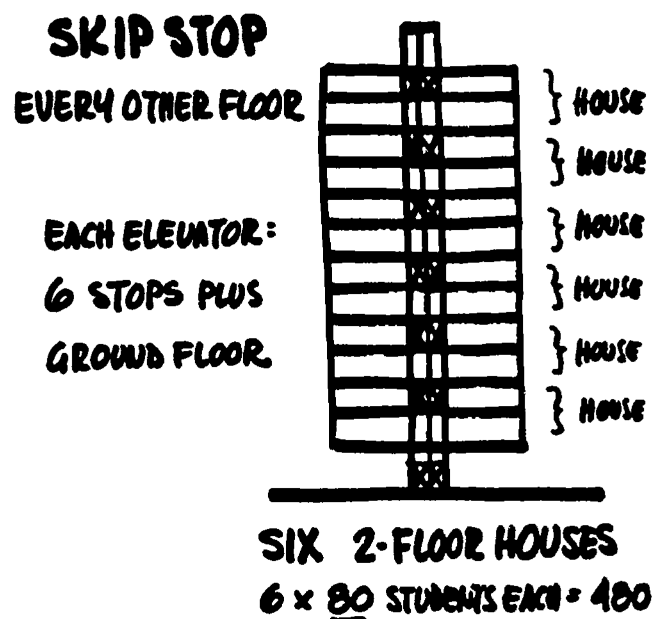
4. Acceptable ratios of students housed to number of elevator cars may vary widely since factors of speed, control systems, type of student occupancy, and building arrangement will all have effects on service.

5. Residence halls elevators lead a hard life especially in men's units. Youthful impatience, an inherent tendency toward horseplay, and the challenge to outwit the automatic controls combine to result in not infrequent breakdowns. This problem is most acute at the beginning of a new term until the residents learn to respect the elevator mechanism in their own interest.

6. Provision of an extra elevator for normal use by maintenance staff and service personnel assures greater availability of passenger cars for student traffic. In case a regular passenger elevator is temporarily out of opera-







tion, the extra elevator, if located nearby, can be used for student traffic to maintain service at nearly normal standard. Reference to the table shows that with an extra elevator for service use, residence halls operate satisfactorily at notably higher student ratios per regular passenger elevator.

SKIP-STOP ELEVATOR SERVICE

Traditionally elevators in high-rise buildings give access to all floors with openings at each level. Skip-stop elevator service has been tried in a number of residence halls with elevator access provided at every other floor, or even at every third floor. Several advantages were expected, but experience with special arrangements of this type has been less satisfactory than hoped for. Some institutions which have tried the skip-stop idea are planning elevator stops at each floor in their newer high-rise buildings. However, the marginal sketches which illustrate skip-stop service do suggest that some very interesting concepts can result from this type of elevator installation. Due consideration should be given to the possible advantages or disadvantages as they may apply in a given case:

ADVANTAGES OF SKIP STOP

a. Cost savings from reducing the number of elevator stops and the number of elevator doorways and waiting alcoves required.

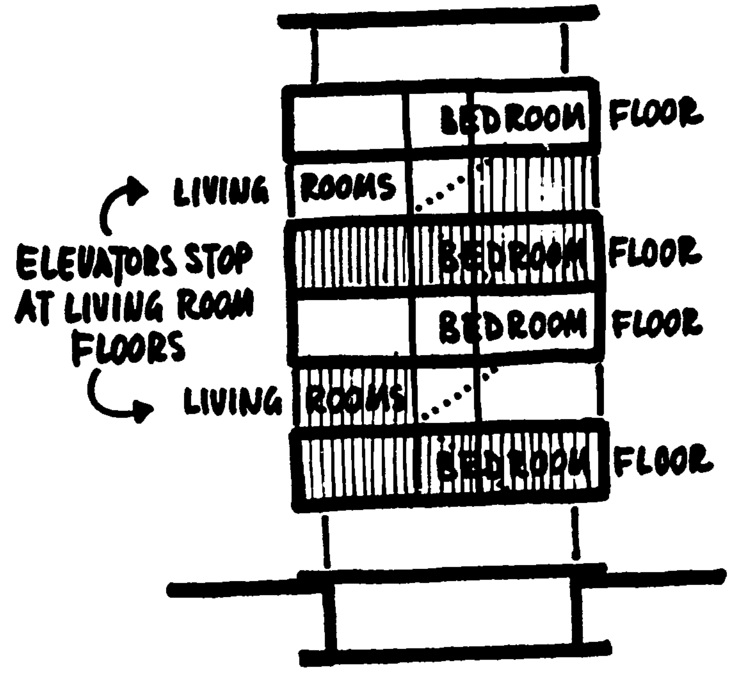
b. Faster service from cars making quicker round trips with fewer stops.

c. Retention of desirable features of traditional residence hall living in which a common entry point serves all students of a "house" on two or three adjacent floors. From the entry area, students use stairs for access to their rooms as in a low-rise unit. Careful distribution of common use facilities and features such as a two-story lounge are then planned to increase the contacts and shared activities of students on the several floors of the "house."

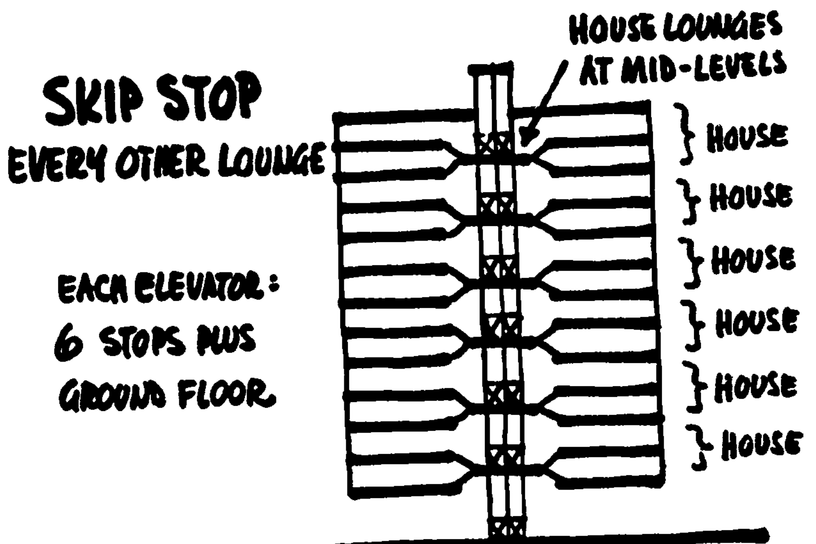
DISADVANTAGES OF SKIP-STOP

a. Extra service requirements for handling of luggage and furniture at beginning and end of terms, are better met with stops provided for all floors.

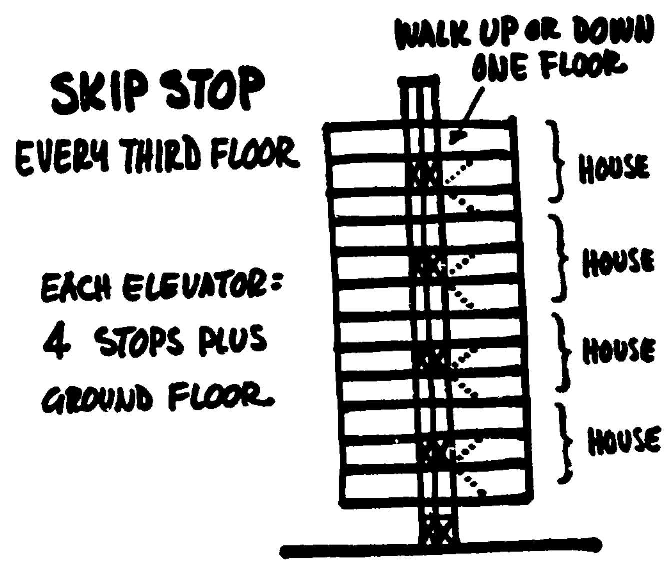
b. Some resentment is felt at the limited access character of skip-stop and the arbitrary prevention of normally direct and convenient access to elevators.



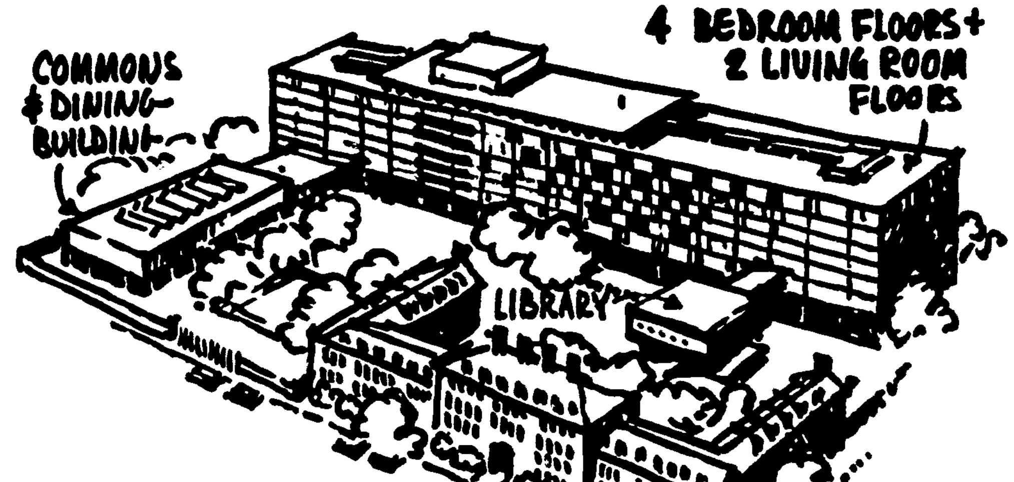
QUINCY HOUSE – HARVARD



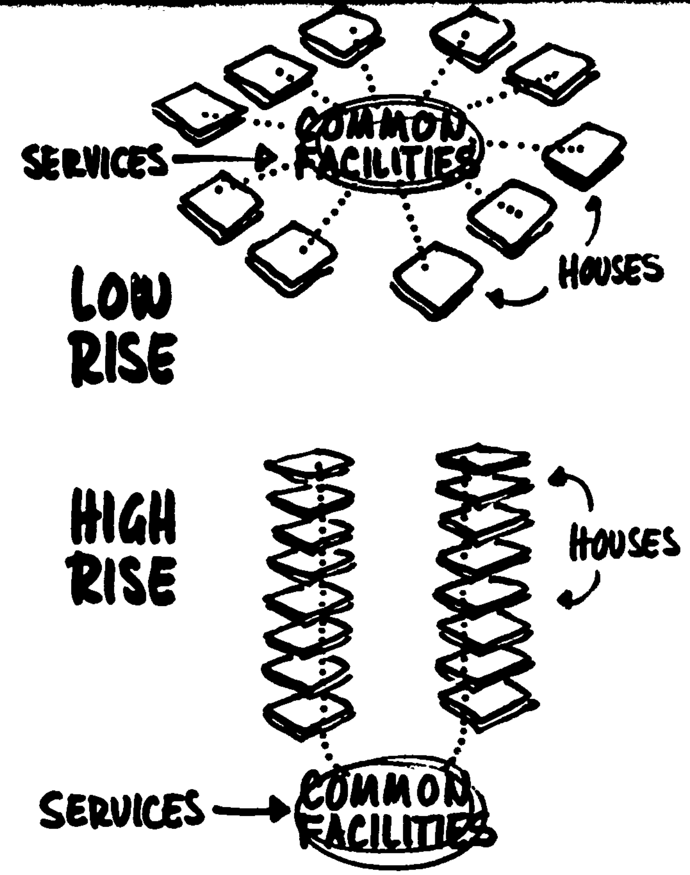
SIX 2-FLOOR HOUSES
WITH MID-LEVEL LOUNGES
6 x 80 STUDENTS EACH = 480



FOUR 3-FLOOR HOUSES
4 x 120 STUDENTS EACH = 480



QUINCY HOUSE
HARVARD UNIVERSITY
FOR 250 STUDENTS



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c. Although hall traffic and noise distraction are less on floors without elevator service, these annoyances are correspondingly increased on the floors having elevator access.

d. On intermediate floors the relative quiet and the use of a stair access tend to give a feeling of remoteness and even exclusiveness which divides rather than promotes the intended feeling of community between the several floors served by one elevator stop.

COMMON FACILITIES AND SERVICES

As residence halls have developed over the years from simple dormitories to modern residence halls, the variety of facilities and number of services provided has increased markedly. The desires of a particular institution relative to the size, location and types of common facilities to be provided in residence halls will vary widely. The following check list summarizes generally accepted common facilities and services which may be considered in fitting an institution's needs and objectives into a housing program:

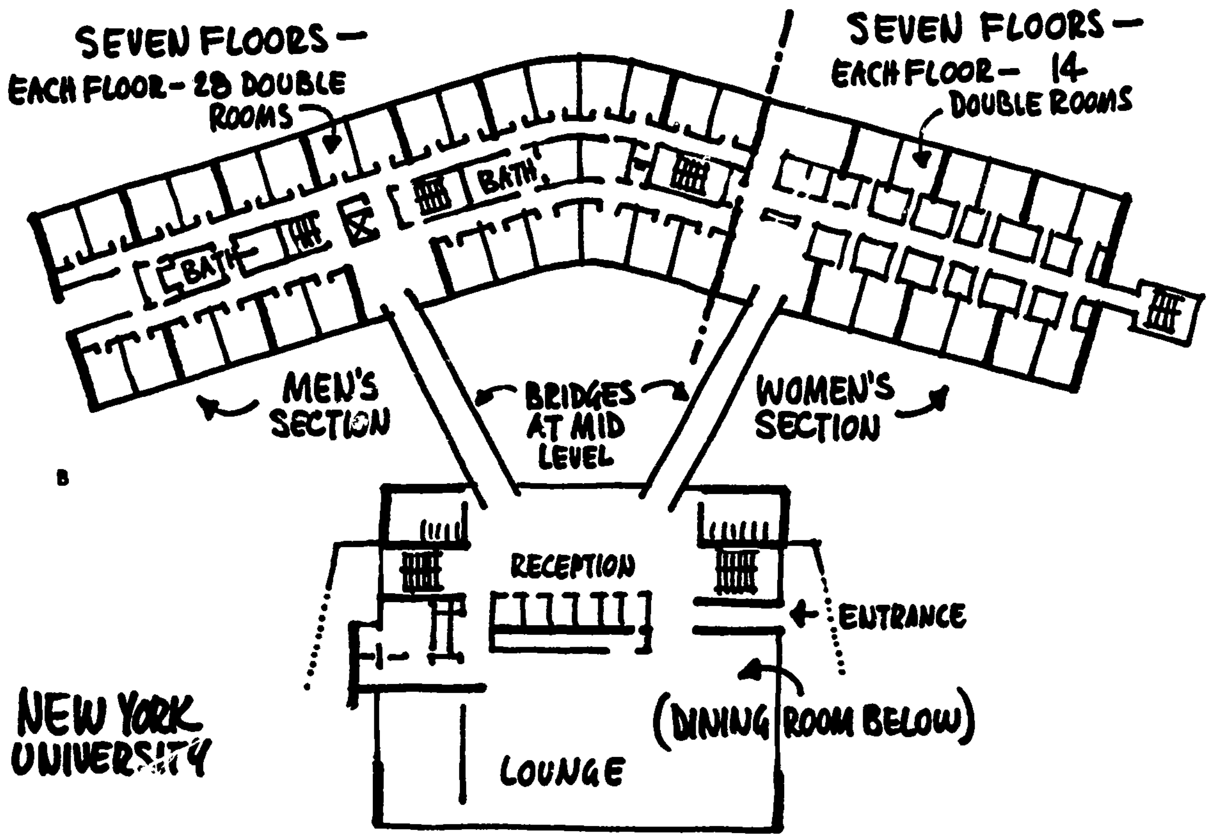
REFRESHMENT
- Dining Facilities
- Snack Bar
- Drinking Fountains
- Vending Machines
- Kitchenettes

ACTIVITIES
- Study Areas
- Typing Rooms
- Music Practice
- Hobby Rooms
- Parking
- Car Washing

RECREATION
- Lounges
- Game Rooms
- Party Rooms
- TV
- Sun Bathing
- Outdoor Areas

SERVICES
- Mail
- Telephone
- Dry Cleaning
- Laundry
- Pressing
- Hair Drying
- Linen

Many of these facilities can only be justified if they are available to a significant number of students. They may be provided in large low-rise units. Considerations of convenience and availability in a spread out low-rise housing area will tend toward duplicating facilities in various locations. High-rise buildings offer a concentration of student population in relatively small areas, permitting the centralizing of some services and certain facilities for the common good of all students. A central location usually can serve more students with less investment in space and equipment than is required if the facility is provided in several locations. The planning of higher concentrations of students on smaller areas of ground offers opportunities to be exploited as well as special problems to be solved. The following observations are made to point out considerations in detailing common use facilities and relating especially to high-rise residence halls:



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NEW YORK UNIVERSITY

FOOD SERVICES

Central food facilities to serve high-rise residence halls generally tend toward mass feeding arrangements. The resulting economic advantages include less supervision, common preparation of varieties of food, better menu varieties, and opportunity to operate with a smaller and more experienced staff. Small satellite dining rooms can be worked effectively around a central kitchen, but the need to base planning on cafeteria style service should be recognized if costs are to be kept minimal.

In some institutions, a variety of requests are made for 5-day, 7-day, or free choice on contract meal arrangements. High-rise building concentrations of students might result in sufficient volume to allow special arrangements and meal ticket adjustments.

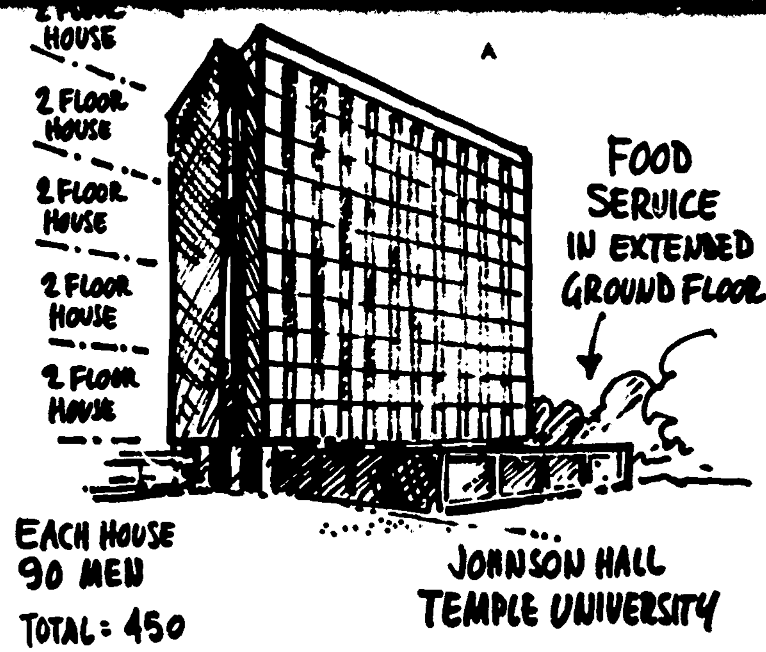
Snack bars and vending services may be more readily provided in high-rise projects since volume is a key to successful operation of these facilities and centralization in fewer locations will require less equipment and the equipment installed will get more use. Location on main floor or lower level permits better servicing since vendors and their personnel may have direct access to maintain stocks and equipment and consequently can be kept off living floors.

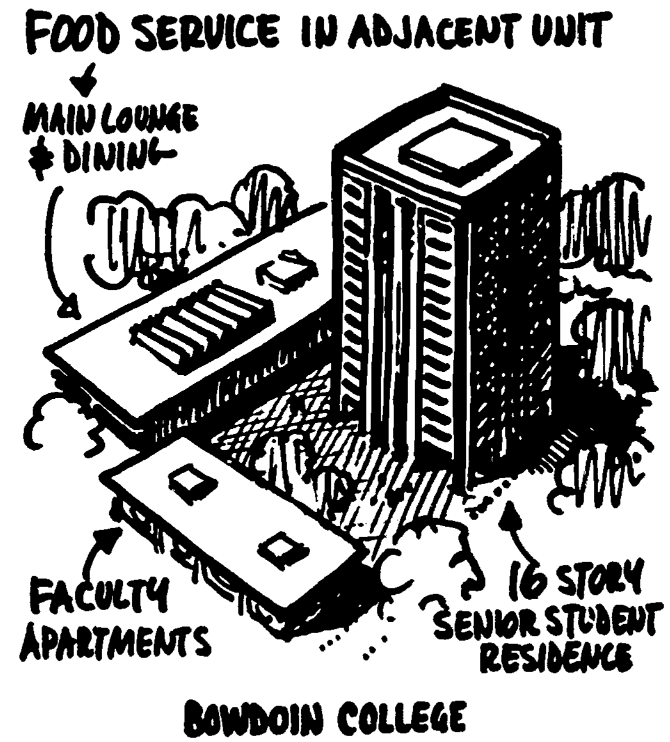
ACTIVITY SPACES & RECREATION AREAS

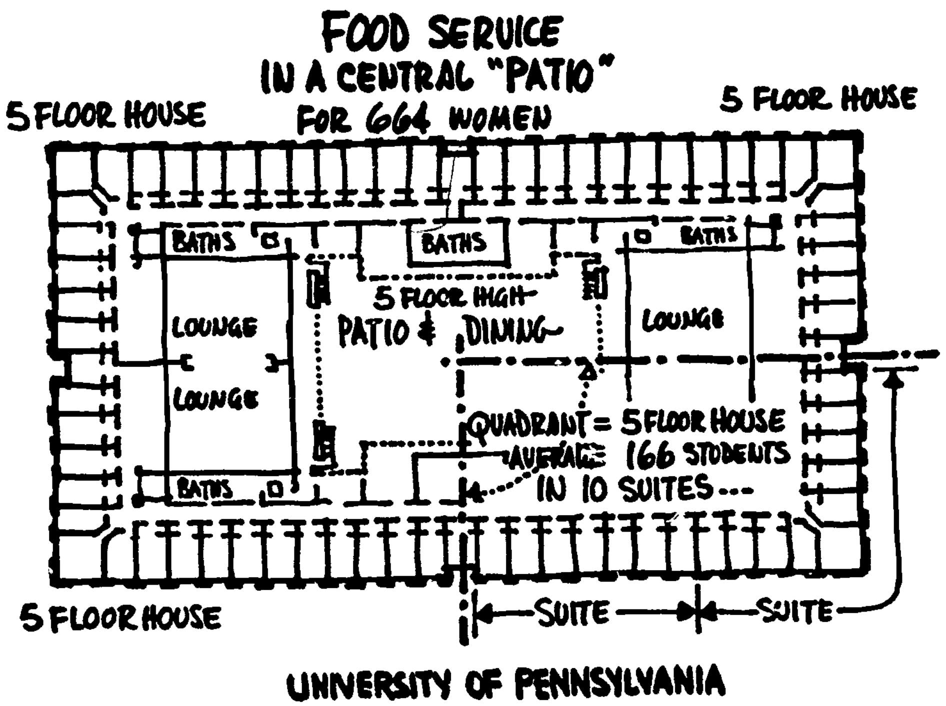
The high-rise concept offers the possibility of providing specialized activity spaces as well as specialized areas for indoor and outdoor recreation. These can be readily accessible for use during short periods of free time in the student day. Instead of a series of multi-purpose areas in several locations and serving small groups of students it becomes possible to have several areas closely related, each equipped for a particular use or interest. Total area and amounts of equipment may actually be somewhat less. Overall use will tend to be more intensive and general participation will be greater.

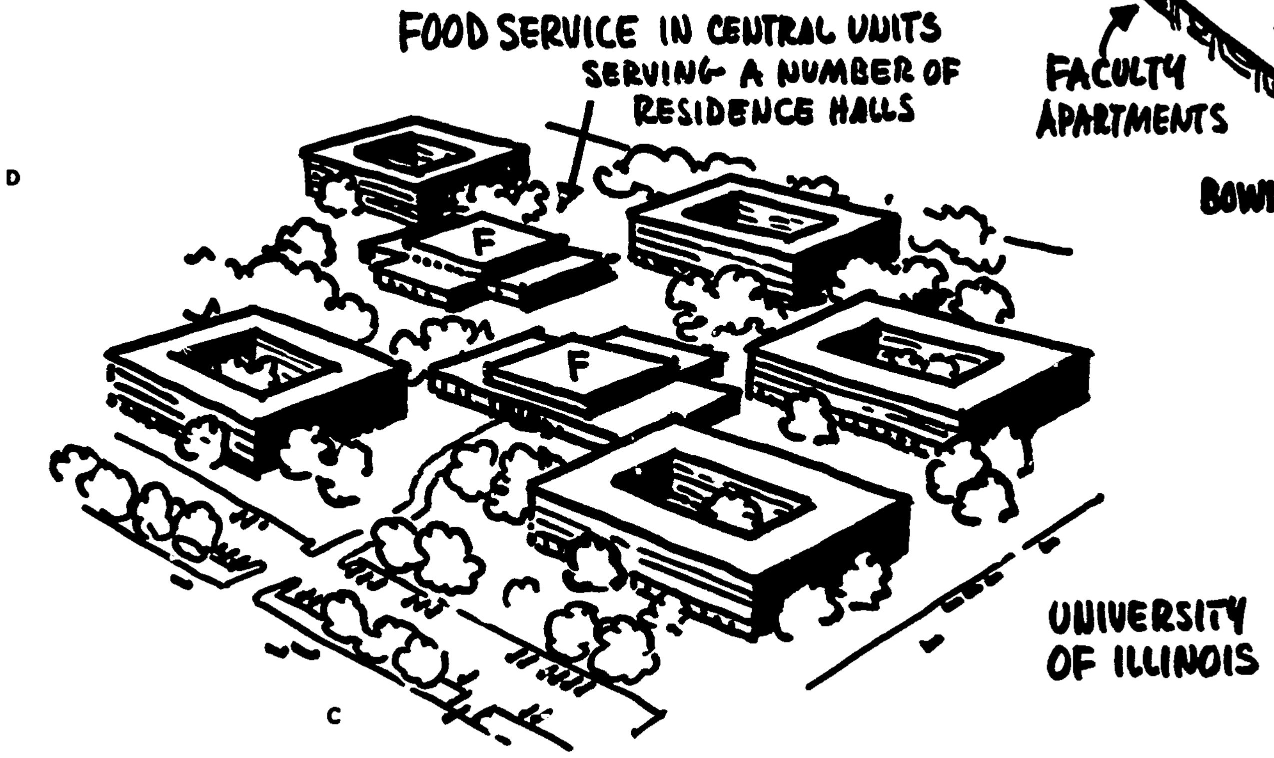
COMMUNICATIONS

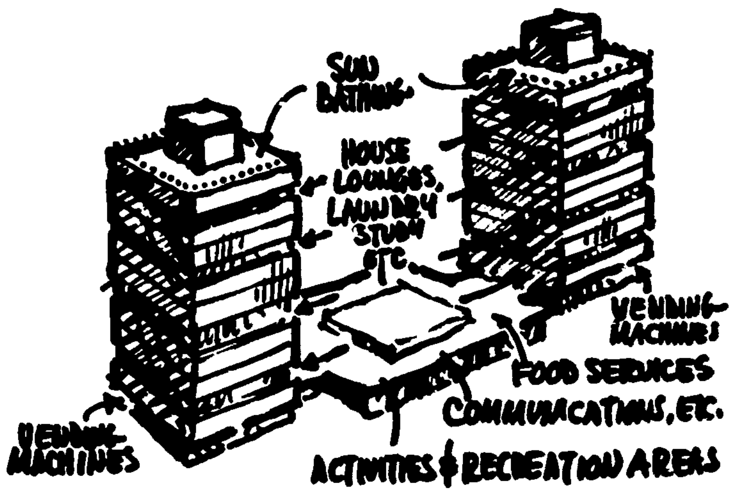
The problems of telephone communications and handling of student mail entail the same conflict of adequate service and reasonable costs regardless of the type of residence halls contemplated. The needs become greater and the problems more acute in the high-rise unit, but fortunately the opportunities to centralize these serv-











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ices and to provide adequate central staffing are also greater. In these critical services it is most important that recommendations be obtained from local postal authorities and local telephone officials.

STUDENT SERVICES

With regard to personal services and conveniences, a thorough application of the principle of concentrating facilities on lower floors of a high-rise building may be unwise. Obviously a single large pressing room with thirty ironing boards, located in the basement of a fifteen story building, would be a poor answer to the need it is attempting to serve. In planning areas for laundry, pressing, hair drying, etc., it may be feasible to provide small areas for these purposes in each low-rise residence hall, while in high-rise units it would be desirable to disperse the facilities on upper levels where they would be more directly accessible to students.

COMMERCIAL OPPORTUNITIES

The tendency toward concentration of facilities and services and the volume potential of large high-rise residence halls can offer opportunities for added revenue which may be considered and planned for. A hotel-type service can be afforded summer conference groups through arrangements wherein central check-in services are available. The volume potential of the high-rise unit may warrant provisions of space for commercial ventures such as barber and beauty shops, gift corners, branch bookstore services, dry cleaning stations, and other services.

LOCATION OF CENTRALIZED FACILITIES

In low-rise residence projects, centralized facilities such as a cafeteria, kitchen, study-lounge, offices, etc., if provided, are usually in a separate building centrally located in relation to a group of residence units. In large high-rise units the number of students housed often justifies incorporating these facilities in the high-rise unit. The major central facilities are best located on the main floor and in the basement or lower level, if one is provided. The combined size of these facilities frequently totals much more than the typical upper floor. If these levels are extended beyond the main mass of the building, several advantages may be gained:

1. Construction of a low projecting wing may be permitted to be of low cost fire resistive type.

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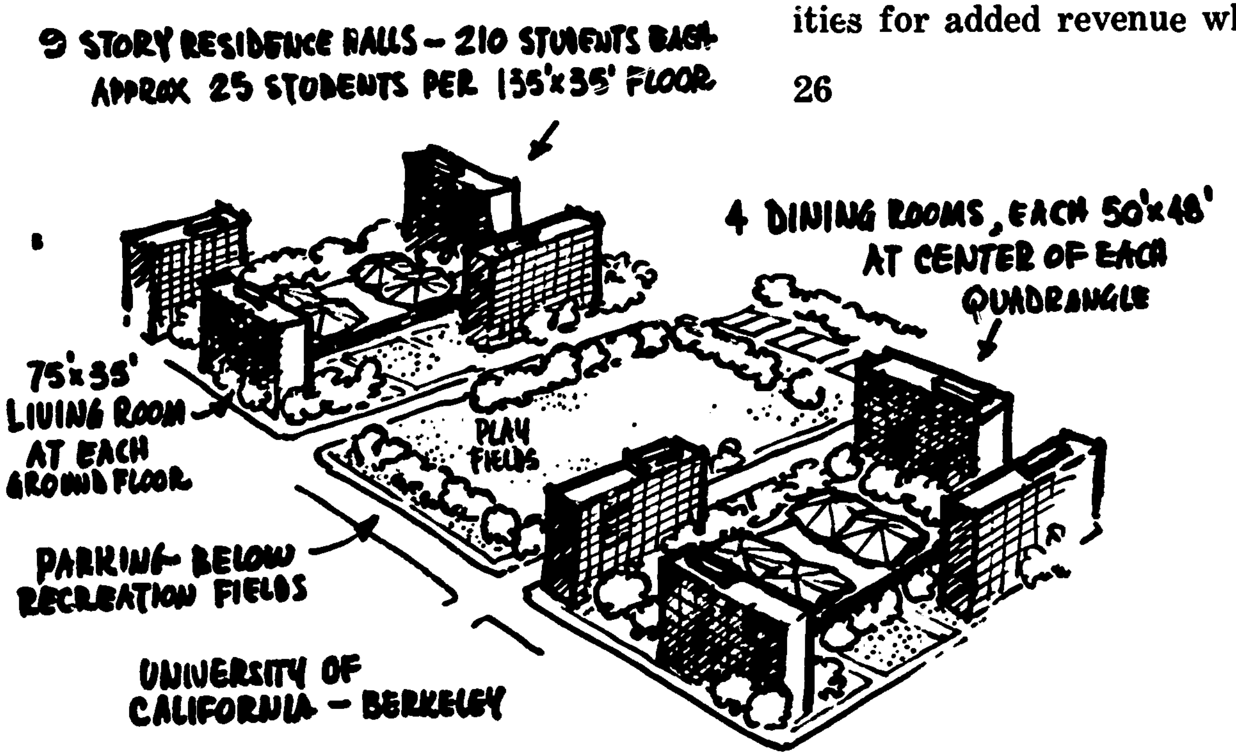

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2. Desired spaces in an auxiliary wing are freed from limitations of floor to floor height and column spacings established for the main building.

3. Service drive access and required mechanical services may be provided more simply with less distrubance to the main building.

OPERATIONAL FACTORS IN HIGH-RISE RESIDENCE HALLS

Operational factors are of three general types relating to managerial supervision, housekeeping and maintenance. Since the same functions must be performed, regardless of the type of building, there appear to be no significant basic differences in the staffing and systems of operation for low-rise or high-rise residence halls. Details of operation do vary between the two types of buildings and these relative differences should be understood.

MANAGERIAL SUPERVISION

a. The concentration of students in a high-rise building with convenient elevator access to various parts of the building results in easier supervision and less time and effort spent in walking about the building.

b. An office or control point usually can be located to function more effectively in a high-rise unit because of its basic nature and the reduction of the number of entrances.

c. Supervisory staff is more accessible to the students resulting in better and easier communications.

d. Building inspections can be made more readily because horizontal travel distances are reduced.

e. Security problems are significantly reduced because of fewer exterior doors, easier control of incoming supplies and service personnel and because placement of common-use facilities and public areas on the lower floors usually results in keeping all student rooms above the street level.

HOUSEKEEPING

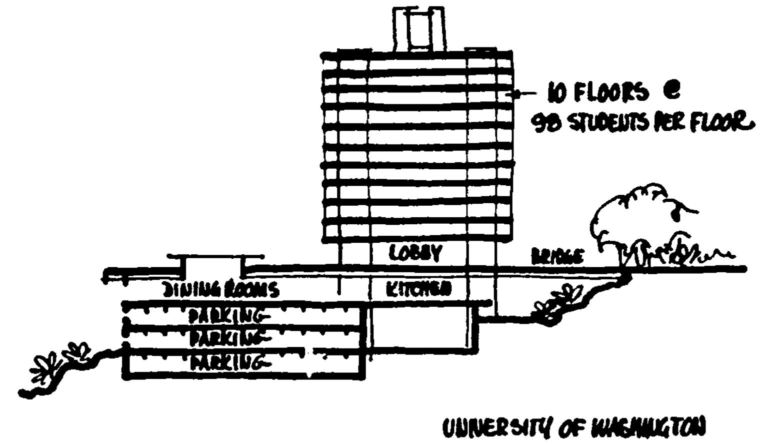
a. With less ground area per student in high-rise units, the cost per student for ground maintenance and snow removal is less.

b. Elevators make the use of carts practical and time-saving for cleaning personnel. Working time can also be reduced because the distance to central supply and equipment rooms may be shorter. These factors may make larger work assignments possible.

c. Although small linen rooms and storage for hand luggage may still be needed on each floor, the main linen room and storage area can be centrally located in the basement for good control and accessibility.

d. Window cleaning in high-rise units can be more difficult and therefore more costly unless proper consideration is given to this problem in the design and planning stage.

e. Trash and paper disposal is a problem in either type of residence hall. It is becoming more common for city ordinances to prohibit incinerator disposal systems. The most common system currently employed is the use of trash chutes conveniently located on each floor with the accumulated trash periodically removed from the site or burned in an incin-



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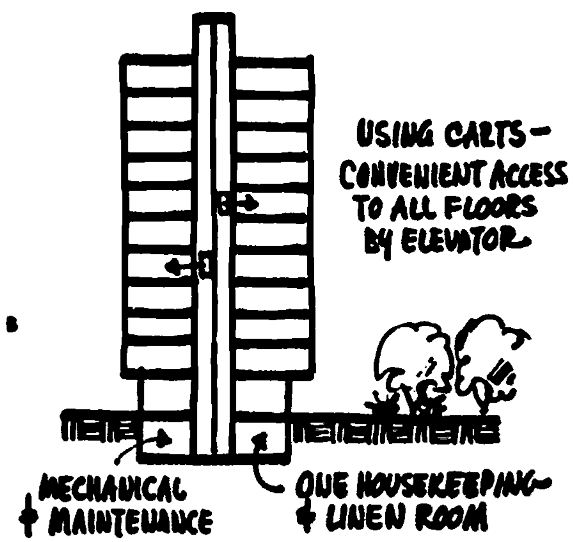

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erator if permissible. This method will generally require a chute sprinkler system to reduce the fire hazard. With a trash chute or incinerator chute system, it is evident that fewer collection points, and consequently fewer disposal chutes are required on high-rise buildings. In elevator-type buildings trash chutes may be eliminated in favor of central collection points on each floor. A trash-cart system similar to methods used in office buildings is then used. Fire safety is provided by a shower head with a fusible link control.

MAINTENANCE AND REPAIR

a. Mechanical equipment and controls for heating, ventilating and utilities in high-rise buildings are centralized, tending to require less overall space and less engineering personnel.

b. Centralized operating devices and controls for heating and ventilating are larger and more complex because of the size of the job to be done. High-rise residence halls are more apt to have air-conditioned areas thereby adding cooling equipment to the maintenance load.

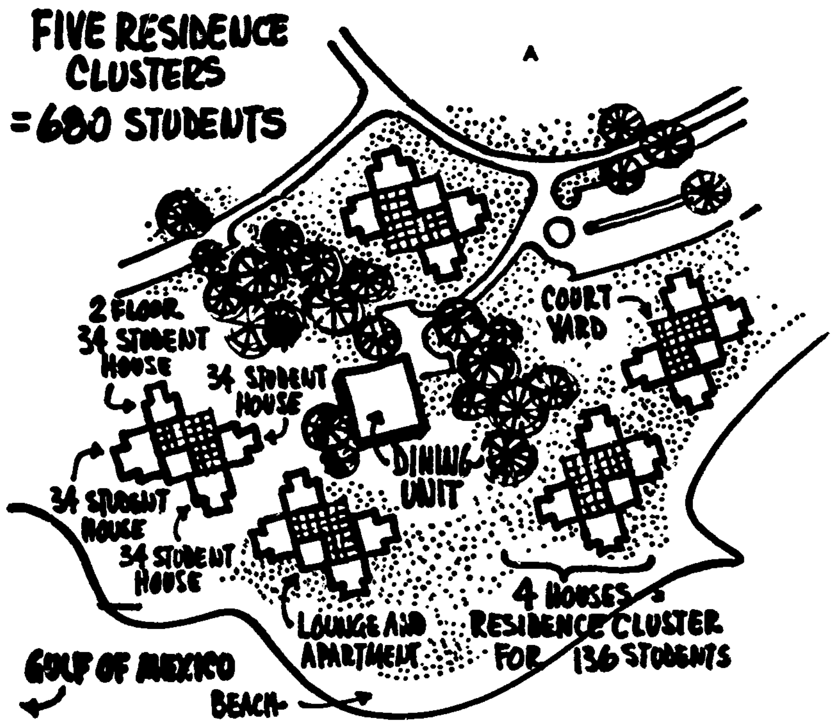
c. The more extensive and complex mechanical systems of high-rise units tend to become more sophisticated than in low-rise buildings which may require more specialized and technically trained maintenance personnel.

d. Exterior inspection, tuck-pointing and outside maintenance are more difficult and costly because of heights involved in high-rise units.

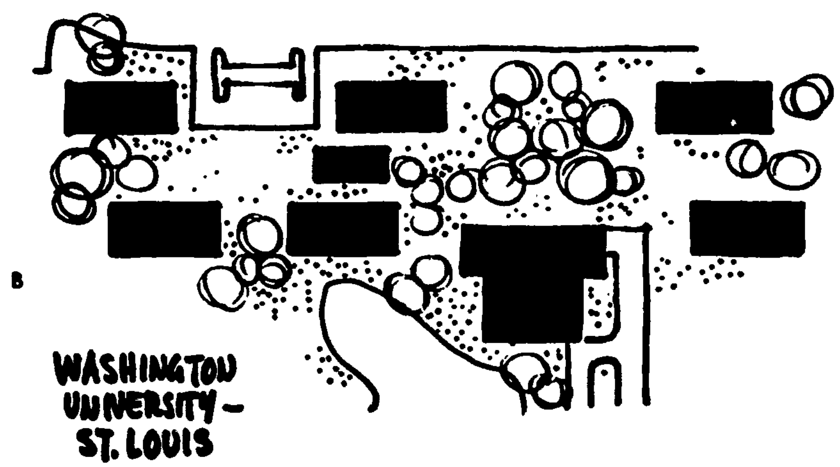
e. Elevators offer some advantages to the maintenance department. They reduce transportation time for personnel on routine inspections. They provide easier movement of furniture, equipment and items to be repaired.

f. Elevators add substantially to maintenance and servicing costs. The complexity of automatic controls and hard usage by the students make this a troublesome problem, especially in men's residence halls where student horseplay adds to elevator difficulties. Some institutions prefer to contract on an annual basis for servicing by a qualified elevator maintenance organization.

g. General maintenance and repair need to be more thorough and prompt because of the relative concentration and complexity in a high-rise residence hall. A particular breakdown or malfunction can affect a greater area and more readily assume an emergency character. Power disruptions are more critical due to dependency on elevators and relative isolation of upper floors. Emergency standby generators are desirable and may be required.



FLORIDA PRESBYTERIAN COLLEGE



INTANGIBLE VALUES IN RESIDENCE HALLS

Up to this point, key phrases have been "cost savings," "area reduction," "repetition of elements," and "concentration of students." Obviously if considerations relating to these factors were allowed to become the governing criteria in planning a residence hall, failure of the building to achieve its purpose would be assured. As in most areas of human activity, intangible values must be allowed precedence over purely material considerations.

We have been evaluating physical attributes and measurable differences of high-rise and low-rise residence halls. The directions of maximum economy in use of land, building area and materials and the greatest efficiency in common services, operation and maintenance need to be determined. However, the purpose of such economies is to allow a greater portion of the construction and operating budget to be devoted to the intangible qualities that are most essential in residence halls for students.

Colleges differ in their objectives. They differ in how they view the place of their residence halls in relation to the education of the student. Determination must be made of the importance to be assigned to various cultural and sociological implications which are inherent in the construction and operation of college residence halls. These factors should be made explicit and be stated clearly in the program for the project so that the design will be developed to achieve these major objectives.

The remaining sections of this report deal with aspects of low-rise and high-rise residence halls relating to these important areas of concern.

SIZE AND INSTITUTIONAL BIGNESS

The phrase "high-rise residence hall" conjures up an image of a large hotel-like structure housing upwards of a thousand students. Many a housing administrator, recognizing the pressures for hous-

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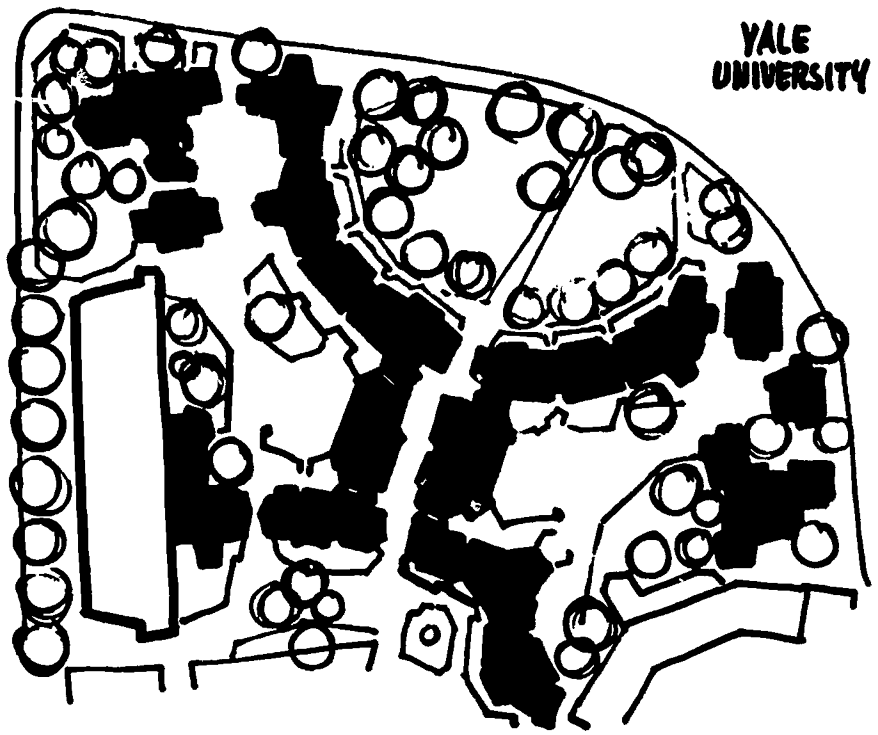

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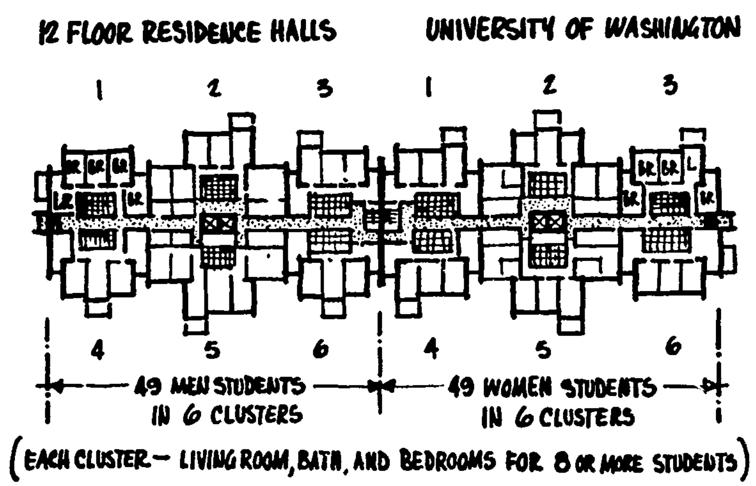

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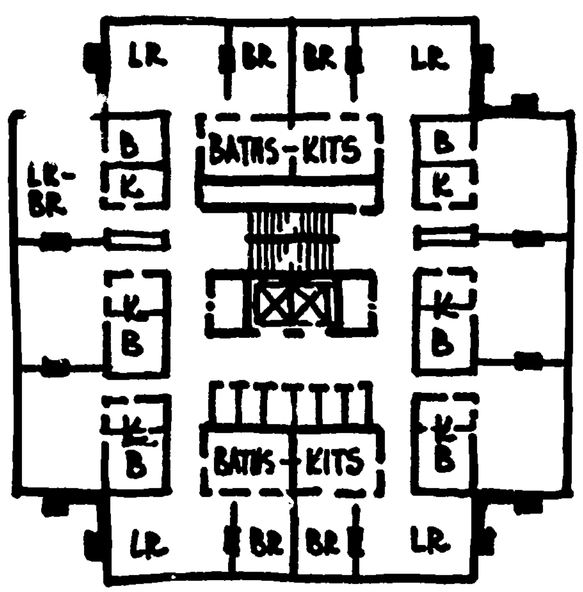

16 FLOORS – EFFICIENCY & 1 BR. APARTMENTS
MARRIED STUDENT HOUSING – M.I.T.

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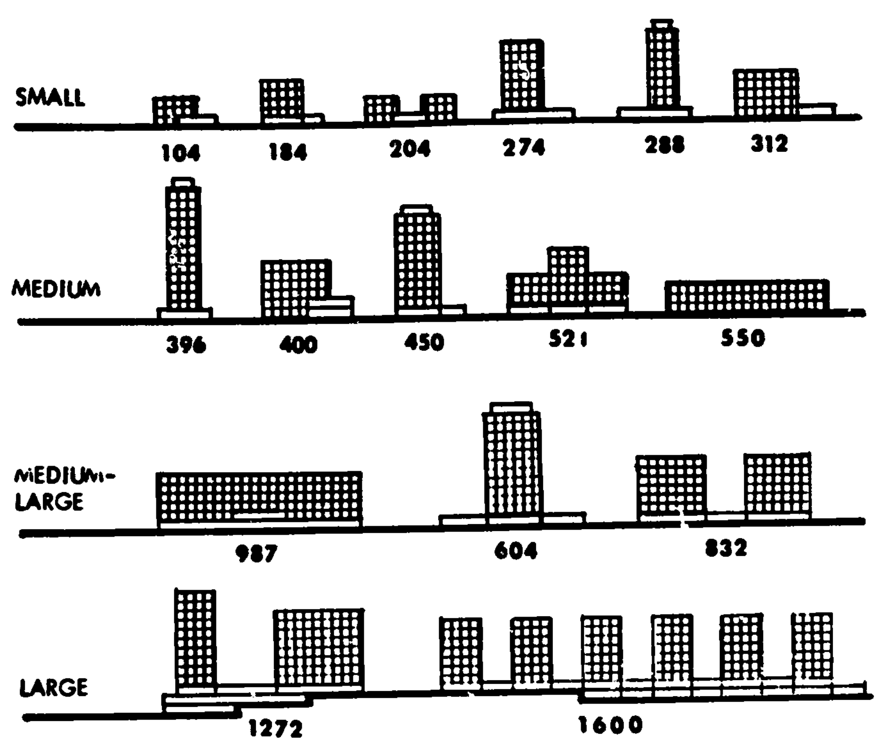
ing increasing numbers of students on decreasing areas of available land, will reluctantly contemplate high-rise residence units with this image in mind. As with many preconceptions, this image is too narrow and the reality offers a wide range of possibilities.

The accompanying chart shows in a graphic manner the variety in height and ground dimensions for various building capacities as represented in the cross section of high-rise residence halls types covered in the national survey made for this report. The diagram blocks of the chart do not attempt to show actual building silhouettes. They are based on an arbitrary scale in which one unit of width equals ten students of floor capacity and each unit of height represents one story of building.

RESIDENCE HALLS come in all shapes and sizes

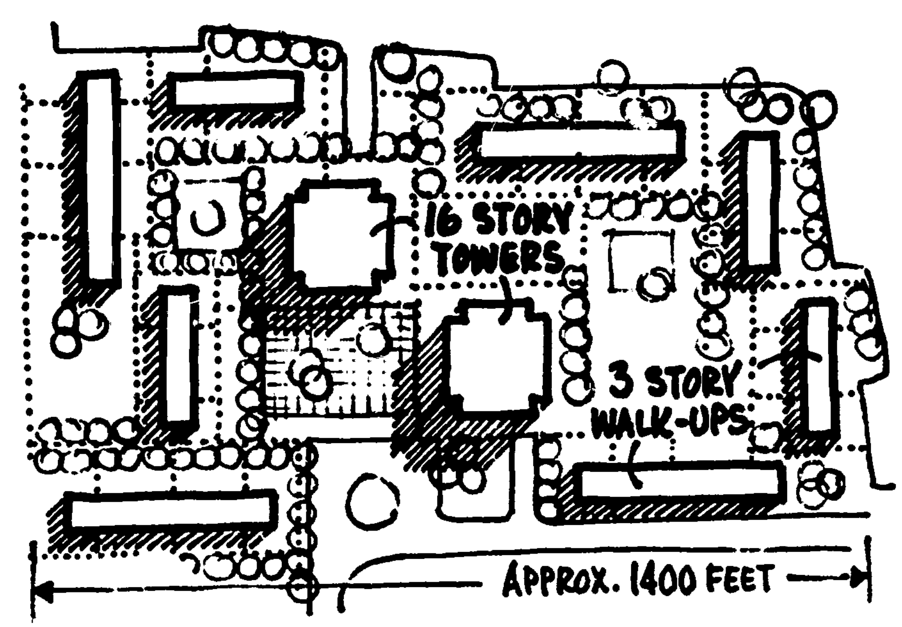


LOW-RISE RESIDENCE HALLS MAY BE LARGER THAN RESIDENCE HALLS WHICH ARE **HIGH-RISE**

Sheer size, on occasion, may have particular advantages and even be desirable for some types of building. This is clearly not an asset in student housing, although large units may be essential to meet the needs. The reality of bigness as well as the appearance of bigness seem inimical to the very concept of residence halls and the role they should play in the personal and social development of the individual students who live there. Many current tendencies in the planning and design of the larger types of residence halls, and high-rise units especially, have to do with minimizing the necessary physical size and subdividing the large unit into smaller units designed for small group living.

To the extent that a high-rise residence hall tends to be large, it becomes at once more difficult and more necessary to maintain a residential scale and character. Generally ceiling heights are kept low and overall height is minimized. Windows are usually of residential type with smaller glass areas than may be used in other campus buildings.

High-rise units, like tall men, are bound to be relatively conspicuous. As such, they need to avoid pretentious design. A single unit should be de-



MARRIED STUDENT HOUSING–
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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signed to combine well with existing or future units for a common group relationship. The concept of a residential community for students can serve as a guide.

Individual units can be designed as well adjusted members of an eventual group by using some elements as common denominators. With a basic discipline established and a general goal in mind, the dullness of undue repetition can be avoided, and a desirable degree of individual character within a cohesive grouping can be achieved. Some variation in heights of high-rise units can combine well with a proportion of low-rise auxiliary buildings or residence halls, to form a pleasing integration of vertical and horizontal shapes.

SOCIOLOGICAL IMPLICATIONS

Sociological aspects of residence halls living are those factors which relate to the student society, its organization needs and development. For two residence halls of equivalent capacity, it cannot be shown that there is any significant sociological difference between one classified as a low-rise building and another which is of the high-rise type. Although there has been much discussion of the most effective group size and physical size for a typical floor, it would appear that the building as a whole can be just as effective whether it is a high-rise or low-rise structure, regardless of the group size per floor.

One of today's major problems is numbers of people. We are all compelled to learn to live with and relate to more and more people in larger and larger groups. College campuses face this same problem. Individuals generally have small groups with which they identify themselves. Sociologically speaking, these are primary groups. Provisions should be made for such primary groups in residence halls. The interaction and relationships of various groups contribute to the progress of learning to live with large numbers of people, while small isolated groups generally fail to achieve similar progress.

A residence hall must have an adequate layout for traffic flow and for facilities to meet the physical requirements of its residents. The sociological planning must be flexible to permit adjustment to the needs of the group and the individuals that constitute it. Society is changing, and if residence halls are to be a tool of education to provide leadership, they must also be able to adjust and keep pace with changing times. Too much rigid adherence to a preconceived social pattern for student living can obstruct rather than promote good sociological relationships.

If we assume a moderately large high-rise residence hall of ten or twelve stories, there are inherent characteristics that have sociological implications for the individual and for the group:

1. *BETTER CONTROL*—The more obvious physical organization of the high-rise building creates an atmosphere of orderliness and administrative control quite independently of actual control measures. High-rise buildings do not lend themselves to panty raids.

2. *MORE PRIVACY*—Since lower floors of high-rise buildings are usually taken over by common use facilities, student living floors have more privacy and women residents have a feeling of greater security.

3. *OUTSIDE DISTRACTIONS*—If located in a busy area, outside distractions would tend to be less troublesome in a high-rise building.

4. *UNIFORMITY*—The more rigid discipline of a high-rise structure often results in a monotonous stacking of identical units on top of each other, even to identical color schemes and furnishings. Such excessive uniformity

MARRIED STUDENT HOUSING — HARVARD

MARRIED STUDENT HOUSING — YALE

can have a depressing effect minimizing the importance of the group as well as the individual.

5. *DISCIPLINE*—If the high-rise residence hall fails to provide the intangible values essential to a satisfactory environment, a rebellious attitude tends to develop which leads to vandalism and disorderly group behavior. As evidenced in low-cost public housing, such reactions are magnified in high-rise units.

There are several sociological implications in the placing and arrangement of services within a residence hall. For instance, a service facility may be set up to serve all occupants of a building, or it may be separated into different locations serving each floor or living unit. By its location it can affect group identification, academic atmosphere, supervision and group activities. The following chart shows the probable effect on these sociological factors of the centralized or decentralized placement of the services listed:

SOCIOLOGICAL EFFECTS FROM PLACEMENT OF SPECIAL FACILITIES

	IDENTIFICATION WITH OWN GROUP		GROUP ACTIVITY & PARTICIPATION		EFFECTIVENESS OF STUDENT GOVT.		ACADEMIC ATMOSPHERE & STUDY CONDITIONS		ADMINISTRATION & SUPERVISION	
	if in house units	if for entire building	if in house units	if for entire building	if in house units	if for entire building	if in house units	if for entire building	if in house units	if for entire building
STUDY HALL	+	O	+	O	+	O	—	O	O	+
REFERENCE LIBRARY	+	O	+	O	+	O	—	O	O	+
BROWSING LIBRARY	+	+	+	O	O	O	+	+	—	+
TYPING RM.	+	O	+	O	+	O	—	O	O	+
GAME ROOM	+	—	+	—	O	O	—	+	—	+
TELEVISION	+	O	+	O	+	O	—	O	O	+
VENDING MACHINES	+	—	+	—	O	O	—	+	—	+
KITCHENETTE	+	—	+	—	O	O	—	+	—	+
LAUNDRY	+	—	+	—	O	O	—	+	—	+
PRESSING	+	—	+	—	O	O	—	+	—	+

KEY: (+) = contributes (—) = detracts (O) = irrelevant

Recently much interest has been expressed in the idea of including classrooms in residence halls complexes and buildings. In some cases, classrooms are intended for exclusive use by residents of the halls in which they are placed. In other cases the concept assumes general use as a campus classroom. Experience with classrooms in residence halls has been very limited but tends to indicate the following:

a. Classrooms for the exclusive use of residents contribute to group identification, academic atmosphere and general study conditions in the residence hall.

b. Classrooms used jointly by residents and other students detract from group identification.

c. The sociological effects of classrooms in residence halls are the same whether in high-rise or low-rise units.

PERSONAL SPACE

Although building space has physical dimensions and measurable costs, its intangible values are also very real. Caution should be exercised in reducing areas and dimensions in student living areas, particularly in the typical student room. Reductions which make everything slightly undersize can be self defeating. Since lineal feet of partitions, number of doors, etc. are not reduced in the same ratio, cost *per square foot* actually goes up.

Minimal living spaces are less than satisfactory in any building. In a high-rise building the undesirable effects are multiplied and problems of congestion, noise and disorder may result which would not occur in a low-rise unit.

After satisfying the physical space requirements for the various facilities, including student rooms, there are other space factors which should be considered in developing the area, the shape and the relationships of the various living spaces. It is often these factors which cause students and administrators to prefer certain residence halls over others which may statistically provide more space per student. These factors have been called "Personal Space and Territory" by Dr. Robert Sommer of the University of Alberta in an article on the subject in the February 1960 issue of Canadian Architect.

Personal space follows the individual around. It may be the area he needs to thumb through a magazine in a lounge without feeling an uninvited part of a conversation between two students he doesn't know. It may be the space he needs to concentrate on study without being distracted by someone studying near him, or the space he needs to get his clothes out of the closet and dress without stumbling over the bed of his room-mate, who doesn't have an early class.

Territory is the space that the individuals of a group assume as their own, in which outsiders are considered guests or interlopers. Its boundaries are set by recognizable but often unpredictable physical elements of plan or space relation. Lack of understanding of this factor is sometimes seen in the floor lounge which is meant to serve students in two or more wings of a building. One group may preempt it as part of its territory or more often, since it does not clearly belong to either of the groups, it is not really used at all.

Imaginative and understanding use of these principles of sociological planning and space psychology is a much more important consideration in achieving a successful residence hall than the mere fact of being a low-rise or high-rise unit. A building so planned is truly economical because the housing provided is the kind of home for students which it was intended to be.

GENERAL CONCLUSIONS

The high-rise concept for residence halls is largely a result of new needs in student housing and new urgencies in the problems traditional with residence halls. While it does not lessen the problems of residence halls planning, it does offer a way by which some aspects of current problems of land and capacity may be resolved.

Research and analysis of existing high-rise residence halls does not produce special formulas for general application in planning this type of unit. Guideposts and warning signs have been established, however, to prevent the needless creation of new problems which might arise from undue reliance on the high-rise principle as a panacea.

The effectiveness of this report will be determined by the degree to which those concerned with student housing are encouraged to initiate their own study and planning process in this field. With knowledge of the elements to be considered in evaluating the high-rise concept, judgment can be made as to its possible advantages in a particular residence halls problem.

If economic considerations and physical factors indicate high-rise as a logical answer to the problem at hand, it need not be thought that the student is necessarily the loser in the quality of living provided. The same thoughtfulness and thoroughness in planning which can keep a low-rise residence halls from being a barracks, can also keep a high-rise unit from being an impersonal warren. Some of the best of the newer high-rise residence halls suggest that it may be possible to develop qualities of student living superior to what has yet been seen in low-rise units.

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APPENDIX A

A COMPARATIVE EVALUATION OF HIGH RISE VERSUS LOW RISE DESIGN IN RESIDENCE HALLS*

For some time there has been considerable thought and discussion devoted to the comparative merits of high rise versus walkup buildings in residence hall developments. Unfortunately a realistic evaluation of the two is difficult to ascertain due to the many variables affecting the design of a given residence hall complex, and a final selection of building type has been made on the basis of judgment, largely influenced, for the most part, by the location and, of course, land costs. Other cost factors are difficult to analyze at the inception of a project due to the fact that preparing comparable designs for estimating purposes is apt to be costly to warrant the study. Moreover, in general the site that would accommodate a high-rise building might not permit sufficient density with low-rise units. Finally the distinct differences in the plan and general design of the two types make a true comparison almost impossible. The result is that architects and housing administrators have no final answer to the rapidly developing trend toward high-rise residence halls induced by land shortages near the campus core. The purpose of this study is to illustrate in a specific instance what the comparative merits and costs appear to be in an existing walkup development as opposed to the same complex developed with high-rise units to comparable size and amenity.

The residence hall group selected for this study is the Peabody Drive Residence Hall group located at the University of Illinois, Urbana. The complex of buildings, completed in 1959, consists of six four story residence halls, two food service buildings and a post office-snack bar building. The residence units developed with a courtyard scheme, are grouped in clusters of three, each cluster being oriented around and connected to a central food service-dining hall building. Capacity of each of the residence units is 490 students. (Some of the rooms in these buildings are three man rooms, but for the purpose of this study, we are assuming double occupancy and triple occupany in the same proportion as might be developed in high rise units.) The site is an acre plot which contains older men's halls and is located on the western periphery of the campus near recreational areas and men's athletic fields. The ground floor of each of the residence units is used for lounges and rooms for paraplegic students. Care was given to "opening up" the ground floor area, however, to integrate the open court with the surrounding landscaping. The result is a pleasant campus atmosphere with ample green space that is in scale with the buildings nearby. Although the buildings are large, the site development with its variety of vistas through the courts and in the surrounding quadrangles reduces the effect of the building size. No automobiles are parked or permitted in the project group and as a consequence a quiet academic atmosphere is inherent.

The residence units are constructed of reinforced concrete framing with continuous slab with a regular structural bay of 11′-8″ x 15′. Interior partitions are of concrete block, painted. Flooring is asphalt tile throughout except in the lounge which is carpeted and the shower and toilet areas which are ceramic tile. Ceilings are exposed concrete, painted. Each student is provided an ample closet and drawer space in his desk and under the bed. The comparatively small rooms have proven very successful and appear to be much larger due to the glass area which extends from wall to wall. The exterior of the buildings are brick, glass and aluminum, used on the spandrels over concrete block backup.

* A case-study prepared by:
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Richardson, Severns, Scheeler and Associates, Architects
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The units have proven to be very economical both in capital and operating costs. The construction cost per student was comparatively low because of the repetitive nature of the structural system, the reuse of formwork, the comparatively large number of identical units and the actual plan. The latter reflected savings in that the enclosure of the court into a doughnut plan as opposed to two parallel corridor buildings permitted more rooms without an increase in number of stairs and very little increase in plumbing requirements.

For purpose of comparison a high-rise development of comparable construction, materials, lounge space, toilets, etc. was envisioned. The result is a hypothetical complex of six eleven story buildings, similarly grouped in clusters of three around a central food service building. The ground floor was retained as a lounge area although with no rooms for paraplegic students, and provided identical lounge space as the four story structures. Student rooms are located on the ten remaining floors with twenty two man rooms and four three man rooms per floor. This provides a total capacity of 520 students in each of the six residential units.

The food service buildings in each case would remain the same. It is important to emphasize this point because quite evidently if a food service facility were to be incorporated within the residence unit comparisons would necessarily be much more difficult. In general, with the necessity for large spans and the complex ventilating and air conditioning equipment required for a food service facility the incorporation of such within the housing unit is not practical. Unless the site is absolutely confining it is much more economical and better design to place the food service unit as a separate wing or as a separate building.

In addition no comparison is indicated for basement space. There is central heating from the University Boiler Plant. The existing halls have no basements other than under the food service units. For the purposes of the study it is assumed that no basement is provided in the high rise unit other than for connection to the food service basement areas, comparable to a similar arrangement in the existing buildings.

The first comparison made was on the basis of square feet of area provided for each student. It was assumed that three elevators would be required in each high rise unit thus increasing the amount of construction space per student. The restult of this comparison is as follows:

	Low Rise	High Rise
Number of Students	3156	3120
Total Square Footage (less basement)	495,048 G.S.F.	526,680 G.F.S.
Square Footage/Student	156.8 G.S.F.	168.86 G.S.F.

An analysis of exact costs are difficult in view of variables involved in the bidding, construction methods of various contractors etc, but in order to try to equate these factors the contractor who constructed the Peobody Drive Halls and who was successful bidder on a thirteen story residence hall now under construction in Urbana, was consulted.

Several factors involved in the construction cost were considered. Evidently, the space required for elevators as well as the elevators themselves would be an added expense. In this case the total would approximate $200,000. On the other hand depending upon construction techniques there might be savings in high rise construction due to repetitive use of forms, pouring by crane, consolidation of foundations and piling, and the simplified stacking of plumbing, reducing horizontal runs. In like manner the heating is consolidated and would be more economical in a high rise building. The considered opinion of the contractor was that the building construction costs should be comparable and if anything somewhat less for high rise units with identical floors. (It should be pointed out in this connection that if variations of floor plan are contemplated the costs would rise proportionately. It is also important to have regular structural modules so that repetitive use of forms is inherent in the design.)

The type of exterior wall is, of course, a major cost factor in either event. Assuming the same type of wall the differential in cost would be only a matter of difference in square footage which in this study would amount to 5600 more square feet of exterior wall in the high rise building or approximately $22,000 per building or $132,000 for the entire group.

The most important cost factor then is the land. In the study it was apparent that the total site could be reduced by 125,000 square feet without increasing the density alarmingly. The same setbacks and open areas were held and indeed somewhat more open area is present in the high rise scheme. Assuming a land cost of $4.00 per square foot, a saving of $500,000 would result.

In summary the total differential in cost would approximate:

Additional Floor Area 5000 sq. ft./building*	$510,000
Elevators ($200,000/building offset by other Construction Factors Including Mechanical, Foundation, Roof, Consolidation of Utilities)	132,000
Exterior Wall	
Total extra for High Rise	542,000
Savings in land cost	500,000
Total extra for High Rise	$42,000

* Primarily created by space required for elevators.

As might be expected, then, the critical cost factor appears to be land cost. To date not enough experience at the University of Illinois indicates significant differences in operation and maintenance costs, but the considered opinion of the operating and maintenance staff indicates that if proper care is taken in the design of high rise buildings, the operation and maintenance should be somewhat less than for low rise. This assumption is based on the fact that if proper janitorial and maid facilities are provided on every floor and that if the elevators are adequately designed, then the operating personnel should have a somewhat easier task. Moreover, there is a feeling that somewhat less dirt would be tracked in by the students in a high rise scheme. Maintenance of furniture, partitions, doors, windows would be the same as in low rise. In the case of fire prevention, the use of interior standpipes and hoses appears to present no serious problems. Window washing can be handled if careful thought is given to window selection.

It is important, therefore, to consider land cost and land utilization as the strategic factor in the selection of building type. The authors have, in the past, done considerable study on the relationship of housing building volume in relationship to land. It is clear that in any housing development for university students at the undergraduate level there must be sufficient land either on the site or adjacent thereto to provide for recreational activity. At the University of Illinois an approximate area of 200 square feet of land per student is provided. Obviously with the development of high rise structures and the consequent reduction of land needed for building construction this area can be reduced proportionately. Chart 1 shows the proportionate amount of land needed for undergraduate housing for buildings of various heights. These figures were derived from model studies and actual situations which appeared desirable both at Urbana and elsewhere. The ratio of land to total building volume is correlated with actual building coverage and in all cases the ratios were studied visually as well as theoretically. It should be pointed out, however, that other institutions in any given circumstance might recast these particular formulas to fit their own situation. The principles of determining land needs, however, should apply in any situation.

As has been mentioned, Chart 1 shows the desirable land needed, (parking excluded) to accomodate recreation and esthetic needs for any given housing development for undergraduates. The next step is to determine the amount of building required for a given project. The case study has indicated that the housing units of the Peabody Drive development would provide for approximately 160 gross square feet per student (excluding food service and basement areas) on the four story scheme as opposed to 170 square feet per student in the high rise scheme. (The differential would be attributed to the elevators.) It is acknowledged that this allotment per student might be somewhat smaller than required by other institutions, therefore, for the purpose of study it may be assumed that a square footage of 180 square feet per student might be allowed for the low rise and 190 square feet for the high rise of, say, twelve stories. Depending on the institution these figures might be 200 and 212, but it is important to note that in spite of the base assumption the principle of determining choice of high rise versus low rise should still apply with respect to land costs.

From evidence of our case study, and again subject to individual situations, the actual square foot cost for construction would appear to be approximately the same whether low rise or high rise. The differential in cost, if any, is the necessary extra amount of square footage required in the high rise building because of elevators, ducts, of ancillary facilities. This percentage increase appears to be in the neighborhood of 5–6% of the total building both in space and in dollars.

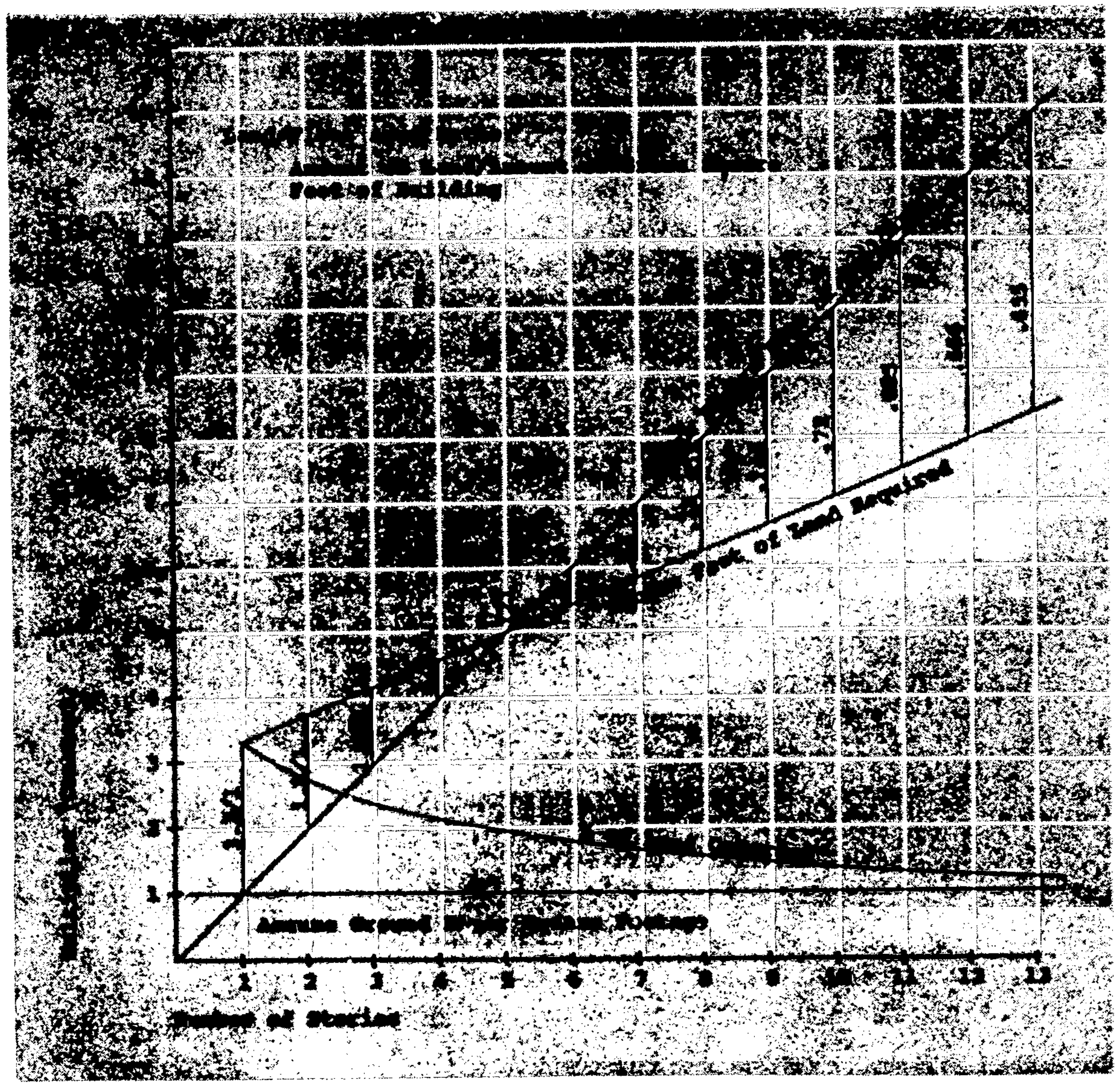

CHART 1. DETERMINATION OF LAND AREA REQUIRED FOR ANY GIVEN HOUSING BUILDING

EXAMPLE:
Amount of Land Required for a 12-Story Building of 120,000 gross square feet?
1. Assume 10,000 sq. ft. ground floor
2. Multiply by 12 for building gross
3. On chart note land needed is on line 8
4. Multiply ground floor by 8
5. Land required 80,000 sq. ft.

or

1. Using L/FAR .666 × 120,000 = 80,000

or

1. Using Land Coverage
10,000 sq. ft. building on ground floor
Land coverage % from chart is 12.5%

$$\frac{10,000}{12.5} = 80,000 \text{ sq. ft.}$$

Chart 2 illustrates the comparison of building space required for each individual student for low rise and high rise as well as the apparent land needs for each student for low rise and high rise. It is apparent that although the building needs rise rather gradually the apparent land needs decrease rather rapidly. The next step is to attempt to equate the two to ascertain when a high rise building might become economical in terms of land value.

Again it should be emphasized that the assumptive factors in each individual case are:

1. Building construction costs
2. Amount of square feet of building per student
3. Amout of square feet of land per student
4. Height and number of elevators

Chart 3 illustrates an example where it is assumed that the building area per student is 180 square feet for a four story building and the comparable amount of square footage for a twelve story building is 190 square feet. Further it is assumed that the construction cost (not project cost) is 15 dollars per square foot in both cases. (Note again that the differential in cost of the high rise is total area not construction dollars per square foot.)

One line on Chart 3 represents the total student cost including construction and land with a four story building complex. The other line represents the total student cost including construction and land on a twelve story project of comparable standards. In this particular case it would appear that if land costs were over 1.50 per square foot it would be well to consider high rise construction. Certainly if land costs were as high as 5 or

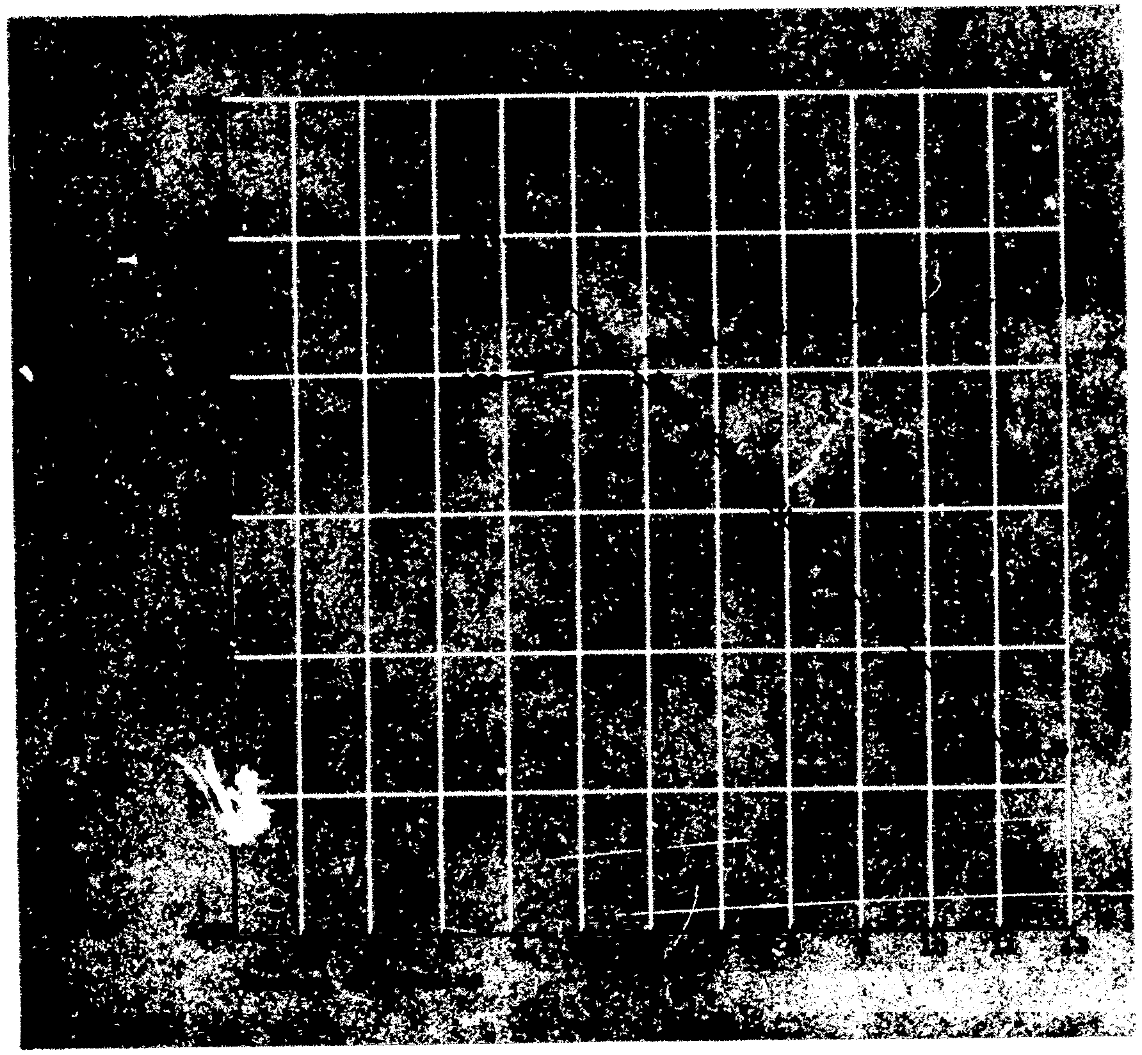

CHART 2. RELATIONSHIP OF AMOUNT OF BUILDING SPACE/STUDENT RELATED TO LAND SPACE/STUDENT

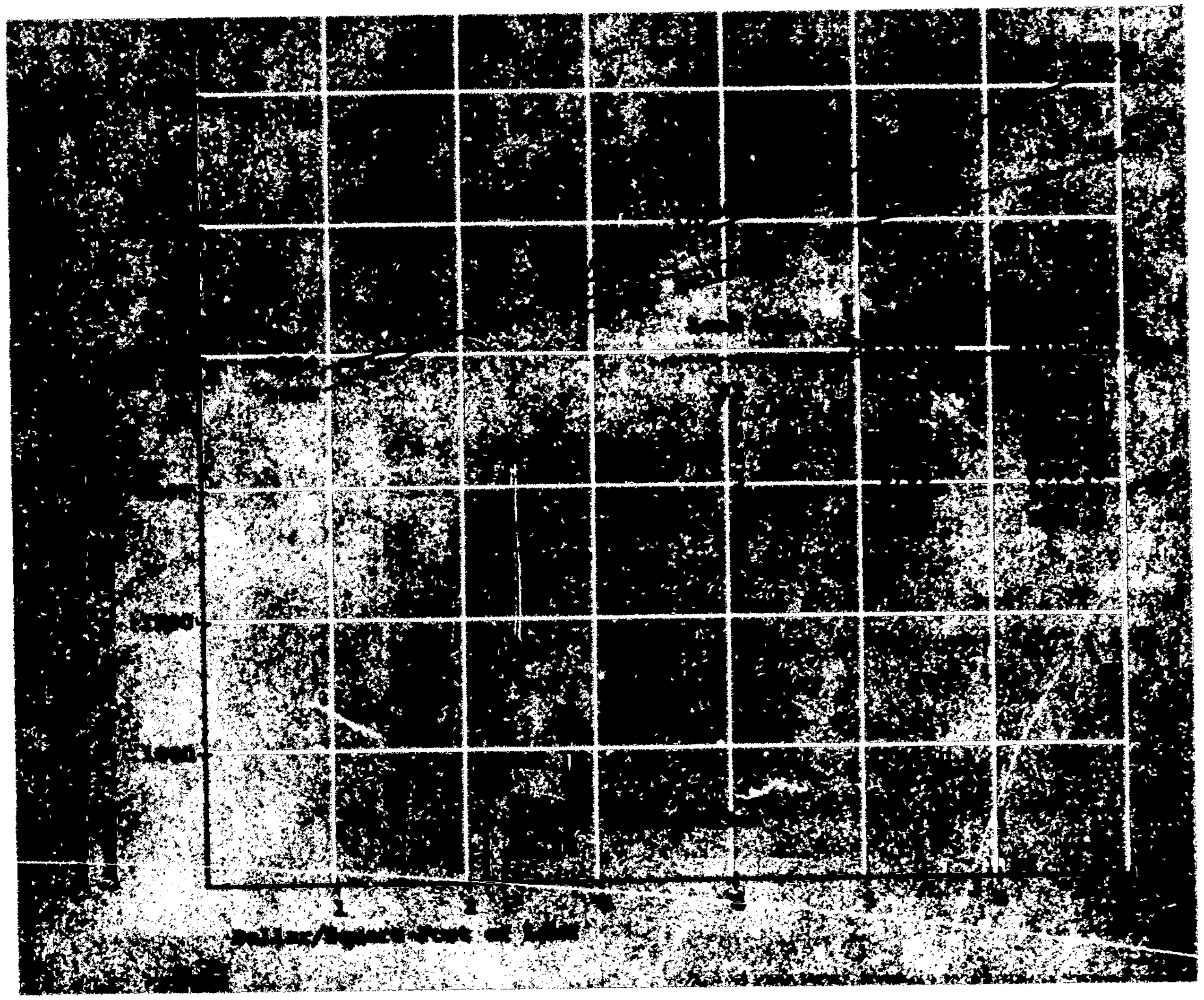

CHART 3. STUDENT COST COMPARISON BETWEEN 4 & 11 STORY BUILDING

6 dollars per square foot a substantial savings would result. Obviously these savings would be even greater if density were increased but in view of desirable land use this would probably be unwise unless nearby open areas were available for recreational use.

Applying other factors and assumptions to the situation might present an entirely different picture. For example in Chart 4 if we were to assume a hypothetical insistence on 200 square feet per student for low rise and a construction budget of 20 dollars per square foot for a low rise building and proportionately higher costs for the high rise we would find that in order to justify high rise, land values would have to approximate at least 2.85 dollars per square foot.

SUMMARY

The purpose of this study has been to try to ascertain the comparative merits of high rise versus low rise residence halls in one specific case. Necessarily the study was concerned more with economics than aesthetics and other amenities which might be provided in either type of development. No argument for either on the basis of housing administration, sociological or aesthetic factors has been attempted. These are, in the opinion of the authors, subjects of study outside the scope of this particular paper.

However, the study of this complex has pointed up, perhaps surprisingly, that high rise buildings can be not only practical economically but might in many cases be more economical initially and for operation than low rise units. The critical cost factor appears to be that of land and location. The paper has therefore attempted to state a line of attack on this critical problem and it is believed that if the general approach outlined herein is attempted a more enlightened evaluation of building type selection might be achieved.

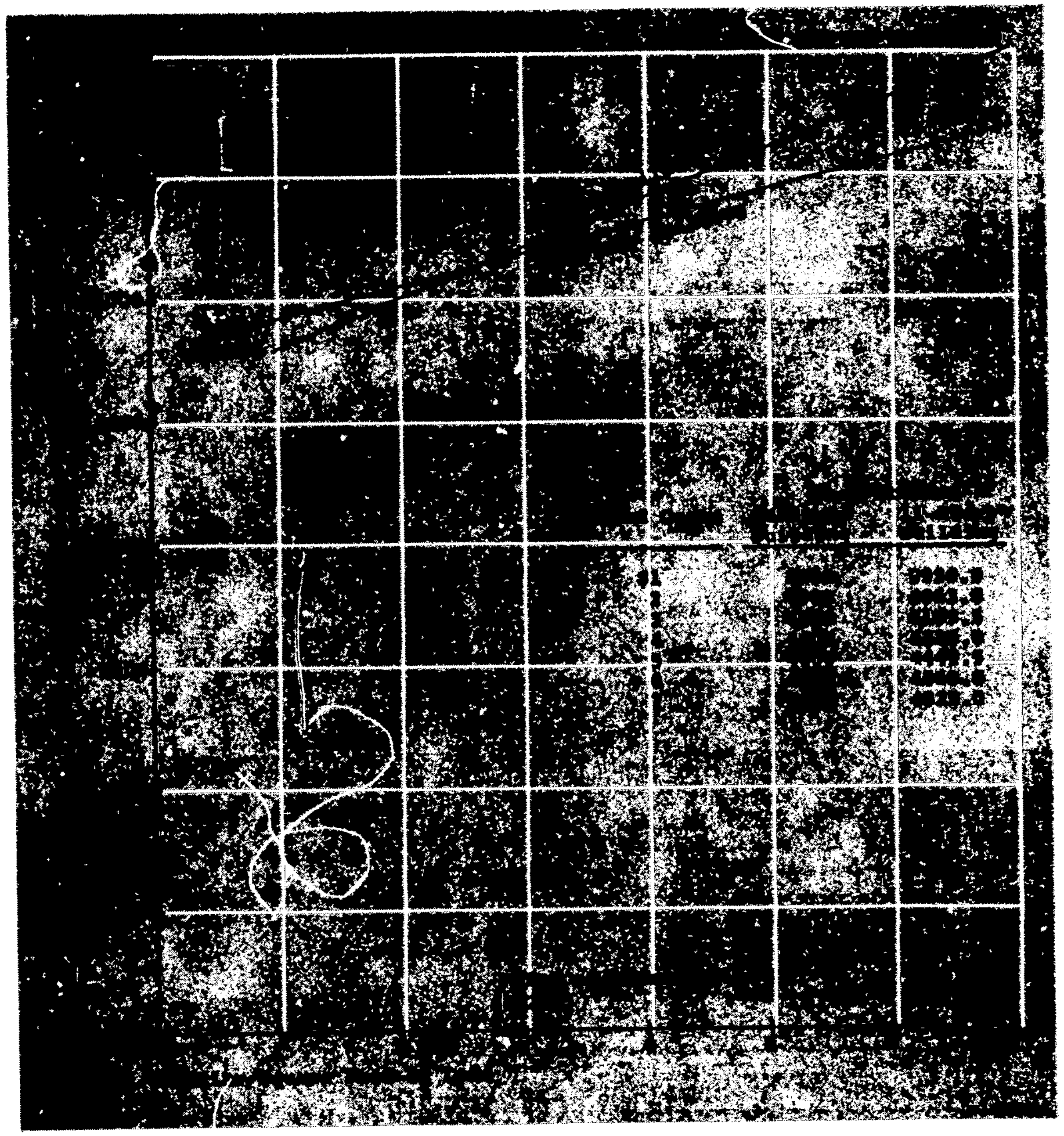

CHART 4. STUDENT COST COMPARISON BETWEEN 4 & 11 STORY BUILDING

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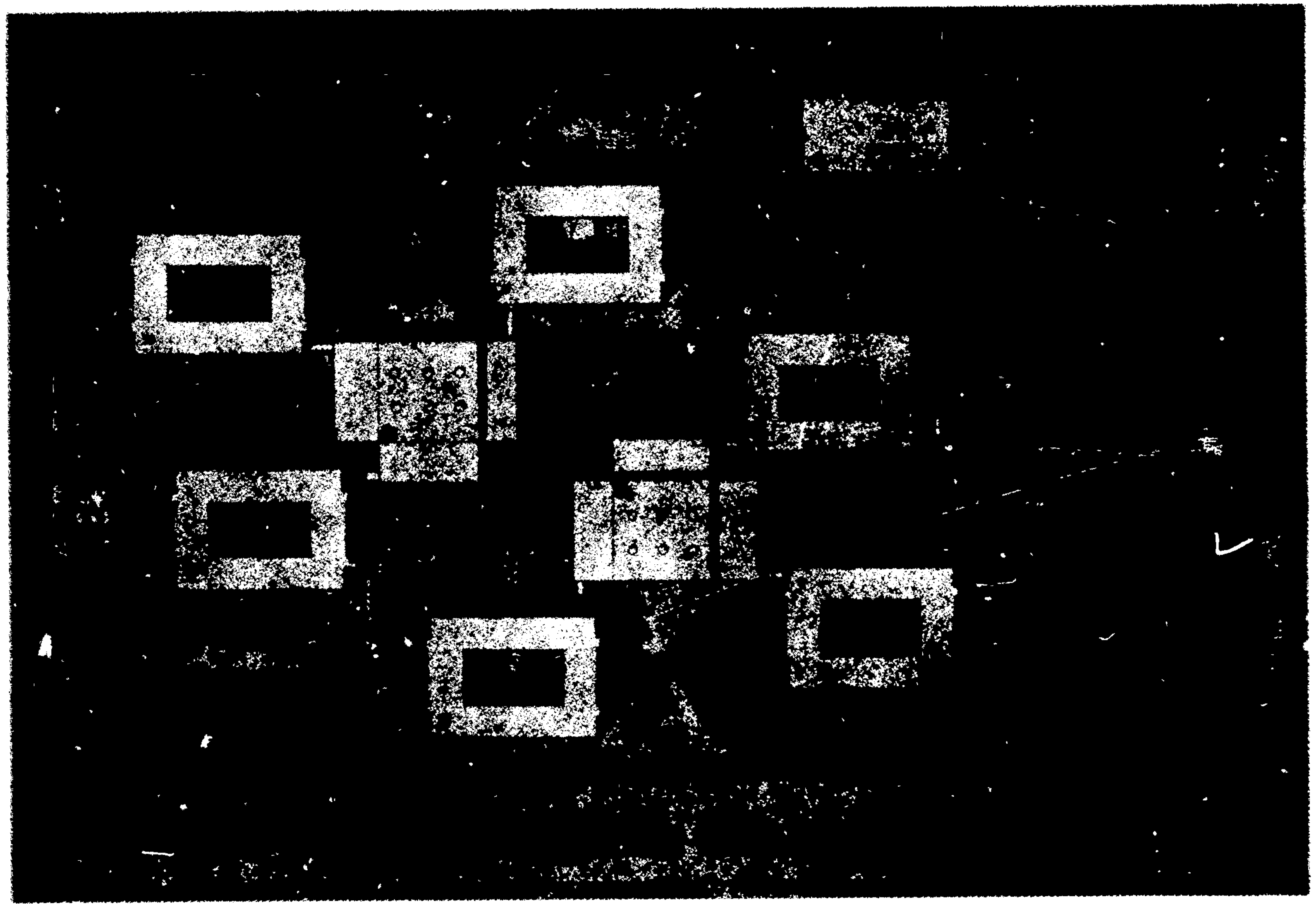
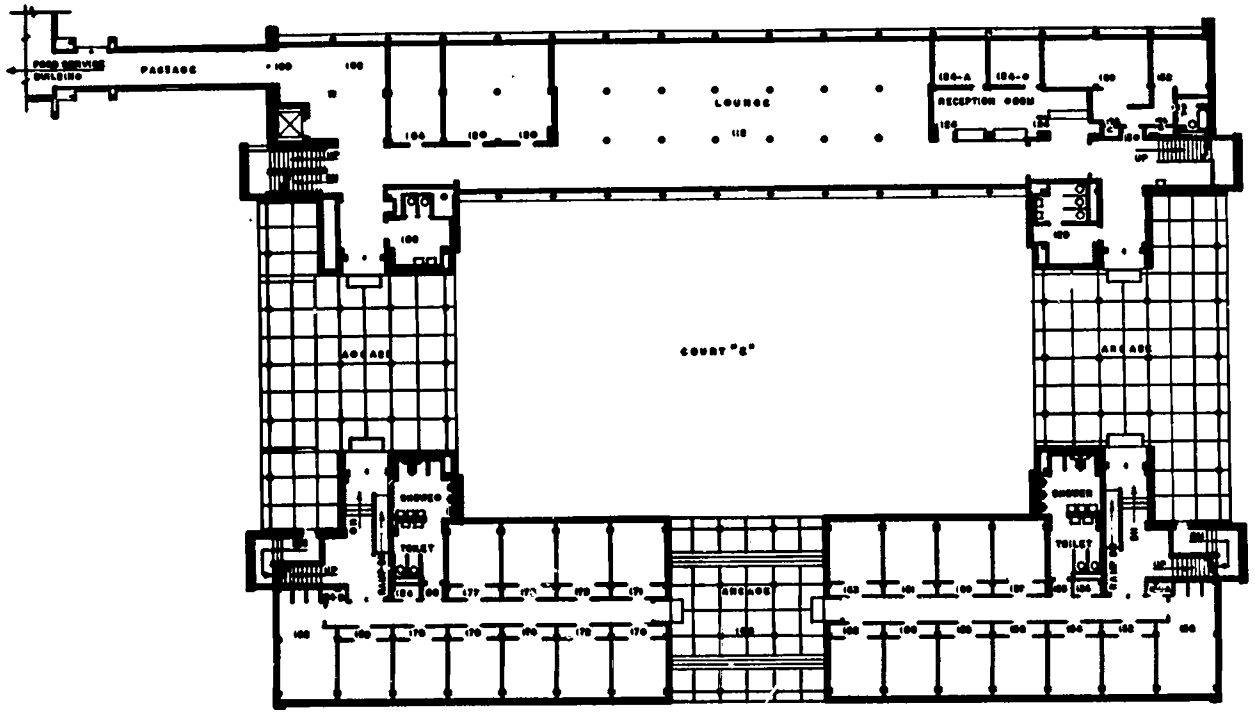
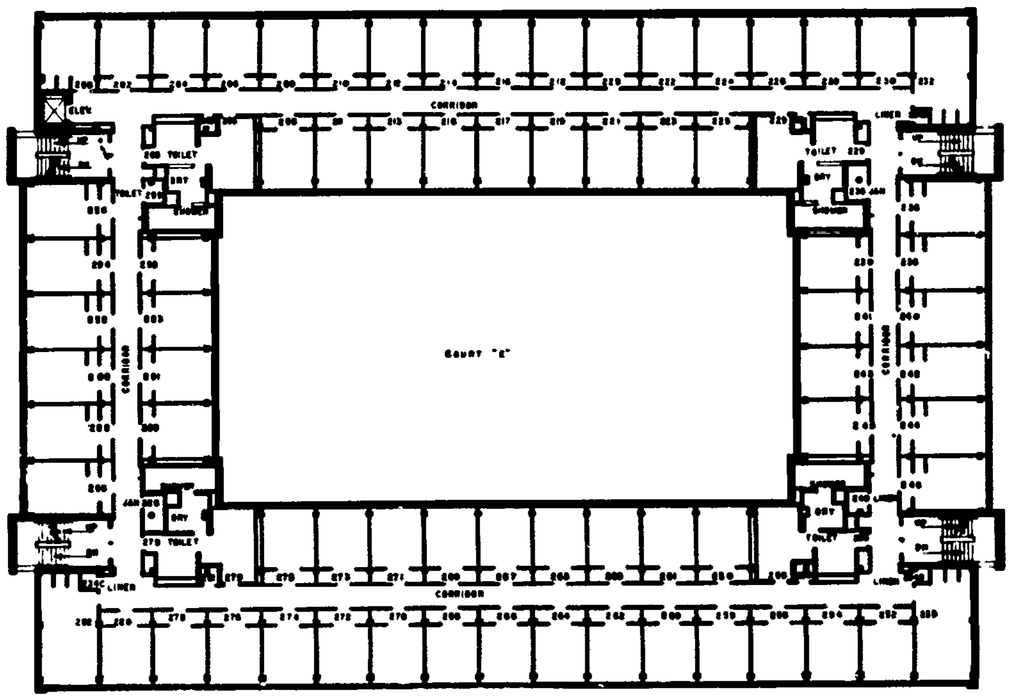
LOW-RISE PROJECT



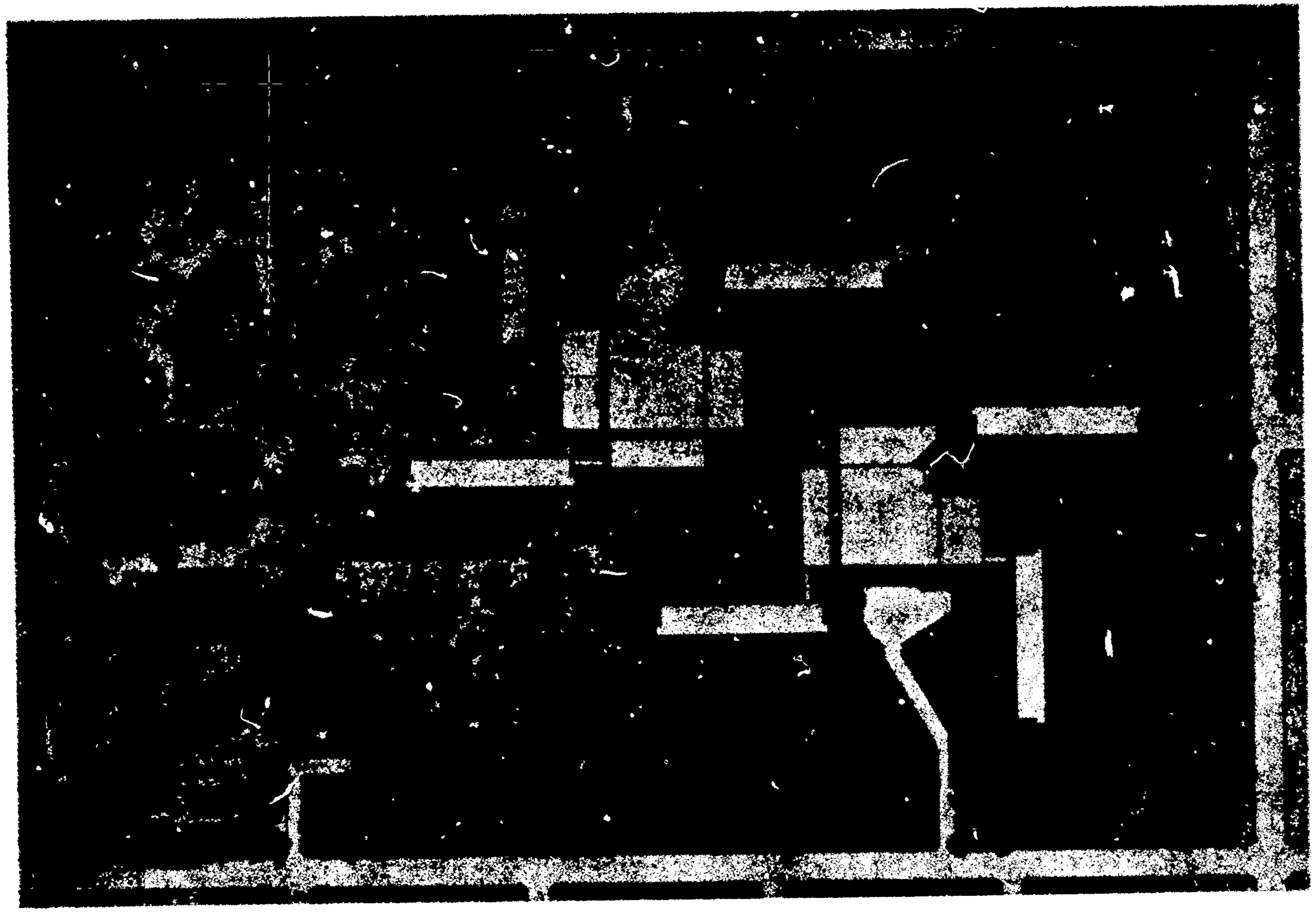


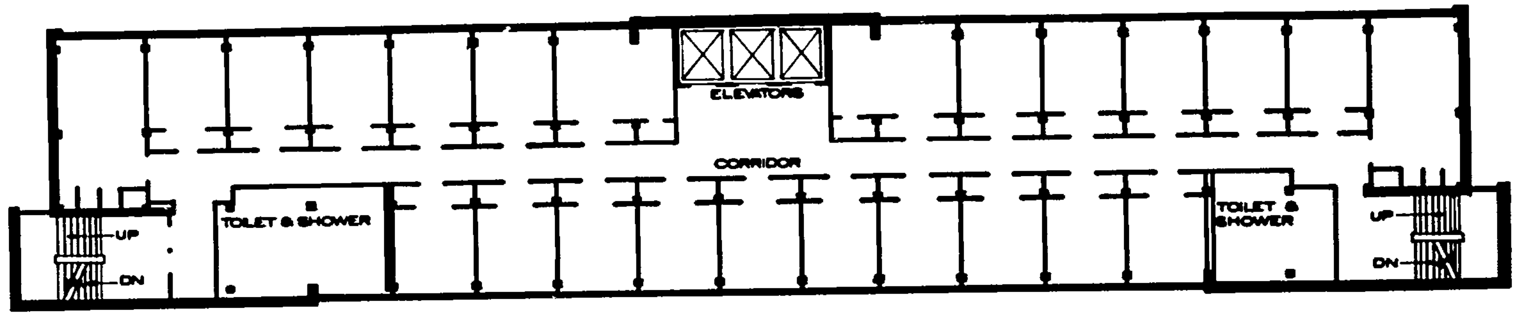
FIRST FLOOR PLAN



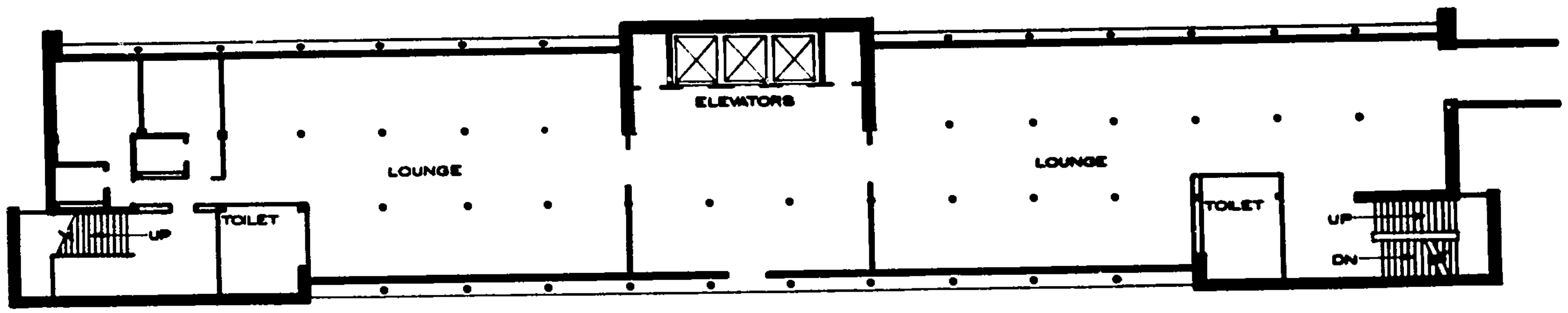
SECOND FLOOR PLAN

HIGH-RISE ALTERNATE





TYPICAL FLOOR PLAN



GROUND FLOOR PLAN

APPENDIX B

HOW HIGH HIGH RISE?

. . . a procedure for self analysis

The comparative evaluation detailed in Appendix A establishes the principle that the *additional* building costs of high rise residence halls as compared to low-rise buildings are approximately *equivalent* to the elevator mechanism plus the elevator building cubage cost. Principle savings in high rise construction can be *equated* to land savings cost. These statements are obviously over simplifications, but can be used for guidance toward determining optimum building heights, provided available land space is unbounded within the limits of the required minimum size to site the optimum sized residence hall. Also, a realistic intrinsic or appraised value must have been assigned to the property before the following analysis method can be employed.

Basically, the total cost of the residential facility is represented by the following:

Total Cost = Land Cost + Building Cost

To obtain the optimum economics in size, the objective is to achieve the minimum rental rate possible to amortize the total investment. The goal then is to arrive at the minimum total cost per occupant. Or:

$$\text{Cost/student} = \frac{\text{Land Cost} + \text{Building Cost}}{\text{No. Occupants}}$$

Land Cost per Student = Area per Student × $/sq. ft.

The gross land area required for a projected student population may be determined by the method employed in Appendix A or from recognized land use density objectives adopted by the institution. Land value for the proposed site is obtained from the known or intrinsic value placed on the property.

Building Cost = Estimated construction cost per student for high-rise construction × number of students + cost of elevators + cost of additional building space required for the elevators.

Estimated construction cost per student can be based on net rentable space planned for each student, increased to gross square footage requirements represented by the anticipated *floor area efficiency*. (40–60% range is typical). University building programming personnel can provide estimating data for this item based upon anticipated functional characteristics of the building. The gross area/student is then multiplied by the estimated construction cost per student. (See Appendix A)

Cost of elevators may be obtained from manufacturer representatives. The estimates on page 11 of the text may be used only for the general comparison purposes of this example analysis.

Cost of additional building space for elevators may be determined by assuming each elevator requires 35 square feet of shaft floor area. This is then multiplied by the estimated cost of the floor area, reflecting the door and control device costs, times the number of floors under consideration.

Number of occupants is established from the selected design criteria of number of students per floor (housing philosophy objective) multiplied by the number of residential floors under consideration.

ANALYSIS METHOD:

Since the characteristics of passenger elevators dictate that the minimum number in any one location is two, the analysis can be started with that number. The total cost per student from that number can be compared with the total cost per student in a three-elevator building, a four-elevator building, and so on, until the lowest total cost per student figure is reached. At this point the residence hall will have reached its optimum economics, thereby establishing the economic break-point on height.

THEORETICAL EXAMPLE:

Assume: Land cost @ $5/sq. ft.
50 students per floor as per housing objectives
Building construction cost @ $20/-sq. ft.
Elevator space cost @ $40/sq. ft. (including doors and controls)
200 students/elevator (desired maximum)

Alternate #1: (two-elevator building)

No. of residents = 2 × 200 = 400
Land area required = (as per Appendix A method)
No. student room floors = 400/50 = 8
Cost of elevators = 2 × 50,000 (est.) = $100,000 (from text, p 11)

$$\text{Cost/student} = \frac{\text{Land Cost} + \text{Building Cost}}{\text{No. Students}}$$

= 62,436 sq. ft. land area × $5/sq. ft.
+ 185 gross sq. ft./student × 400 students × $20/sq. ft.
+ 35 sq. ft. floor area/elevator × 2 elevators × (8 + 1) floors × $40/sq. ft.
+ 2 elevators × $50,000/elevator (estimated, including controls)

$$\text{Cost/student} = \frac{\$312{,}180 + \$1{,}480{,}000 + \$25{,}200 + \$100{,}000}{400} = \frac{\$1{,}917{,}380}{400}$$

∴ Cost/student = $4,793

Alternate #2: (three-elevator building)

No. of residents = 3 × 200 = 600
Land area required = 80,166
No. student room floors = 600/50 = 12
Cost of elevators = $65,000 ea. (estimated)

Cost/student:

80,166 × $5	= $ 400,830
+ 185 × 600 × 20	= 2,220,000
+ 35 × 3 × (12 + 1) × 40	= 54,600
+ 3 × 65,000	= 195,000
	$2,870,430/600

∴ Cost/student = $4,784

Alternate #3: (four-elevator building)

No. of residents = 4 × 200 = 800
Land area required = 90,000 sq. ft.
(extrapolated estimate from Appendix A chart used for this example)
No. student room floors = 16
Cost of elevators = $65,000 ea. (estimated)

Cost/student:

90,000 × $5	= $ 450,000
+ 185 × 800 × 20	= 2,960,000
+ 35 × 4 × (16 + 1) × 40	= 95,200
+ 4 × 65,000	= 260,000
	$3,765,200/800

∴ Cost/student = $4,707

Note: Inspection of trend at this point in the example suggests optimum may be reached at 20 floors using 300 ft./minute elevators. (Over 20 floors would require 400 ft./minute elevators, adding $30,000 to cost of each elevator while land savings is no longer increasing at an appreciable rate.) Accurate figures for elevator costs, controls and doors and students/elevator, along with well defined gross land area per student figures will be required for a sharp definition of the economic breakpoint on height.

APPENDIX C

QUOTATION FROM PROGRAM STATEMENT FOR ST. OLAF COLLEGE HIGH-RISE RESIDENCE HALLS

There have been basic factors which have been given serious consideration in the design of the St. Olaf dormitories. One of these is the nature of dormitory life and the character of the student population—the human factor. The second is the physical and esthetic qualities of the growing campus. The last, and in the final analysis the critical factor, is the economic one which is dependent on the possibilities in structural and other technical fields.

I. With respect to the first it is, on reflection, more and more clear that the dormitory room is not responsive to an analysis similar to the habitats of some people involved in other activities. Whereas the office of an executive, the kitchen of a housewife, or the laboratory of a technician involves repeated acts of a limited type and an orderly pattern of activity, this same orderliness does not characterize the life of the student to anywhere near the same degree. He does many more things in his room, and according to no certain schedule. One day at 7:30 a.m. he is up for an early class; the next he may be sleeping. One day at 5:30 p.m. he may be typing a paper, the next he may be reading, the following simply talking with other students. The next day at this time he may be getting ready for a date. This variety and iregularity is found at any time of the day and through four years.

The conclusion we reach from reflecting on this is that after a certain point is reached the effort to find the perfectly efficient size and arrangement for a dormitory room is not fruitful. The essentials of a dormitory room are not many: (1) enough room, (2) certain articles of furniture—beds, desks, chairs, storage, some free space for personal items. (3) proper lighting for day and night hours, (4) a room shape which allows for any of many reasonable arrangements of these things, (5) temperature control, (6) acoustic isolation, (7) a disposition and relationship of the elements which is esthetically appropriate.

Evidence supporting this sort of "anti-functionalism" comes from two sources. One is the fact that in the course of building hundreds of dormitories the architectural profession has not reached a general conclusion about what shape and arrangement of dormitory room is most satisfactory. In contrast, there is much more general agreement about what is necessary for a good hospital room.

The other source of evidence is more dramatic. The rooms in Ellingson Hall at St. Olaf were planned carefully to provide what is generally agreed to be a lucid, logical, and efficient space for two students. In them there is one arrangement of furniture which exploits this potential to its fullest. In an inspection of 41 rooms of this dormitory two weeks after school began in September, 1962, however, only six were found remaining in the original efficient arrangement. In the others the furniture had been re-arranged in an almost baffling variety of ways. The sort of things could be found in any of the dormitories where the furniture is loose and where the rooms are all identical to each other. The obvious conclusion is that functional efficiency is not a very important thing in the mind of the student.

But what is important?

One thing, apparently, is individualism. The typical college student is going through a period of the development of his individuality. He is away from home for the first time, a member of a large community, consciously or unconsciously asserting his uniqueness. It is also true, of course, that he often behaves as much as he can like everyone else and wishes—by conformity in dress, for instance—to assert the opposite. But he doesn't like to be pressed into conformity. One way to assert uniqueness is to arrange his room differently from that of his neighbors in the dormitory, and this he does at the expense of efficiency, which his vitality can compensate for, and sometimes at the expense of any order at all.

Our solution to the problem of providing the individual student that which is important to his development at this point is to build rooms which are not alike and repeated along the length of a corridor, but are of widely varying shapes. In our plan there are on each floor of the dormitory a complete variety of rooms. No two are alike among the 15 on each floor of the men's dormitory or the 13 on each floor of the women's dormitory. The floors are, however, repeated vertically through ten and 12 floors respectively. This approach to design is a sharp break from the general pattern of dormitory design, and we think it is a significant and valuable change.

Another characteristic of college men and women is that they are romantics. The bisymmetrical lucidity and logic, and the "classic" lighting of the rooms in Ellingson and Hoyme Halls, isn't apparently to the taste of a large portion of the population. This is part of the reason for the students' elaborate efforts to complicate the special organization of the rooms by arranging furniture in bizarre patterns. The deans tell us that typically they have no difficulty renting the few odd-shaped rooms which exist in the dormitories on the campus at the same rate as the standard rooms.

Consideration of these matters has led, in the St. Olaf dormitories, toward designing rooms which are asymmetrical, cross lighted, and of non-rectangular shapes. They are not, however, of haphazard contours.

Studies of dormitory living and student society have for a long time come to certain conclusions about ideal groupings of students. Double rooms are preferable to triples or larger groups. Single rooms are too expensive to supply in large numbers at St. Olaf as at most colleges. So the buildings have double rooms.

Ideally a group of six to ten students form a small cadre. That this size group has real value is supported in St. Olaf history by the fact that lasting friendships and real esprit de corps developed in the small groups who lived together in off-campus houses in the years when the college dormitory facilities were minimum. Similar solidarities developed among the men who lived in the rooms around the ends of the Ytterboe Hall wings. A recent attempt to establish this sort of group was made in the men's dormitory at Carleton, where eight to ten students are assigned to each washroom rather than the 30 or more usually so assigned in long corridor type dormitories. The new colleges at Yale establish this size group more effectively but at an excessive cost. In the typical long corridor dormitory, however, it has been impossible to divide the men into groups this small and a part of the bad connotations of the word "institutional" which is so often applied to dormitories certainly is associated with the lack of groupings of this size.

The St. Olaf dormitories establish these groups quite naturally. The rooms do not open off the main corridor, but cluster in groups of three or four on short "branch" corridors, and the men living together in each of these clusters will almost inevitably find themselves associated together.

A larger sub-group in a dormitory is a group of somewhere around 20 women or 30 men. At St. Olaf these have sometimes been called corridor groups or corridor units, and for 25 years the dormitory buildings have been designed so as to support divisions of such sizes in the dormitory population. Organizationally, there have been counsellors for such units in the women's dormitories and architecturally each such unit has some focus—a washroom and/or a lounge and the long corridors have sometimes been interrupted by doorways or stairways to define the group. There is some artificiality in this type of architectural definition, however, as long as the corridor continues and the residents in one group spill easily into the other. In other schools attempts have been made to establish groups of this size by other means. By building smaller buildings where each floor constitutes a group, for instance, the group is clearly established, but the buildings are often too small for efficient operation. Certainly they are at St. Olaf. In buildings on the "Harvard scheme" (the earliest probably being Durfee Hall at Yale), a group of residents clusters vertically about a stairway. This scheme is out of favor in recent years partly because of expense, partly because internal communications and (in the case of women) control are difficult, and partly because communal facilities are hard to provide.

Our high rise buildings establish this sort of group clearly and avoid all the difficulties of the other types of solution. Each floor is such a group.

On the foregoing basis it seems that the proposed buildings will meet the hopes and needs of St. Olaf more effectively than the traditional type of building. They suit the character of the student and student society better.

II. High rise buildings have been built frequently in both colleges and large universities. As far as we know, their justification has been based on the need to conserve land space. This is true also of the proposed building for Bowdoin College.

At St. Olaf we have no such imperative. A concern for the character of the campus as a whole, however, leads us just as surely to the opinion that it will be wise to go up instead of out. The character of the campus has been established from long past by the irregular shape of the mesa-top, the irregular road system, the generous and irregular spaces between buildings, the lack of conventional malls, axes, and formalities, a wonderful variety of wooded and grassy areas, of open and partially enclosed spaces, and finally, by a variety of building heights which is consistent with the informality and irregularity on the horizontal plane.

A view into the future suggests that there are two dangers to this established character. One is that buildings may be too close together if those built in the future all extend in horizontal masses. The other is that a uniform four-story height will destroy the pleasant irregularity of the horizon profile now existing. Thorson Hall, which used to crown its promontory like a castle, no longer does so because Ellingson Hall stands near it. We are not sorry about this, but if a four-story building were built between Kildahl and Ellingson the result would be less than ideal.

The proposal of high rise dormitories meets as well as possible both of these potential dangers to the character of the campus. Space between buildings will remain generous, and the irregular horizon profile will improve, both from inside the campus and from the surrounding countryside.

III. The economic issues which must be faced in dormitory construction are complex and difficult. The possibility of high rise construction was faced at the beginning by both the architect and the College administration with a good deal of uncertainty. The virtues of the scheme seemed apparent; but a consequential increase in cost seemed equally apparent.

An unusually thorough study of expected costs was therefore undertaken by the architect and has been pursued as carefully and as persistently as possible through the period of design development and working drawings.

The evidence supplied by the early studies and supported by continuing ones has satisfied the College and the architect that this type of building is comparable in price to the two most recent dormitories which were built at St. Olaf. Indeed, if a factor for the increase in cost of building over a period of three years is applied it would not surprise the architects to find these buildings bid cheaper than Hoyme and Ellingson Halls, on a per student basis.

A.C.U.H.O.

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APPENDIX D:

CHECKLIST FOR RESIDENCE HALL PLANNING

(To be expanded in detailed program)

STUDENT ROOMS:

____Number of students
____Number of single, double, triple, suites, etc.
____Connecting rooms or study areas
____Approximate minimum sizes and ceiling height
____Furnishings:
  ____Wardrobes
  ____Medicine cabinets
  ____Tackboards
  ____Bookshelves
  ____Drapery tracks
  ____Mirrors
  ____Drawers
  ____Valuables storage
  ____Desks and chairs
  ____Luggage storage
  ____Bed size and type
  ____Study lights
  ____Table space for record player, tape recorder, TV, etc.
  ____Picture hanging devices
____Finish materials—walls, ceiling and floors
____Door and window specifications
____Locks, keys and performance requirements
____Conduits and outlets for TV, telephone, and electricity
____Ventilation requirements
____Wall switched light
____Heating and cooling requirements
____Washbasin

LAUNDRY FACILITIES:

____Location(s)
____Ironing boards
____Washers, dryers and extractors
____Drying racks
____Seating space
____Sewing–pressing room
____Ventilation
____Lighting

TOILET AND BATHROOM FACILITIES:

____Private, connected or central
____Shower stalls, bath tubs, toilets and lavatories
____Toilet area separate from bath area
____Drying and dressing areas
____Deep sink with hair wash attachment
____Hair drying equipment
____Lockers, medicine chests, dispensers, disposals, towel hooks, mirrors, shelves, and miscellaneous accessories
____Floor drains
____Ventilation
____Sunlight
____Heat
____Drinking Fountain
____Electrical outlets and lighting
____Hand laundry sink and drying racks unless provided separately
____Location of maintenance equipment

LOUNGES AND COMMON ROOMS:

(Unit, main, library, reception, study, recreation, music, typing, TV, etc.)

____Functions
____Location and sizes
____Administrative control
____Relation to entrance foyer
____Food service
____Fireplace
____Telephone
____Paging system
____Music and TV
____Furniture and arrangement
____Ventilation
____Ceiling heights
____Materials and finishes
____Acoustics
____Mechanical and electrical equipment
____Storage
____Maintenance

RESIDENT DIRECTOR AND STUDENT COUNSELOR APARTMENTS:

(May be married couple)

____Location(s)
____Privacy vs. accessibility
____Size
____Telephone and TV outlet
____Office area
____Bath
____Equipment and storage

ENTRANCES, FOYERS, GENERAL USE, AND ADMINISTRATIVE OFFICES:

____Doors
____Recessed mats
____Reception desk
____Relation to elevators and stairs
____Telephone system (public and resident)
____Paging and record playing system
____Adjacent offices
____Coat room
____Toilets
____Mailboxes (key or combination)
____Post-office and package delivery
____Laundry and dry cleaning
____Wall safe
____Finishes and furnishings
____Recreation rooms
____Hobby rooms
____Snack bar
____Notions counter
____Service area

UTILITIES, MAINTENANCE, AND STORAGE:

____Trash handling method
____Maintenance equipment and storage
____Student clean-up closets
____Maintenance personnel lockers, toilets and showers
____Service access
____Work Bench
____Linen and supplies storage
____Service stairs and/or elevator
____Storage area for student materials (baggage, ski racks, clothes bags, etc.)

OUTSIDE AREAS:

____Sun bathing
____Athletic games
____Sheltered entrances
____Bicycle racks
____Parking

GENERAL PLANNING CONSIDERATIONS:

____Total number of students to be housed
____Sizes and subdivision of groupings
____Counselor program and requirements
____Independent services to be allocated to each group, floor, and hall as required (lounges, kitchenettes, laundry, etc.)
____Organizational requirements for dining and cooking functions (central or independent kitchens)
____Organizational requirements for lounge functions
____Organizational requirements for management functions
____Relation to outside noise generation elements (traffic, play fields, interior courts, etc.)
____Relation of interior noise generation areas (kitchen, kitchenettes, reception room, baths, laundry, foyers, etc.)
____Pleasant atmosphere
____Orderliness thruout
____Initial cost vs. maintenance
____Maintenance facilities and location
____Fire rating
  ____Framing system and materials in general, including floors
  ____Number of exits
  ____Maximum distance from rooms to exit
  ____Fire alarm and fighting apparatus
  ____Fire doors
____Security and night watchman station
____Orientation (desirable to have sunlight touch each bedroom sometime during day)
____Ventilation (natural — mechanical — cross ventilation) door vents—direction of wind—air conditioning—transoms
____Kitchen odors and over-heating (mechanical equipment and solar gain)
____Method of heating and hot water supply (heat source)
____Screening (insect)
____Auto access to student storage
____Parking
____Deliveries
____Maximum desirable lengths of corridors
____Snow, removal (pipes or mechanically shovelled)
____Climate — glazing (single or double) — thermal transmission thru walls (heat and cold)
____Site-improvements (existing and required)
____Air-conditioning (general or particular spaces)
____Taxi drop to entrance—sheltered?
____Site survey
____Number of floors
____Elevator requirements (passenger and freight)
____Relationships of view and mass to existing adjacent buildings
____Relationships to main campus traffic
____Site and roof drainage
____Methods of student control (number of entrances and general office and sign-in requirements)
____Compliance with building code requirements
____Incinerator
____Site utilities (gas, water, electricity, sewer(s) and steam)
____Maintenance factors for exterior of building and grounds
____Housing of visitors
____Apartment requirements for type of administration and counseling selected
____Maintenance personnel required
____Relation of service entrance for functions served
____Water supply and softening requirements
____Exterior sillcocks and lawn watering
____System of communication
  ____Telephones (each room or in hallway)
  ____Signal system or 2-way call from rooms to desk
  ____Pay phones
  ____Paging system in dining rooms, lounges, reception rooms, laundry and toilets
____Television, radio and conduit planning
____Security—locks, keying, panic hardware and alarm system on exit doors. Remote controlled main entrance door lock
____Linen storage (locations)
____Bulletin board locations
____Full length mirror locations
____Relation of men and women's toilets to main lounge, entrance, and dining
____Inclusion of special functions such as:
  ____Music practice room
  ____Television lounge
  ____Radio station, dark room, sewing room, etc.
____Students/rooms, suites, and related bath
____Ratio of single, double, triple, and suites with corresponding bath requirements
____Rain and sun protection for windows
____Drinking fountains
____NBFU and NFPA (fire codes and ratings)
____Dry cleaning and laundry pick-up and delivery
____Mail handling method
____Baggage room
____Corridors and stairs (5'0" and 5'6" min.)
____Kitchenettes
____Roof access
____Lighting intensities thruout
____Materials and finishes:
  ____Color—desirable hues and values
  ____Wall protection—if lavatory included in rooms
  ____Window stools
  ____Furnishings
  ____Type and finish of doors (solid core suggested for sound control)
  ____Exposed mechancal equipment
  ____Door frames
  ____Trim
  ____Type of windows—materials and finish
  ____Corners of walls and furniture for durability
  ____Skid resistance of stair and treads and other flooring materials
  ____Heat considerations for furniture (electric irons, cigarettes, etc.)
  ____Ceiling, wall and floor finishes for following spaces:

	consider:
sleeping rooms lounges toilets dining kitchen corridors offices laundry	sound transmission sound absorption maintenance costs sanitation redecoration flexibility for individual expression
showers recreation stairs lobby terraces	durabilty vs ease of damage

Note: Food Service requirements require specialized and detailed consideration outside the scope of this study. For "Checklist of Items Frequently Forgotten in Food Facilities Planning," see proceedings of the Food Facilities workshop, Cornell University, 1962.

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