HOUSING DESIGN IN MULTI-STORY SECTIONAL BUILDING SYSTEM

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ABSTRACT

This study is an exploration toward a possible new method
for design and production whereby industrialized housing
can be made more flexible to changing users' needs.
This study is organized in three parts;

I. Introduction; Social and economic changes over the last two
decades have affected the form of housing in the United States.
The emerging attitude toward housing is more modest, responsive,
and humanly scaled. Studies on users' need are reviewed.
"Framework approaches " are considered viable design methods
for responsive housing.

II.System: Based on the framework approach,an industrialized
building system is introduced. Multi-story sectionals are
the basic space modules of the system . Those are factory
produced prefabricated heavy boxes to be assembled on site by
tilting up, allied with the spanning floor slabs.

III. Design: In the proposed system, multifamily apartment
plans will be designed , comprising various building types.

Thesis Supervisor: _____
                   Waclaw Zalewski
                   Professor of Design of Structures

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I would like to thank Prof. Waclaw Zalewski
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My appreciation also to my father-in-law,
HanBok Do, for his support to my study
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Special thanks to Mr. and Mrs. Lee at BanPo.

To my parents for giving me happy memories.

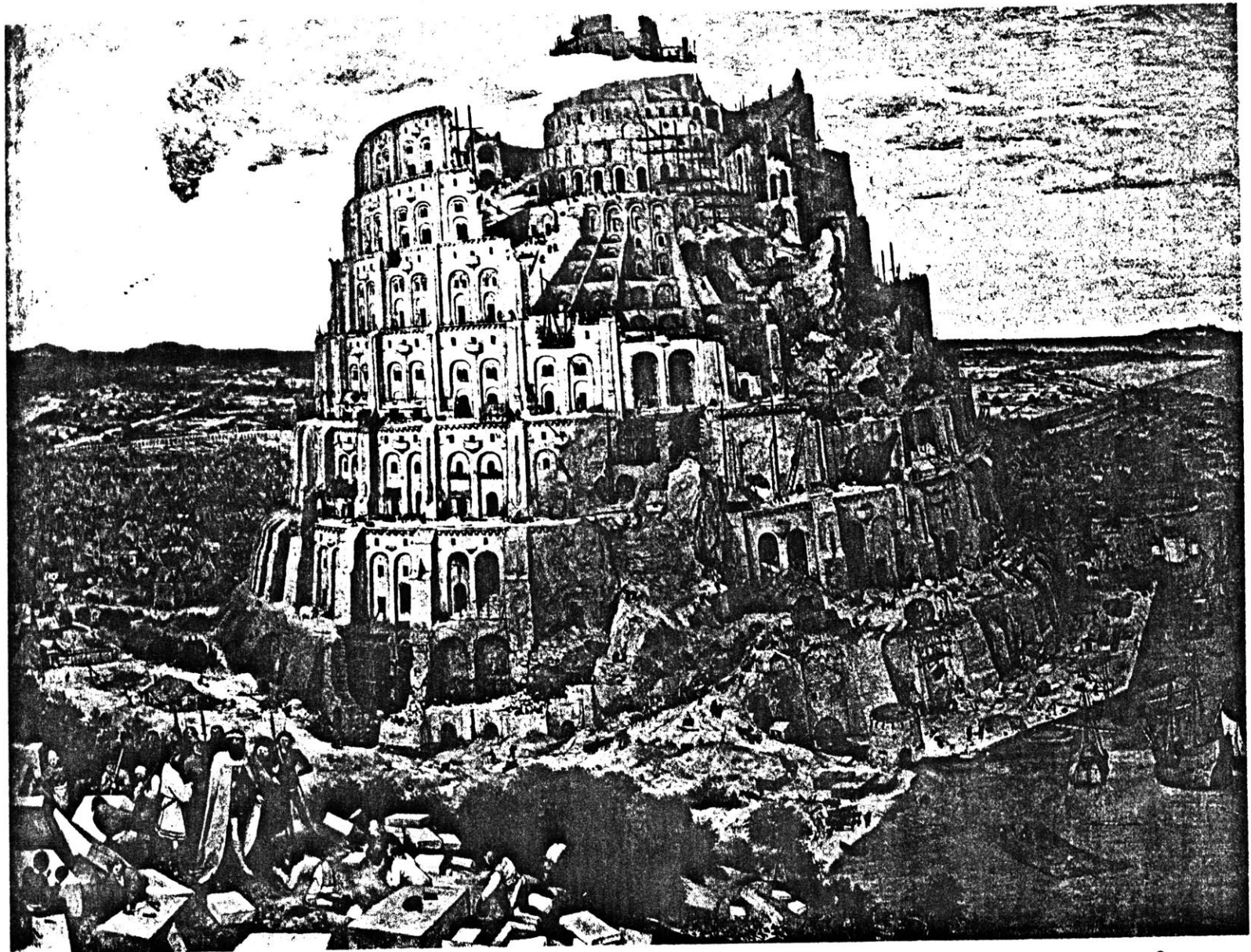To my little daughter, Arum, for her constant
Dad care.
and
to my wife,Yunsoo,for her great devotion
to her husband.
I am forever grateful.

content

introduction

Up to now the house is built down to the smallest detail
and man is pressed into this dwelling - in spirit the same
from Scotland to Ghana - and adapt himself as best he may
to the life that the architect furnishes him with.

Smithson,A.,Team 10
Primer, MIT press,1968
p.76 .

We must prepare the 'habitat' only to the point at which
man can take over.

We aim to provide a framework in which man can again be
master of his home.

    ------- ATBAT, Bodiansky,Candillis, Woods----

The apartment, as the environment of private family life
within the urban context, has become stereotype with few
exceptions. The marvelous diversity of possible human activity
is excluded from consideration for most new multifamily
housing, limited to housing essential human activities
--cooking and eating, sleeping,relaxing,bathing .--
Framework approach recognizes these restrictions in housing
and overcomes the problem by allowing variation within each
household.

MULTI-STORY SECTIONALS are the basic space modules of proposed system whereby the framework of multifamily apartments are designed and built. The system allows much flexibilities during the design stage for anticipated space arrangements and throughout the life cycle of building.

In the past, Americans have tended to look upon the problems of providing decent housing as predominantly technical. Much effort has been spent in this century trying to industrialize housing production. These efforts have been characterized by the view of housing industrializtion as assemby line process. Buckminster Fuller's 1927 Dymaxion I House is an example of such a product: mass -produced, completely finished, and intended to be sold "fully loaded" with appliances and other mechanical amenities. Same approach was taken in the Lustron House in 1940s. Not one proposed system for Operation Breakthrough(1969) approached the level of consumer choice and flexibility of form that is inherent in the conventional stick-built house. Today, there begins to understand that housing is a process that a house is something that is born, matures, prospers, and dies!

CHANGING FORM OF
HOUSING: LOW RISE
HIGH DENSITY HOUSING.

In North America, the favored form of dwelling is the single

family house with its own piece of land. It appears that the

the tradition has its root back in the early days of the Colonies

when British settlers were ingrained with the image of a manor

and cottage existence. Government agencies have helped home

ownership to become the dominant housing style in American life.

Identifiable units with multiple exposures, cross ventilation,

and the potential for some private outdoor space are among

major elements easily accommodated by this traditional form

at very low densities.

Decades of testing and evaluation has set the list of guide-

lines predominantly imortant in family oriented housing.

The "program" has been codified in various ways, but essentials

can be seen in a list of statements developed by the Institute

for Architecture and Urban Studies in New York. Includings are:
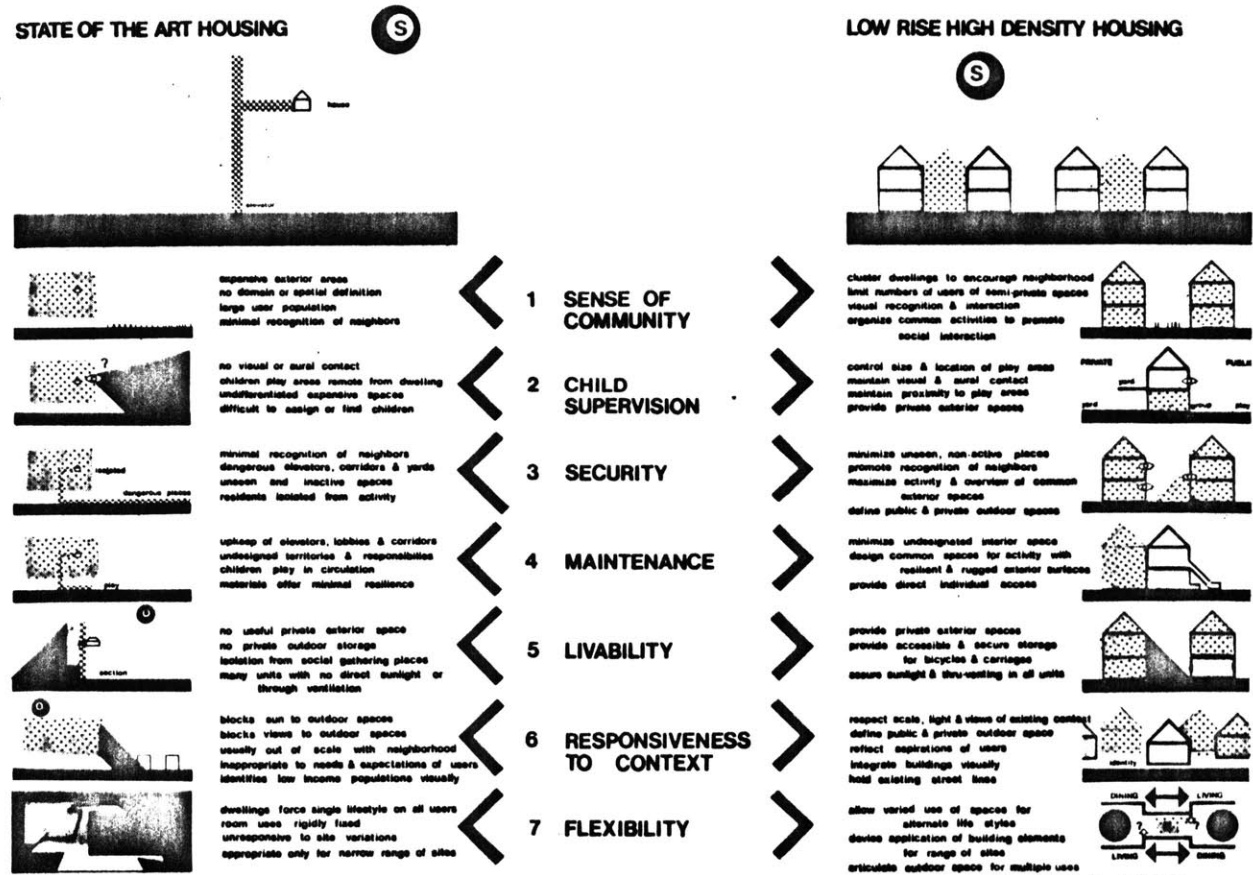
Community: to organize dwelling and spaces to promote
            social interaction.
Child Supervision: to provide visual and aural contact as well
            as easy access between play areas and dwelling units.

Security: to avoid unseen, in active areas.
Maintenance: to minimize undesignated interior public spaces.
Livability: to provide for individual privacy in dwellings,
        for alternative views, and for cross ventilation.
Responsiveness of Context: to acknowledge and repect existing
        scale, Light, views, etc.

Add to this the potential for displaying the identity of the

household and a convenient access to the automobile.

The housing design issues, Low-rise housing, being a closer approximation of the single family house, accommodates the issues better than high-rise.

STATE OF THE ART HOUSING Ⓢ

LOW RISE HIGH DENSITY HOUSING Ⓢ

		STATE OF THE ART HOUSING		ORGANIZING ISSUES	LOW RISE HIGH DENSITY HOUSING

1 SENSE OF COMMUNITY

2 CHILD SUPERVISION

3 SECURITY

4 MAINTENANCE

5 LIVABILITY

6 RESPONSIVENESS TO CONTEXT

7 FLEXIBILITY

ORGANIZING ISSUES

LRHD

Although the single family house may best meet the criteria,
as the land, material, and energy cost rise, this preferred
housing form is now out of reach of most families.

A new goal for housing may be to maintain the features and
amenities of the single family house while aggregating many
more units on a single site for economy's sake.

As economic and ecological pressures for denser residential
development increase, so does the seriousness of this dilemma.
1) a reduction of private outdoor space to give more community
space; 2) a loss of identity for individual units to allow
repetition of structure and economy of production; 3) a re-
duction in ease of access to increase security; 4) a reduction
in view and exposure of dwelling to increase privacy and numbers
of units; are the sacrifice of personal amenities for economy
and community enhancement may entail.

Density may be expressed as people per acre, dwelling units
per acre, FAR(Floor are ratio of building to site), people per
habitable room, and so on. Though high density is most often
associated with teaming slums, some of the densest neighborhood

in the United States are also the most elegant. High density

cannot be rigidly equated and numbers alone cannot indicate

quality of life.The negative image of high density in the U.S.

is associated with long standing antiurban planning mentality.

The garden city movement in England and the suburbs in this

country were a reaction to the city perceived as dirty,crowded,

and crime-ridden. One of the major confusions in the continuing

argument over density is the association of high density with

high-rise. The reason for building high-rise is to achieve

greater density and the logic which says rising costs are defrayed

by placing more dwellings upon the land cannot be questioned.

However, employment of the high-rise has not resulted in sub-

stantial increases in density and land use efficiency. When this

building form is used, a great deal of land remains empty to

allow the necessary space between the buildings. Herbert

McLaughlin(1976) found that low-rise was more efficient than

high-rise of more than 10-18 stories. While similar density

may be achieved by either high-rise or low-rise, the cost of

high-rise was greater.

Mclaughlin,H.,DENSITY:
The architect's urban
choices and attitudes,
Architectural Records
(February,1976)p.95-100

There has been large increase on the mubers of multifamily
housing being built. The number of multifamily housing starts
in 1976 was 362,000, but by 1979 it was up to 547,000 units.

In most cases, variety may be assumed to be sacrificed for
increased production. Variety can be seen in two ways. First
there is the potential for the dwellers to individualize and
make distinct their own residences. As densities increase,
this becomes more difficult. As units become a single building
form, individuality becomes impossible. Variety may also be seen
as a range of housing-type alternatives.

Single family units range from one house on an acre to as many
as eight houses per acre, each on a 5000 square foot lot. High
density, high-rise development may be as great as two to three
hundred units per acre. Since the single family house is the
most desirable and acceptable housing form it becomes a standard
against which any other housing form must be compared.

Over the last two decades, the feasibility or acceptability

of high-rise density housing and the single family house has
decreased . A number of different housing forms and ideas have
been generated. Characterized by various strategies to maintain
amenities of the single family house and meet the needs of
particular user group. The accumulation of user group stuies
is beginning to give a clearer picture of which aspects of the
designed housing environment meet with high satisfaction on the
single family house must be retained regardless of density.
A few number of architects are beginning to incorporate this
knowledge into their architectural practice.

CLUSTER HOUSING: Retaining more of the imagery and amenities of
the traditional house form, The appeal of this form of housing
is in the individual access, potential for identity, ground
relatedness and generally pastoral setting at densities double
or triple(up to 20 to the acre) those of single family house
development. Fewer roads and utilities lead to cost saving. The
sharing of walls reduces materials and energy consumption.

URBAN ROW HOUSING: Many town house developments show internally
oriented to create more controlled access, distinguished from

street oriented conventional sitings. Individual parking is often incorporated into the lower levels of the units.(40 to 60 units per acre)

WALK-UP APARTMENTS: Even though many units are not resting on the ground, the combinations of emphatic stoops and direct access to the ground through individual stairways does reinforce the sense of separate dwelling. Many families have taken balcony space and created individualized extenions of their homes in much the same way that the suburbanite embellishes through gardening or decorative additions. Most do not have private outdoor space on the ground. They rely on commonly shared stairs and halls for access and most parking is aggregated away from the units.In this form of housing at moderate densities, the organization that has been used frequently to resolve the loss of traditional house amenities is that of interlocking open space to which buildings containing a few dwellings are oriented.In a site plan of inter-locking spaces, a variety of activity areas are linked to each other by controlled paths.

TERRACE HOUSING: On sites where conventional building forms are

impossible due to difficult terrain, this form of housing was devised. Two strong visual characteristics typify this form. First, the overall form has an aggregated hill town image. This is strong enough to cause residents to identify the whole development as their own individual place. Second, as the mass is stepped back to conform to the hill, each dwelling becomes recognizable and claims an outdoor space immediately adjacent and private on the roof of the lower unit.

ELEVATOR SUPPORTED - LAND-IN-THE-AIR; In conventional double loaded corridor type apartments, the corridor becomes the public space. The fuctions of surveillance and social buffering are dependent upon doorways which, more often than not, open directly into the major living spaces of each dwelling. Methods for correcting this are the ideas of "land in the air'" or the initial justification for pedestrian "street decks".

CHANGING ROLE OF
ARCHITECTS:

It appears that the architectural and planning ideas of modern architects have failed wherever the architect disregards the social and aesthetic values of user. In the days when most

USER
CLIENT
BUILDER
DESIGNER

1. PRIMITIVE PHASE
One actor in design process
User-client-builder-designer are one and the same person

Wealthy client-user hires, and communicates directly with

Master mason or builder who draws up plans and executes them

2. CRAFTSMAN PHASE
Two actors in design process

Wealthy client-user hires and communicates with

professional architect who interprets needs of client, creates a design and interprets it in turn to

contractor who executes (and makes one site modifications to) original design

3. EARLY PROFESSIONAL PHASE. Three actors in design process

Users are separate from fee-paying client; needs are filtered through client to designer

client often an institution, represented by a committee

architect interprets clients' needs, and has to communicate with fellow design professionals (engineers, landscape architects) Has to please clients but not necessarily the real users

Building contractor executes design, and is somewhat dependent on sub-contractors

4. LATER PROFESSIONAL PHASE. Multiple actors in design process

barrier to communication with client and designers created by space, time, economics politics. Recognition of barrier gave rise to new professional user needs consultant, environment and behavior researcher and design programmer

users needs are filtered to designer via client and take 3rd or 4th place after client's own needs, and those of banks, city agencies, federal regulations, etc.

Architect becomes process manager, balancing needs of many actors as well as fulfilling own professional needs

Building contractor limited in interpretation of design into reality by manufacturers of building components union regulations materials specifications, etc.

users have increased in number and become more diverse in terms of needs and values

BANKS

(PRESSURE)

ENGINEER

5. CONTEMPORARY PHASE

PROGRAMMER

INSTITUTIONAL CLIENT

ARCHITECT

LANDSCAPE ARCHITECT

LOCAL & STATE FEDERAL AGENCIES

architects were designing for wealthy, private clients, the
designer and his patron frequently came from the same social
class, shared similar values, and had little trouble commun-
icating . Furthermore, the client and the eventual user of a
designed environoment were one and the same person. The com-
munication of the needs and preference from client/user to
designer was a relatively simple person to person exchange.
With the onset of the Industrial revolution and the emergence
of more complex institutional and corporate environment the
designer-client link became more convoluted.
With the advantages of industrial society modern architecture
has tended to deal with how people should live rather than
how they do live. When traditional social patterns did not
conform to their modern idea of how buildings should be used,
designers ignored them, in the belief that every one in the
world has the same basic social and physical needs regardless
of who the client is.

With the onset of industrialization the architect-client re-
lationship took on a new aspect. In large-scale projects, the

Architecture is going through a kind of minor revolution.

Designers are grappling with the problem of the "unknown user,"

by wrestling with notions of "flexibility,""adaptability;"

and "responsive environment." During the last two decades

increased levels of individual awareness and social conciousness

regarding the physical environment are the consequence of a

common desire to reevaluate traditional social values.

In reaction to the impositions of Modern Architecture the

emerging attitude toward housing in these days seem to be

more modest, responsive, and humanly scaled.

Conrad .U PROGRAMS AND
MANIFESTOES ON 20TH
CENTURY ARCHITECTURE

The MIT Press 1970,p157,

In 1958, Hunderwasser read his Mould Manifesto in the abbey

of Seckau;

> 1. The archirect has no relationships to the building.
> Even if he is the greatest architectural genius he cannot
> foresee what kind of person is going to live in it.The so-
> called human measurement in architecture is a criminal
> deception. Particularly when this measurement has emerged
> as an average value from a public opinion.

> 2. The bricklayer has no relationship to the building.
> If, for example, he wants to build a wall just a little
> differently in accordance with his personal ideas, if he
> has any, he loses his job. And anyhow he really doesn't care
> because he isn't going to live in the building.

> 3. The occupant has no relationship to the building.

Because he hasn't built it but has merely moved in. His human
needs, his human space are certain to be quite different.
And this remains a fact even if the architect and bricklayer
try to build exactly according to the instructions of the
occupant and employer.

Only when architect, bricklayer and occupant are a unity,i.e.
one and the same person, can one speak of architecture.

Historically   the places where individuals or groups participated

actively in the creation of their environments have a special

character. Their uniqueness emanates from the dignity of providing

for one's self, of determining one's own living mode.

In 1972, The Shirt-Sleeve Session, held at the Department of

Architecture of Massachusetts Institute of Technology, was intended:

Allen,E.,edit.THE RES
PONSIVE HOUSE,The MIT
press,Cambridge,1974
p,IX

Dwellings ought to be fitted to people, not people to dwellings;
that building technologies ought to be flexible and changeable
capable of fine-grain physical conference to patterns of human
use; that people ought to be able to participate much more
fully and easily, directly or through machines, in the design,
construction, and later modification of their dwellings.

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FLEXIBILITY AND VARIABILITY: USER PARTICIPATION

In the past decade there have been an increasing number of projects using flexibility as a mean of personalizing architectural and accommodating different life styles.

This principle offers the user the possibility of changing, or making some individual contribution to , his own house.

For the purpose of clarity, it needs to define the meanings of terms:

> FLEXIBILITY: can be defined as the ability to achieve a change of conditions, without changing the basic system as such;

> VARIABILITY: may be defined as the ability to achieve a change of conditions by changing the system.

Thus, FLEXIBILITY refers primarily to adaptation to change, while Variability refers more to change as such.

AS the situation stands today , ordinary multifamily housings provide only the reduced dwelling into a few very specific spaces ,which in result reducing the diversity of human activity the dwelling can support.

Aside from a desired change in locale or place of employment, four types of interrelated change are most likly to require a move if the dwelling is incapable of long-term or life cycle

flexibility. 1) The first major change is household size, occur-
ing by marriages, child birth, etc., which requires spatial needs.
2) An alteration in life style--such as socioeconomic status,
aspirations, values and self definition change. People need to
imprint their houses with their own self images. 3)Changing equip-
ment is a third consideration affecting residential interiors.
--sound equipment, television set, sink washer-dryer,etc.--
4)Over time a dweller's desired activities may diverge from the
sociologists' "norm". --Music listening, piano playing .---

In addition to long-term flexibility, the need for alteration
of the dwelling occurs in other time frames. Although not nec-
essarily a major moving, lack of potential for change can still
cause conflicts and dissatisfaction with living environment.
This kind of changes are referred to"short term" flexibility.

RESOLUTIONS: In order to reduce the conflicts which arise
from both minimal and highly defined spaces, a number of sol-

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utions are possible which permit change and diversity. These methods include perceptual methods for creating privacy, actually increasing or reallocating existing space, reconceptualizing household equipment and reorganizing volume. In addition to these there are planning strategies which have less to do with than the specific physical aspects of the dwelling user in decisions about the dwelling's configuration and ambience.These resolutions are often interrelated. To summarize those resolutions in several categories; 1)Perceptual Resolution;Privacy. 2) Extended Space Resolution: Attempts are made to add spaces to extend the dwelling. In high density, highrise apartments there has been limited experimentation with overbuilding the structural framework to allow for expansion. In row houses, the walls between units may simply be extended to a fixed point of ultimate growth.3) Space Reallocation. 4)Equipment reconceptualization.5) Space reconceptualized: In Le Corbusier's development at Pessac,the machine domains which incorporate kitchens and baths will not themselves be elements of change and flexibility.Instead, individual space interpretations were to be attached at the discretion of the user.
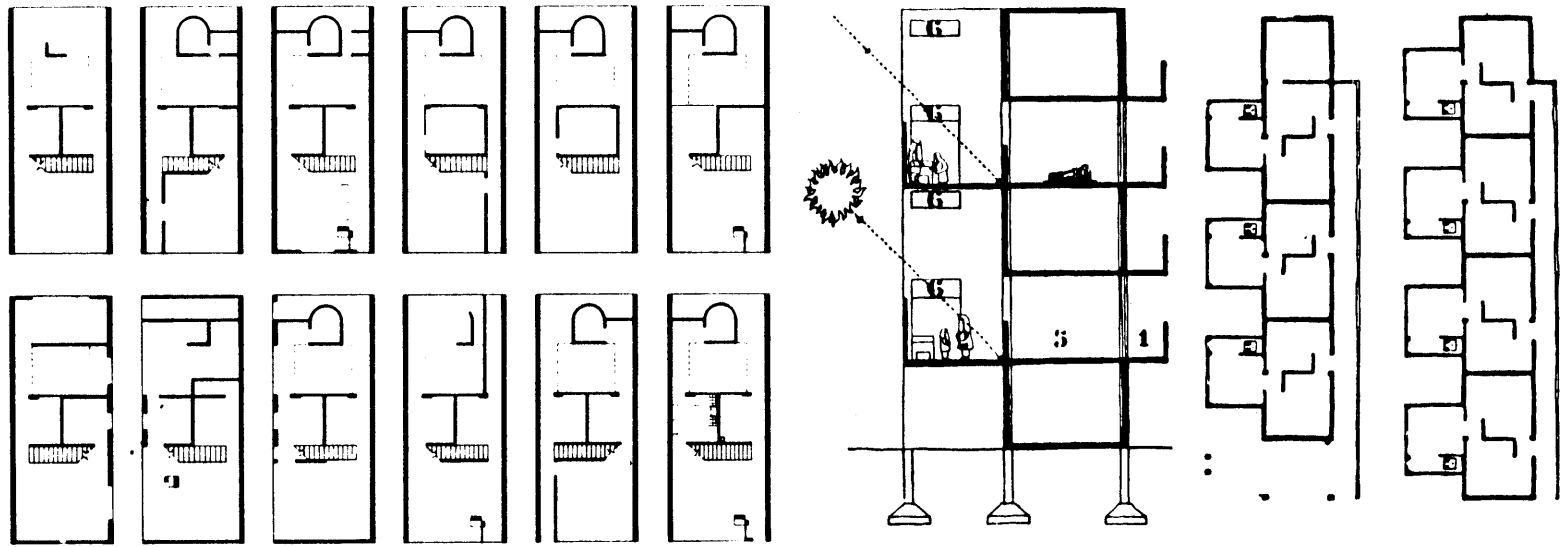
Le Corbusier's Pessac development.   Team Ten's Collective housing in Morocco.

One way to include flexibility in housing was through the
"open aesthetic", which was formulated by Team Ten at Otterloo,
in 1959. It offered the user the possibility to change or add
to completed house so that inhabitants could mark their housing
with their own individual stamp. Helping to build one's own
house, even on the small scale of participating in semi skilled
construction work, is an excellent way to begin bringing the
house and the way people use it closer together. Obviously the
more the client is involved in the basic planning decisions,
such as determining room sizes and locations, the better the
idea works.

23
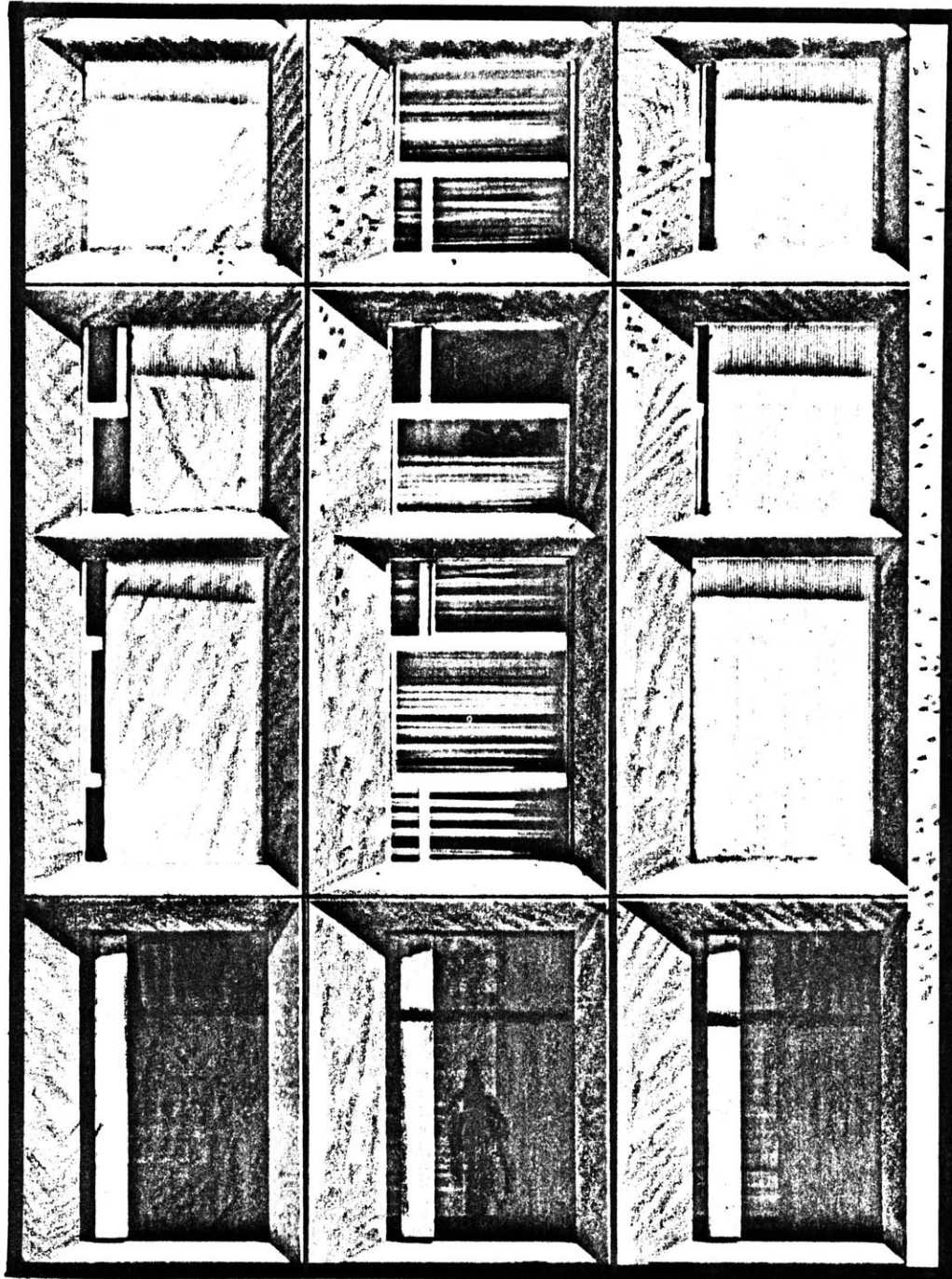
system

ANALOGIES: There are analogies and images of housing that move beyond

narrow sense of industrialization to something richer and more

varied. What such analogies try to do is to create a framework

for housing that leaves the individual householder with partial

or complete responsibility for the arrangement and in some cases

the form of his housing. Such a framework aims at meeting the

needs not only of the first users of the housing, but of each

successive user who might live within the framework.

Its aim is not to try to embody human actions and desires, but

to accommodate them.

1. <u>The wine bin analogy</u>: Like Le Corbusier's Marseilles block,

the block consists of a framework - the wine bin that holds

an infill of housing - the wine bottles. Corbusier saw the infill

as something of fixed arrangement, but conceptually it could be

varied a great deal. It connotes something of fixed shape and size,

but containing wine of every variety. Welton-Beckets contemporary

Hotel at Disney World is direct application of the wine bin

analogy: Its ziggurat framework holds prefabricated steel hotel

room modules.
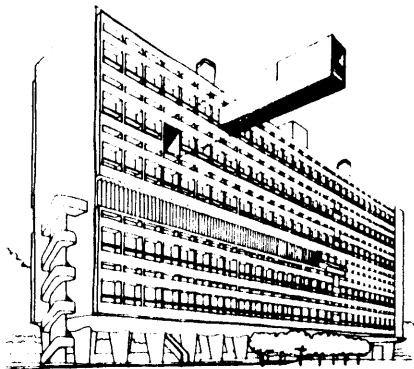
This makes it possible to replace or refurbish whole rooms without disrupting the operation of the rest of the hotel. They also allowed the hotel to be finished rapidly, while minimizing the number of workers who had to be brought to and maintained at the site. But, like the Marseilles block, each of the modules is basically the same. Archigram group's Plug-in City Project and Kurokawa's Capsule Hotel in Tokyo's Ginza District are both variations on the wine bin theme.

The problem of wine bin analogy and its variation is that they depend on some outside force to remove and replace the housing modules, and they picture the module themselves as things of fixed dimension and arrangement. Although flexibility is provided, it is limited, provided to the framework and not to the housing.

Brolin sees some problem in that kind of mega-structures and notes:

Brolin B., THE FAILURE OF MODERN ARCHITECTURE

Van Nostrand Reinhold Co. N.Y. 1976,p.84.

the complications of moving large apartment-sized object through dense urban areas, it seems that mega-structures would only be flexible if they were not used to capacity,

and therefore were uneconomical. With a profitable 3, or 5, percent vacancy rate a mega-structure becomes relatively inflexible: You cannot expand if your neighbor will not contract.
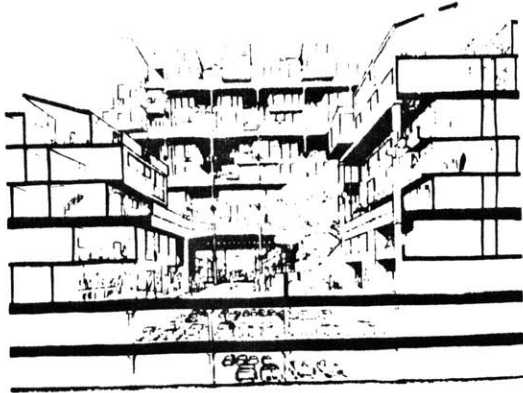
2. The bookcase analogy: This tries to redress such a problem.
The Townland (one of the competitors in the Breakthrough Program) System is based on the same separation of structure and infill that characterizes the wine bin analogy and its examples, but goes a step beyond in providing the kind of ambiguous space that associated with a bookshelf - a space that can hold not only books, but lamps, aquariums, bric-a-brac and a host of other thigs. One of the presentation drawings showed the frame structure filled with a variety of housing types - multi family multi-story and detached single family housing, each somewhat different from the next, at the same time variety of other functions could be inserted in the framework, - playground, schools, stores, offices and community facilities.

3. The play pen analogy: Both the wine bin analogy and the bookcase analogy are evolutions of the 19th century industrial loft. Loft buildings can be thought as an example of separation of framework and infill, but they also can be considered as

separating the building envelope and interior space. What they

provide is a shelterd interior space that can be adapted to

housing and other uses. Another analogy is derived from such

a framework of housing. Martienssen chose the term play pen

because she thinks;

Martienssen,H., THE
SHAPE OF STRUCTURE,
London,U.K.:Oxford
Universuty Press,1976,
p.153

> The play pen provides little more than a defined (and thus
> limited) place where the child can assemble his own
> desired equipment and provide for his own small industries,
> whether those be with paints, bricks, counters, or any
> other articles contributary to his business,-- and the
> important quality is flexibility, adaptability , and
> unobstrusive behavior of container surfaces and limiting
> walls, a lack of encroachment either in actual substance
> or in visual instances, a reticent in fact and lack of
> aggressive demand.

She further notes that the external and internal expressions

of the container can hardly be of matter of importance , so:

> it is the things contained that are of importance, and
> the person or persons manipulating those things, who may
> well desire enlargement of the space available as those
> things take shape or are dismantled.

One cannot simply apply analogies blindly, or think them up

in isolation. Each has to grow out of a consideration of the

community - its technology, its resources its desires.

4. The umbrella analogy: Buckminster Fuller is responsible
for pushing separation of envelope and space enclosed its logical
conclusion, proposing that an immense dome be built over part
of Manhattan, thus creating an umbrella between New York and
the environment. It can easily imagined that the regulated
internal climate of the dome could result in a more tropical
architecture, one less dependent on bulk and mechanical equip-
ment than its outer counterpart.

It can be pointed to some examples of this kind of ideas
though not in such scale, in the building that provides only
a sheltered area for their owners and tenants: large shopping
malls typically provide only raw space and utility hookups,
placing the burden of development on the individual tenant,
who is free to plan the space within a clealy stated set of
rules.

sera doble del castillo
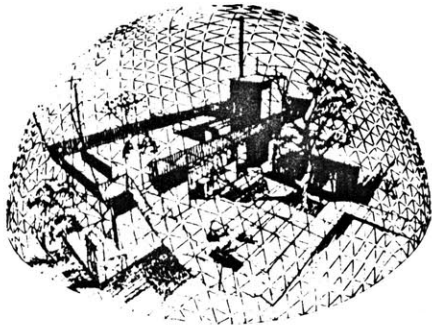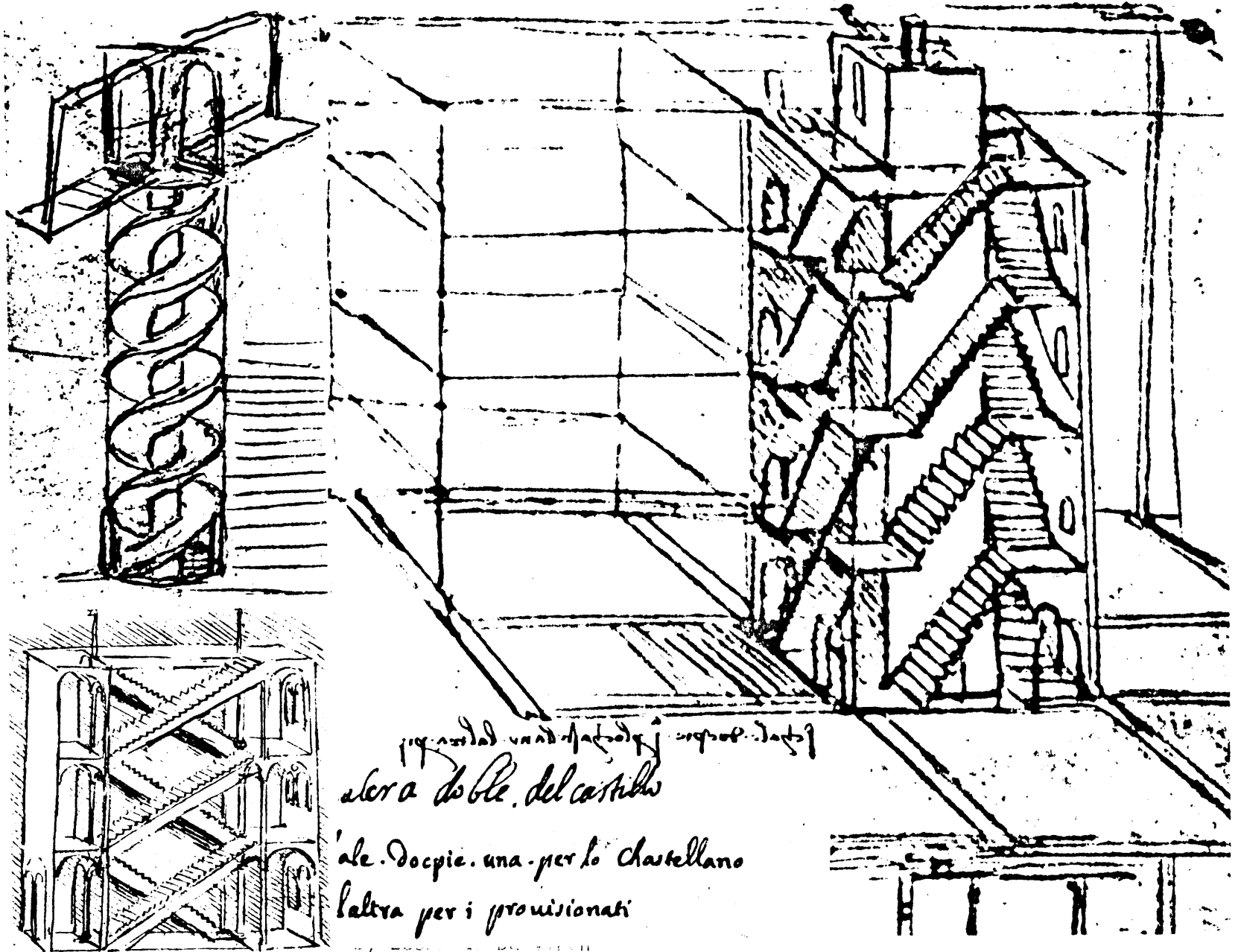
'ale doepie una per lo Chastellano
l'altra per i prouisionati

Among those analogies the "play-pen" concept was adopted in formulating the idea of new system that makes industrialized housing possible to be more responsive to users' needs .

Although "self-help" is the most perfect way to produce dwellings in terms of user participation, there are four areas of construction which are uncommonly difficult to undertake without special skill: 1) structural/envelope system; 2) water/waste system; 3) power/energy system; and 4) foundation/footing system.

From a three- dimensional point of view, buildings designed with planning grid have divisibilities into two kinds of structural volumetric module; the one including "fixed core", such as bathroom or elevator shaft; the other includes sheltering envelope , such as exterior wall or windows:

SYSTEM DESCRIPTION: MULTI-STORY SECTIONAL BUILDING SYSTEM is a sort of specialized case of three dimensional building system. This is basically composed of load- bearing vertical boxes, which are envelope units and service core units, combined with floor and roof panels to create an integral structure.
The modules are monolithically cast, box-like concrete units of same size.

The modules can be combined in a variety of configurations, producing a wide range of building forms from low-rise walk up townhouse to high-rise. The combinations possible for extremely flexible floor plans and form designs.

The modules are produced and finished in the production facility. So there can be a range of finishes available, both for exterior faces and interior surfaces. But in terms of flexibility for users' participation it would be reasonable to leave the interior as constructed.

BASIC UNITS: The basic form of sectionals is a vertically long, narrow volumetric module complete in three sides except

one side which is open. The modules contain all necessary electrical, plumbing, and heating-ventilating services, which are installed during the precasting process. The boxes incorporate all the various openings required, such as door and window frames. Kitchens and bathroom, separate units, complete with fixtures and accessories, installed in the factory.

Those sectionals come in four floor heights, and can be stacked one upon the other to produce high-rise building up to 16 storeys. The size of sectionals is generally limited by the maximum size permitted for highway transportation.

SLABS: The floor panels can be large, roomsized slabs or precast hollow-core planks.In view of the system's objectives, that is to provide flexibility to the plan configuration, hollow core planks are considered appropriate components. Some of the available hollow-core planks in the market is well provided with the characteristics needed in this particular building method. Because the plank is machine extruded on beds up

to 600 feet in length, and can be cut to desired lengths its applicability for this system is emminent. The planks can span up to 48 feet without intermediate support.

ROOF WITHOUT STRUCTURAL TOPPING   Spans based on 40 psf. live load.

Span in feet	0	4	8	12	16	20	24	28	32	36	40	44	48
4"													
6"													
8"													
10"													

FLOOR WITHOUT STRUCTURAL TOPPING   Spans based on 100 psf. live load.

Span in feet	0	4	8	12	16	20	24	28	32	36	40	44	48
4"													
6"													
8"													
10"													

FLOOR WITH 2" STRUCTURAL TOPPING   Spans based on 100 psf. live load.

Span in feet	0	4	8	12	16	20	24	28	32	36	40	44	48
4"													
6"													
8"													
10"													
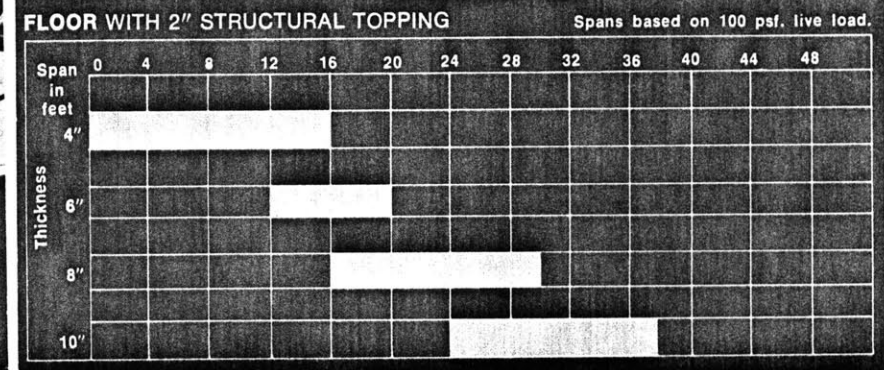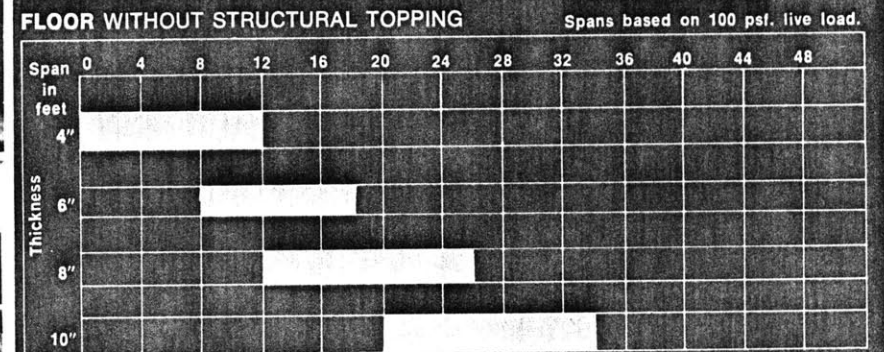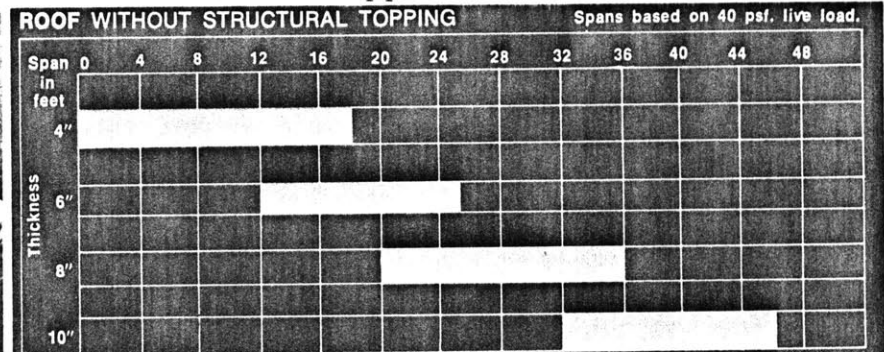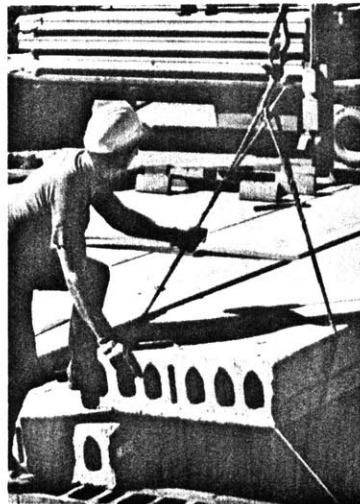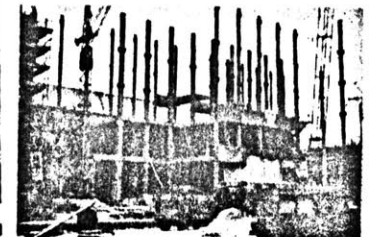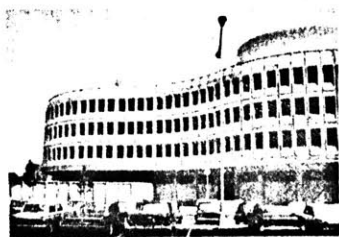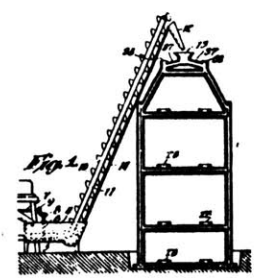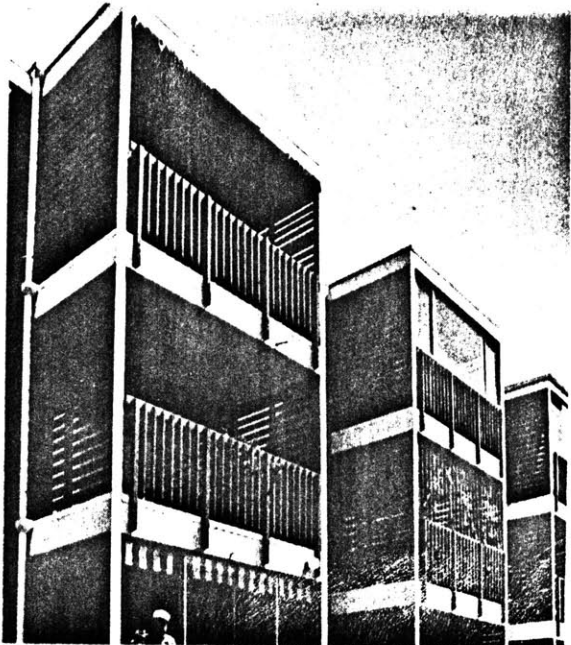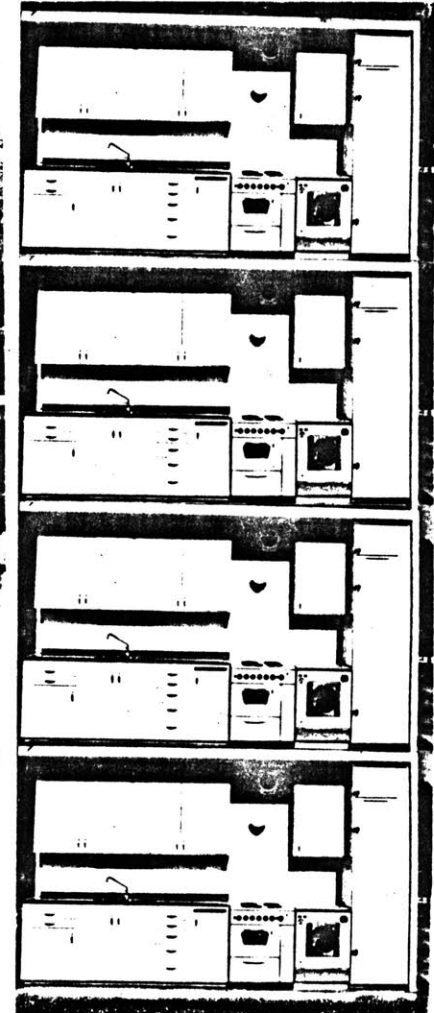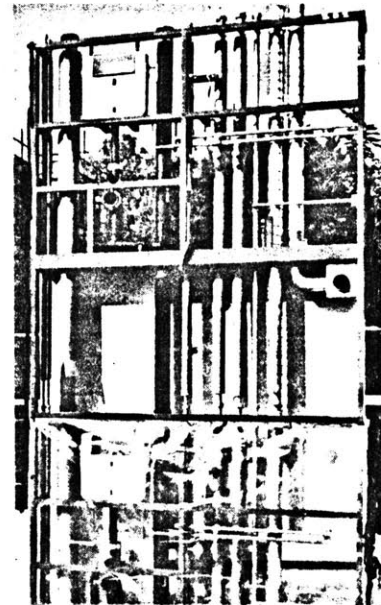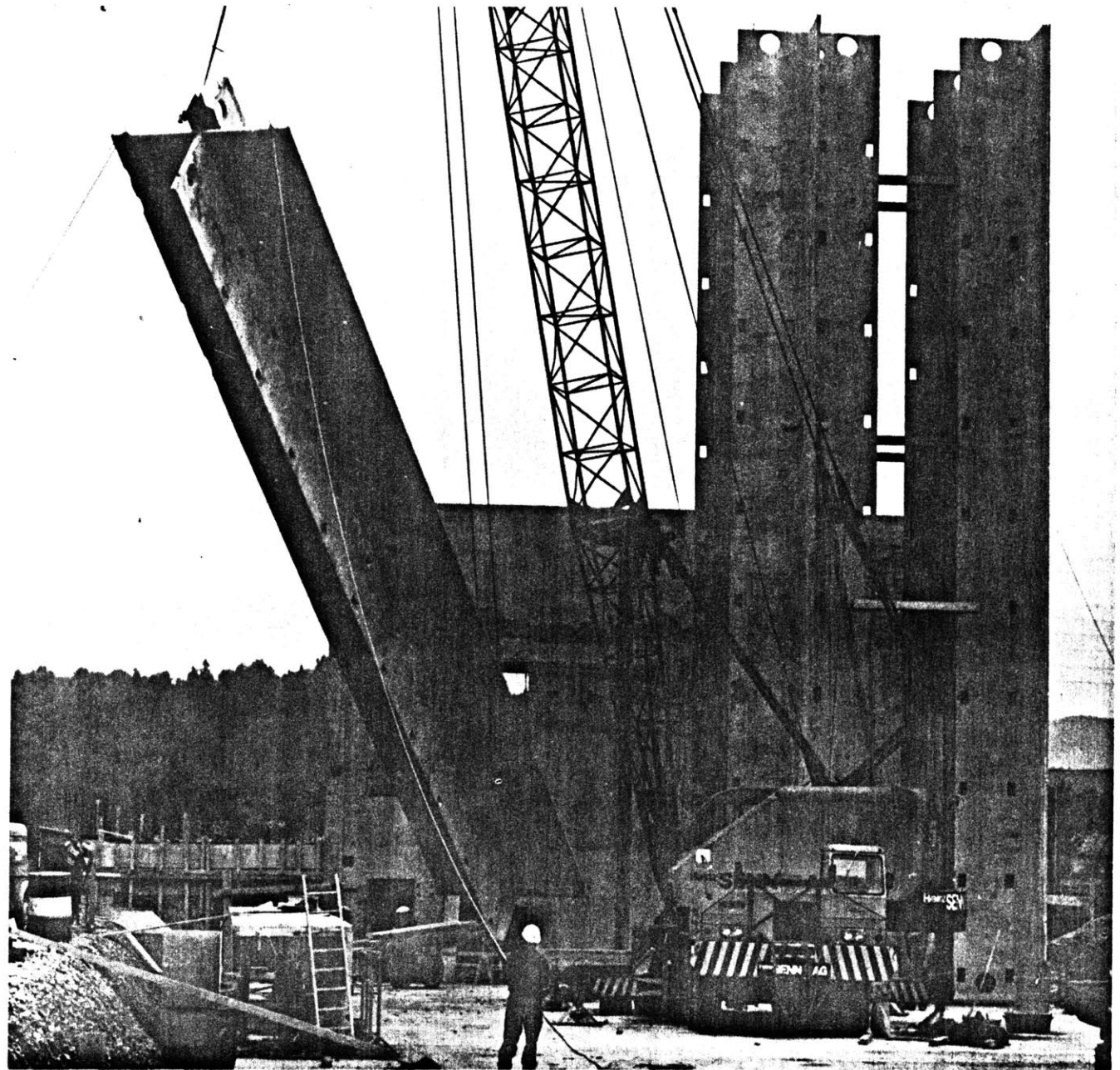
DESIGN

DESIGN METHOD: The housing scheme which starts from an additive system invariably ends in formalism. It has been found in the planning of housing units, that the most effective way to proceed is to start with those elements which can first be determined and defined(entry, kitchen, bath,etc.) and to cluster the rooms around these services. This concept by dissociation is general practice today. Fist the core is determined, then the cluster is formed. This is true for one-family houses as well as for blocks of flats, and as a pl-anning process usually results in good and efficient design.

In The Place of Houses, Moore categorizes domestic spaces into machine domain" and"our domain", a separation similar to Louis Kahn's "served and servant spaces." The "machine domain" can either be condensed appendage to the plan or a compact island within it, leaving the remainder of the dwelling a flexible activity area.
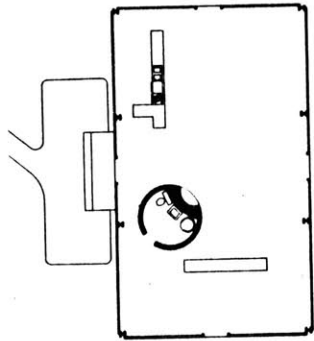
Glass house, New Canaan,
Philip Johnson, 1949
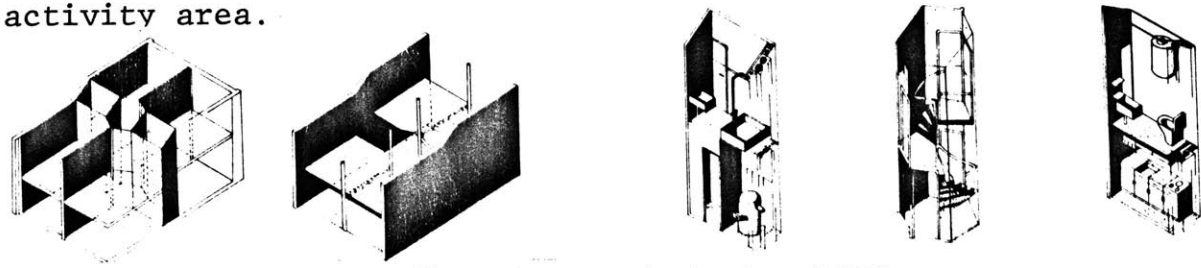
Rietveld's"Kern Huizen"(apple core) design.1929

38

In terms of the directionality of the system, multi-story
sectional system is three-dimensional. By manipulating basic
modules hundres of dwelling plans can be acquired. versatility
of form congiguration would be considered a great advantage of
this system.

AMBIGUOUS ZONE
occupants will
design and build as they wish.

Directionality

a0
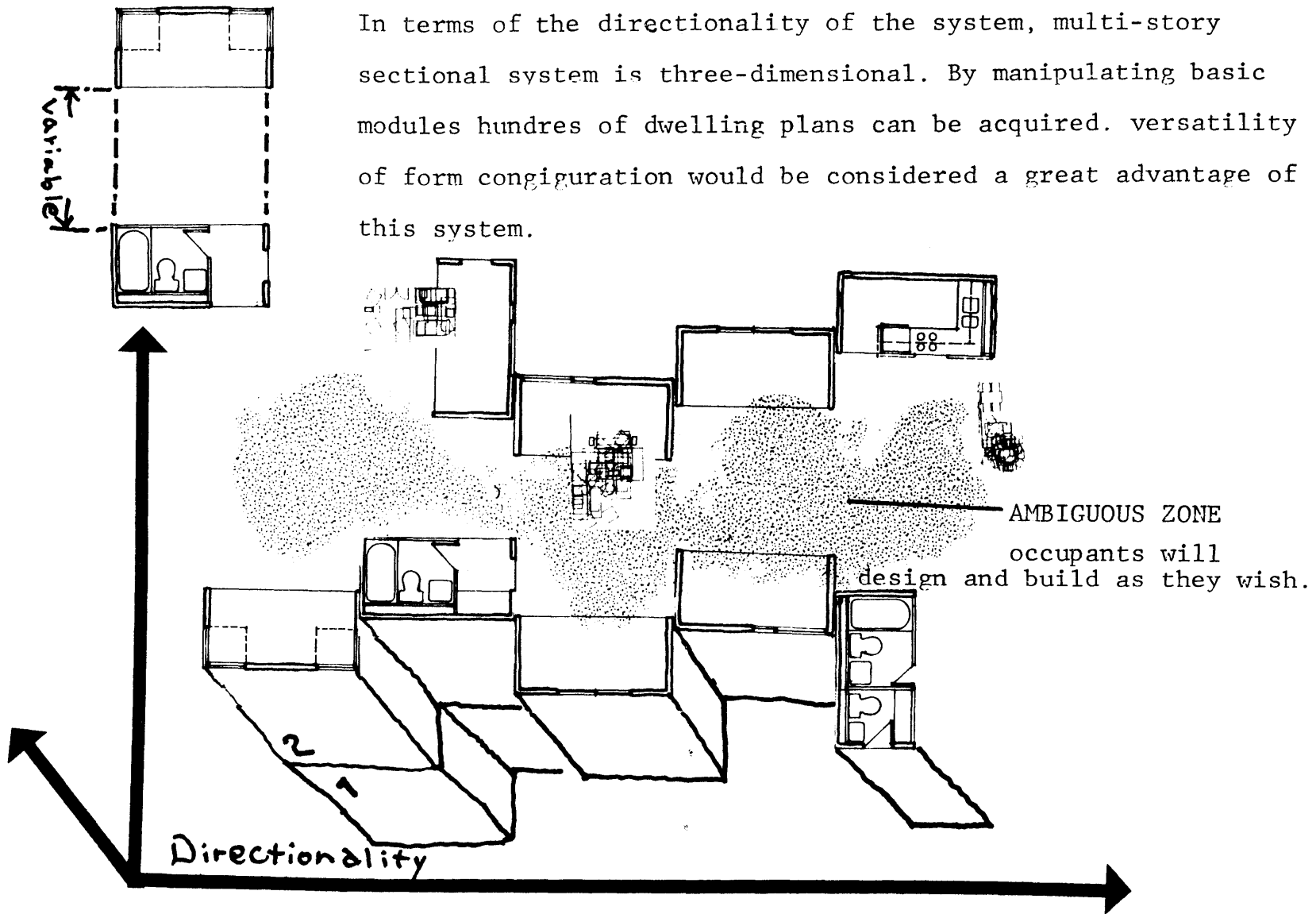
■ENVELOPE
 BOXES
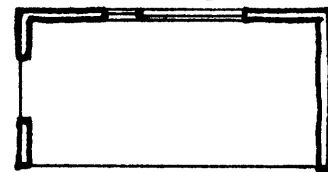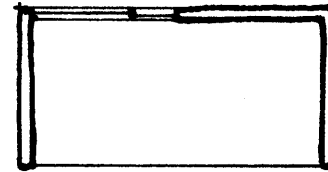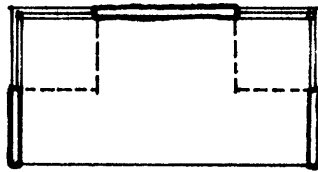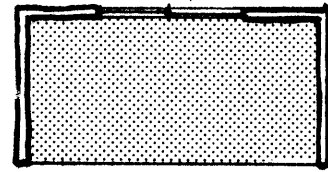
■BATHROOM
 BOXES
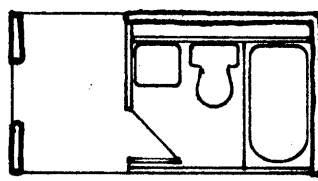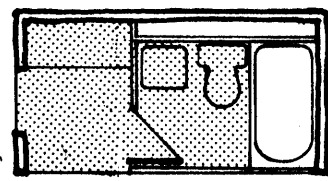
■ KITCHEN
 BOXES
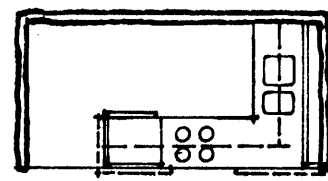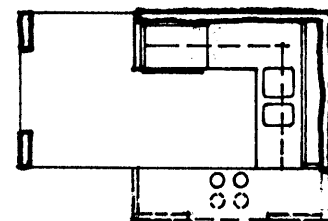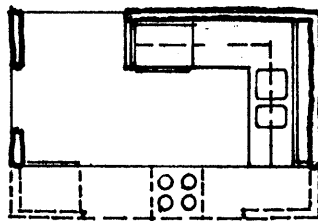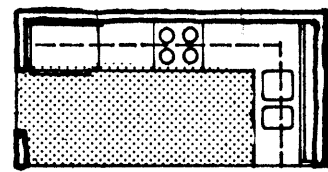
■STAIR
 COMPONENTS

BASIC MODULES

1

2

3

4
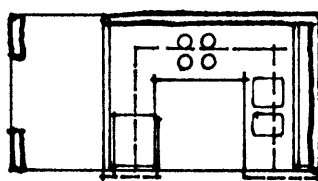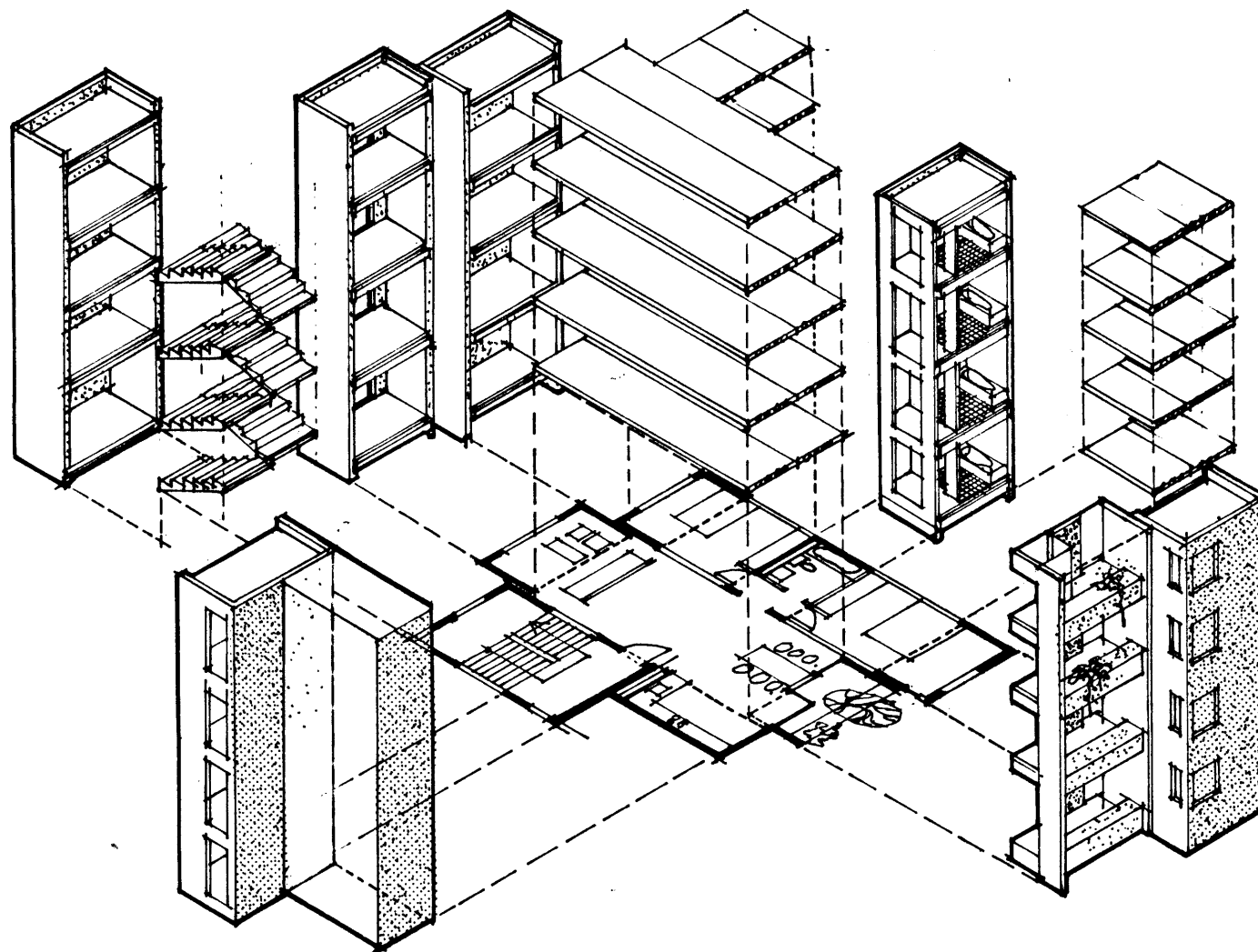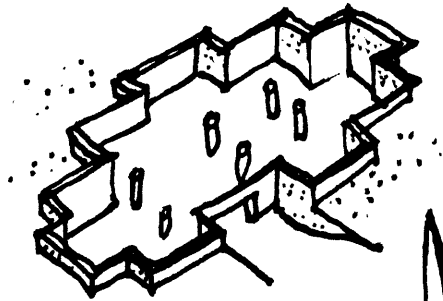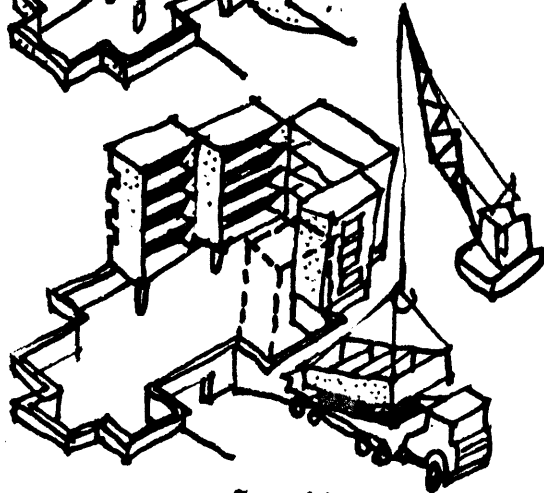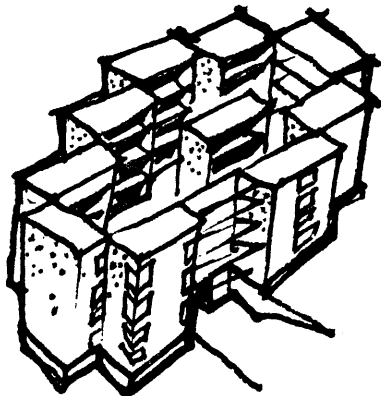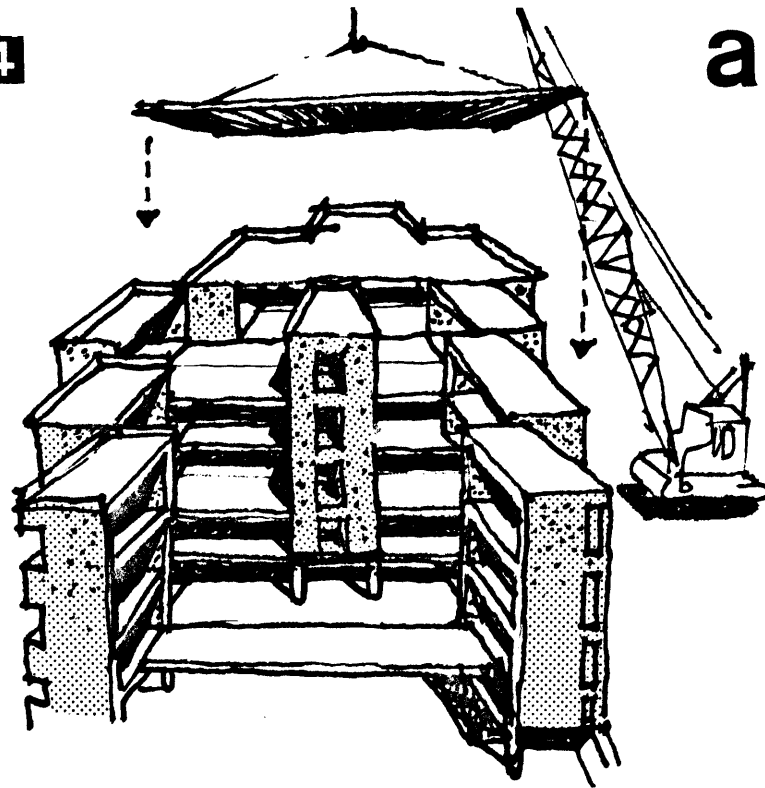
■ Foundations are finished.

■ Multi-story sectionals are transported and erected by tilt-up method.

■ Boxes are jointed.

■ Slabs are lowered and positioned.

ASSEMBLE

a3

a4

a4

a6

a7
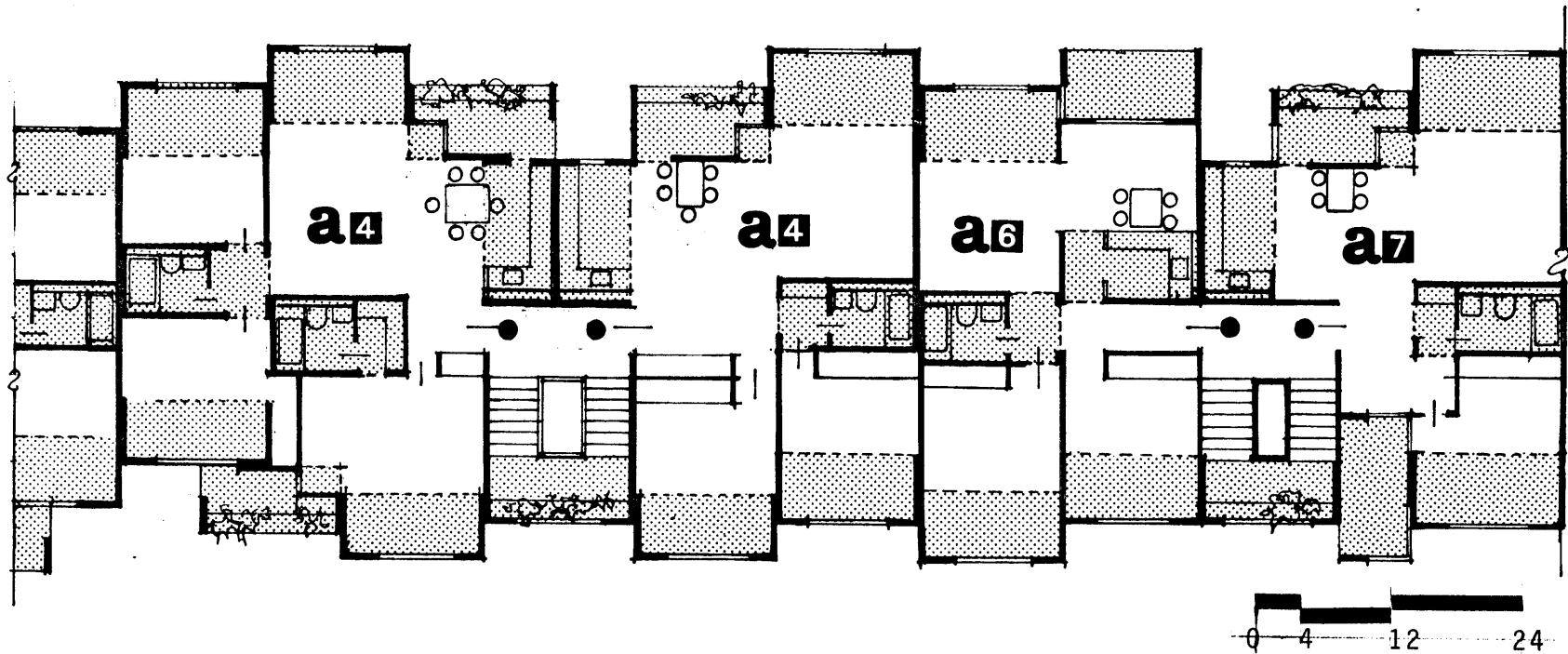
■FLOOR PLAN OF A LOW-RISE WALK UP APARTMENT : One stairwell serves two units.

a.4

BR

LR

A5 ▶

BALCONY

DR   KIT.

BATH

A5

ENT.

◀   ▶

BATH

dn.

BR

MBR

▼

BAL.

0   2   6   12
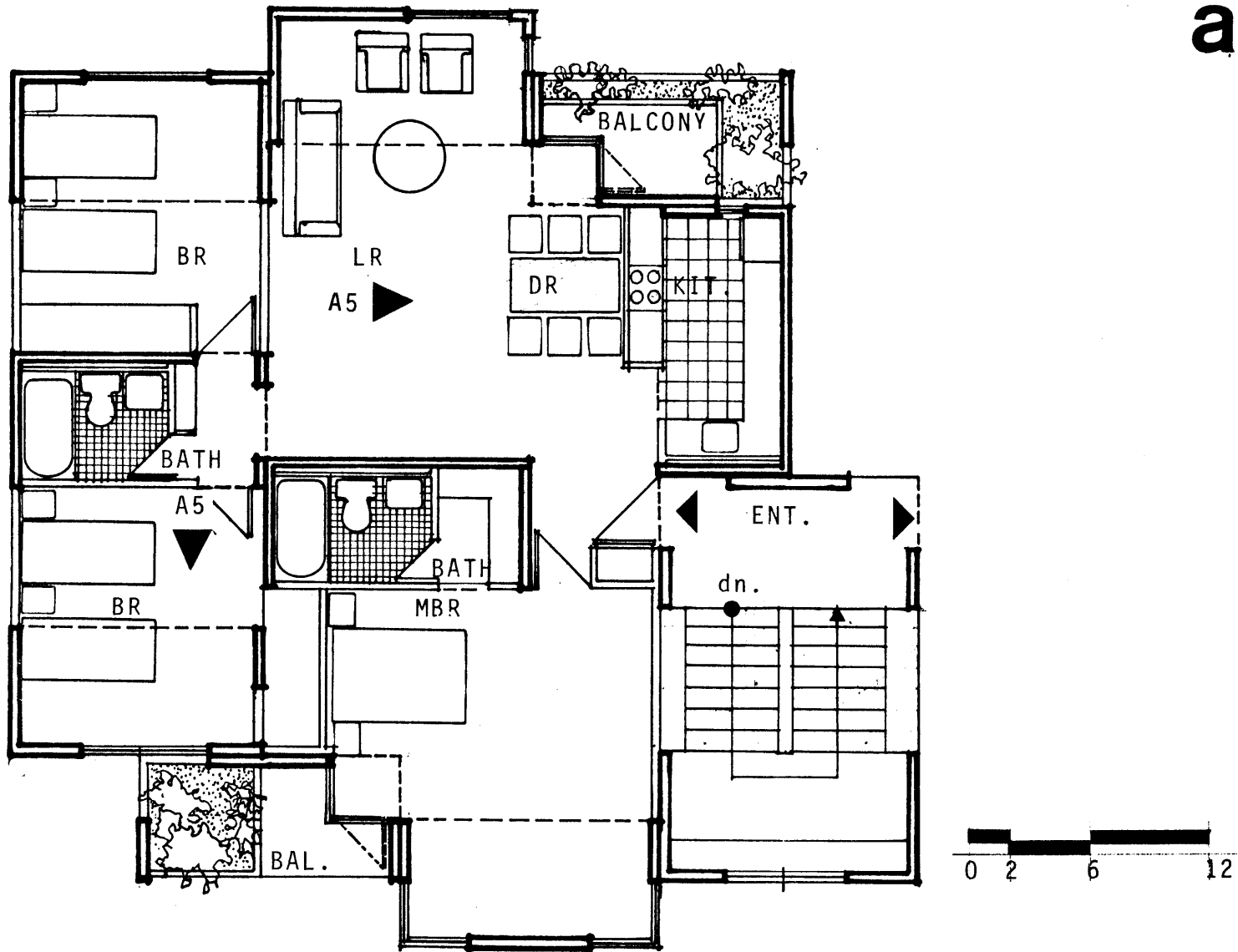
■DOUBLE ASPECT THREE BED ROOM UNIT: LOW-RISE WALK UP APARTMENTS.
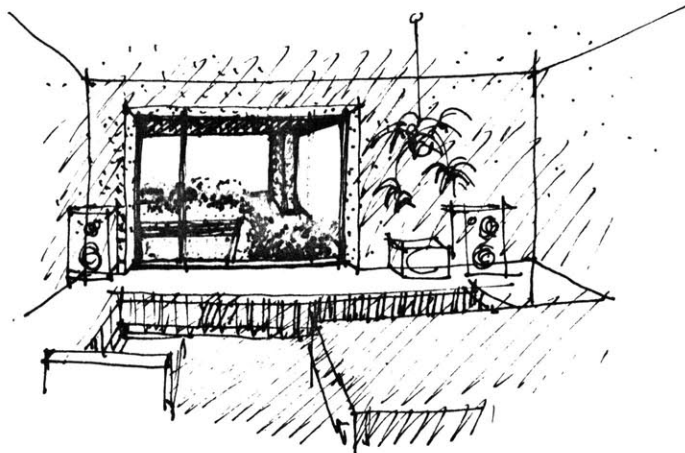
■ View from the inside of bed room toward the balcony.(A3)
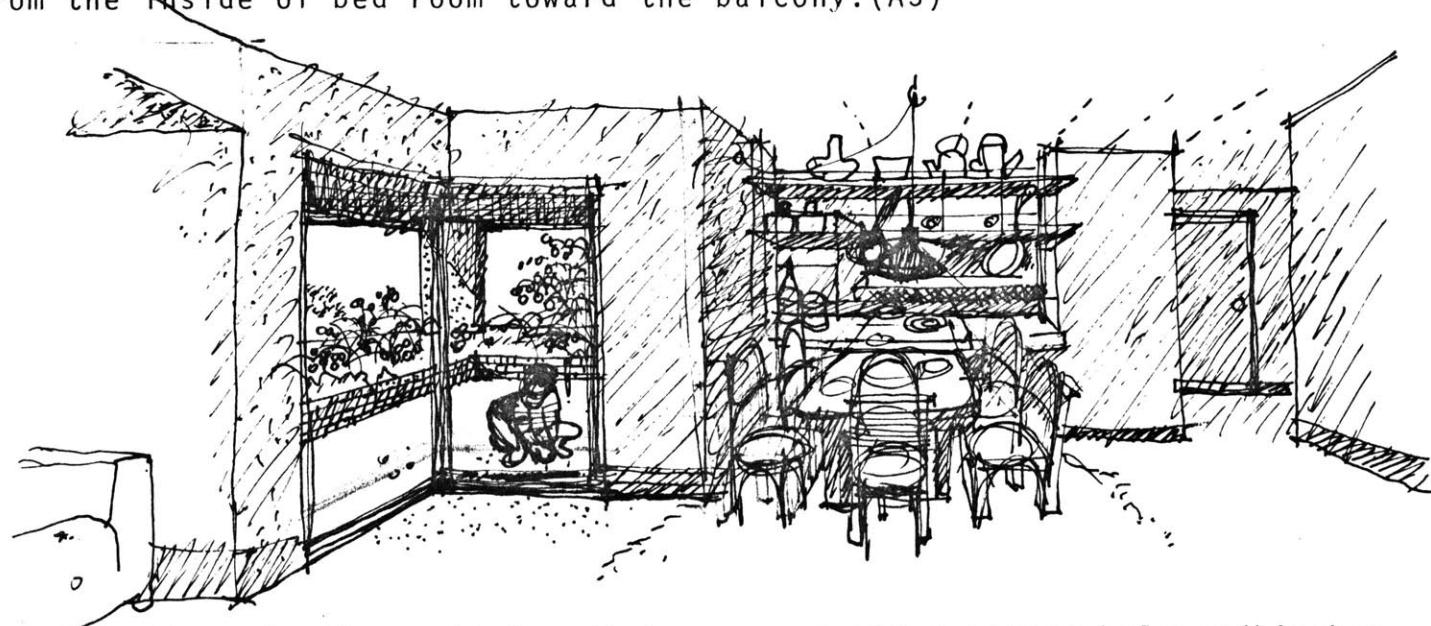
■ Interior perspective of A3   living dining room,looking toward balcony/kitchen.

BALCONY

LIVING

KITCHEN

DINING

ENT.

BATH

BED

BED

0 2 6 12
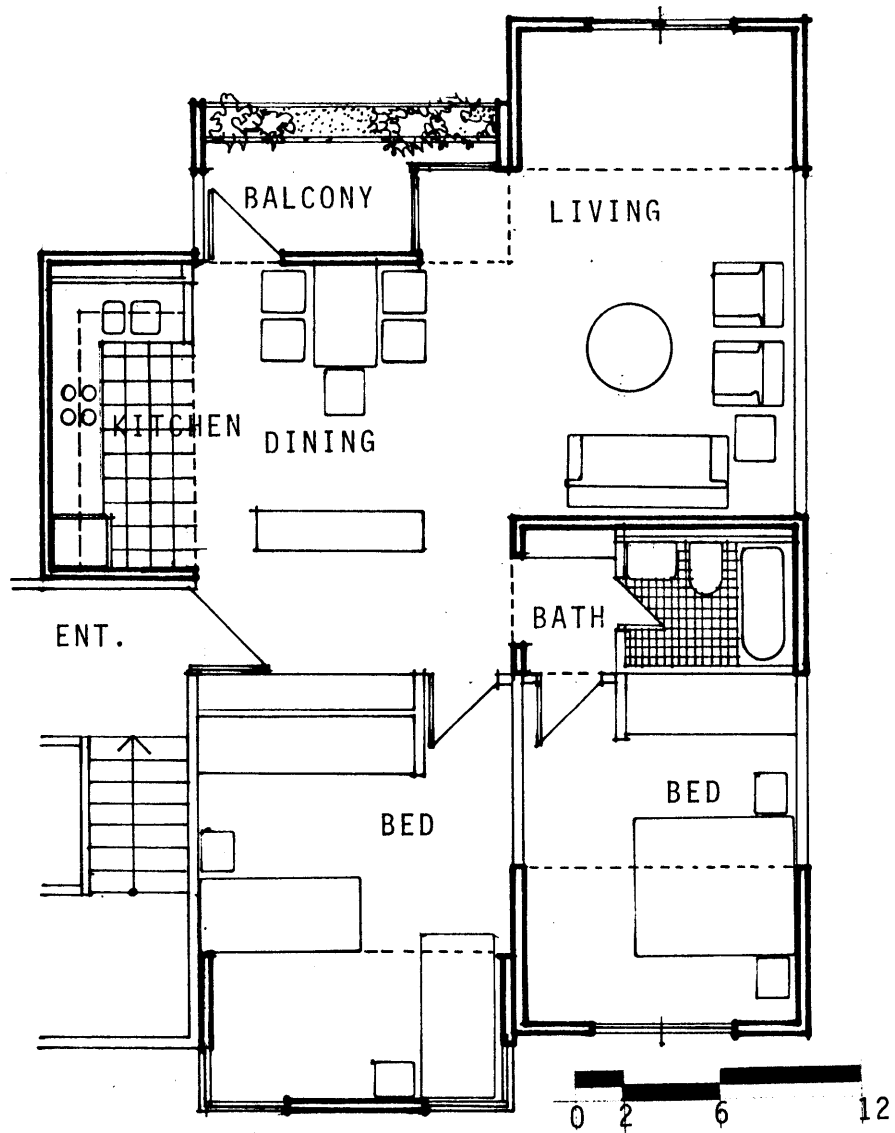
■ Two bed room unit in low-rise walk up apartment.

BAL.

DLR.

BT

BR

BR

DR

BAL

BR

LR

BR

Alternative plans.

a7

BALCONY

BALCONY

BALCONY

BED ROOM

BED ROOM

KITCHEN

LIVING-DINING

BATHROOM

HALL

ENTRANCE

MASTER BED ROOM

BATH

0 2   6   12
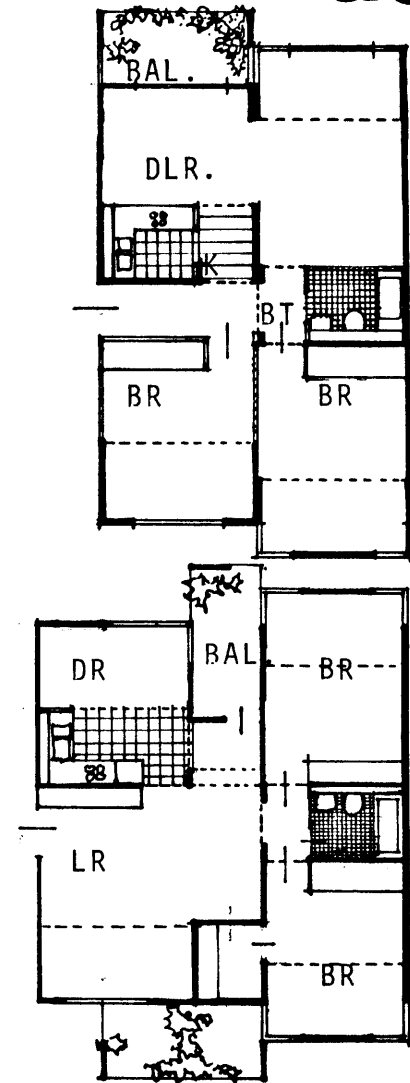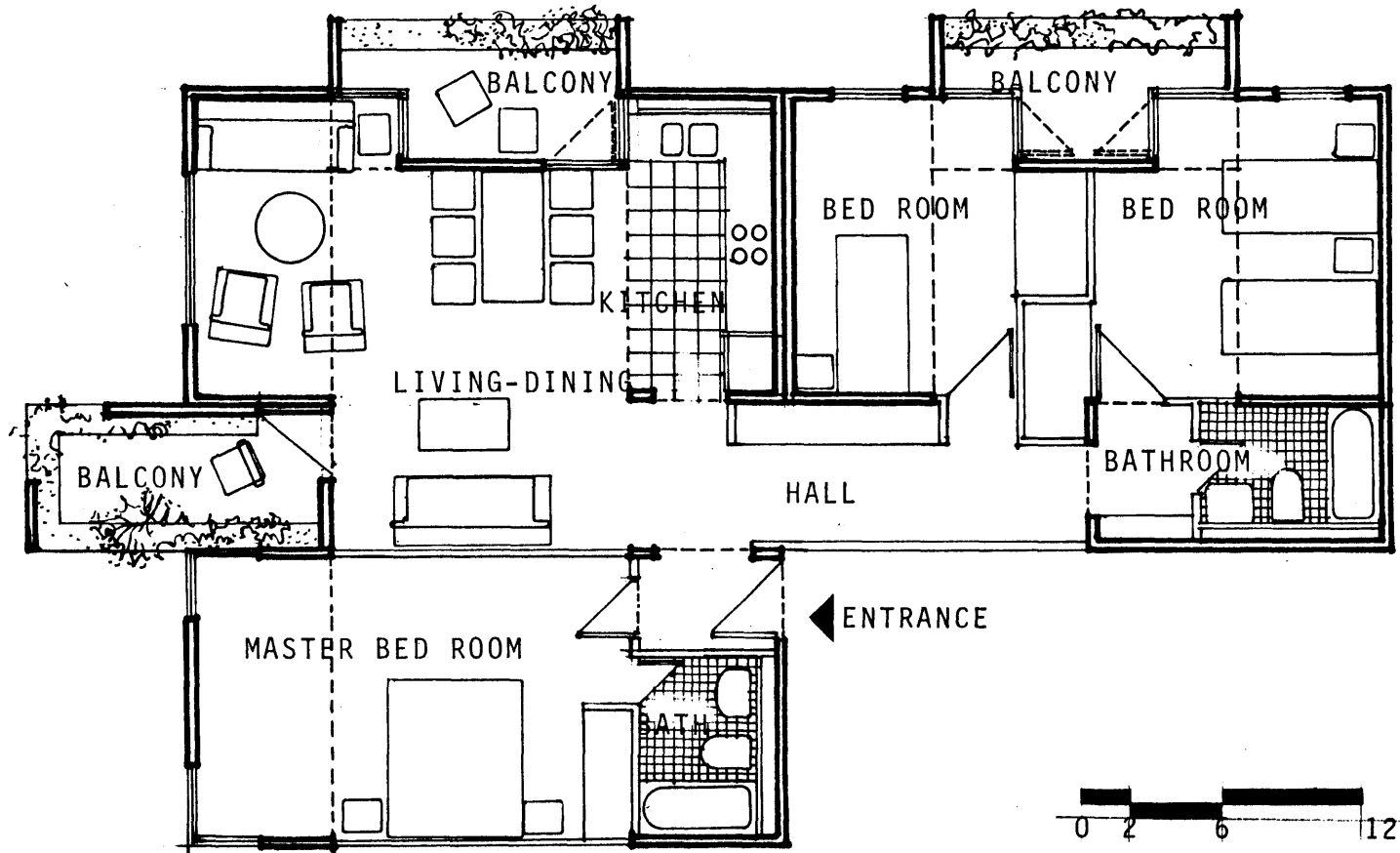
■Double aspect corner unit(three bed room) in high-rise apartment.

a8

BAL. LR K BR BR BAL LR D
BAL. ENT ENT B K BAL
MBR B BR
BR B BR
ENT ENT
BAL LR K BR BR K LR BAL
BAL BAL

0 4 12 24
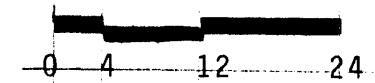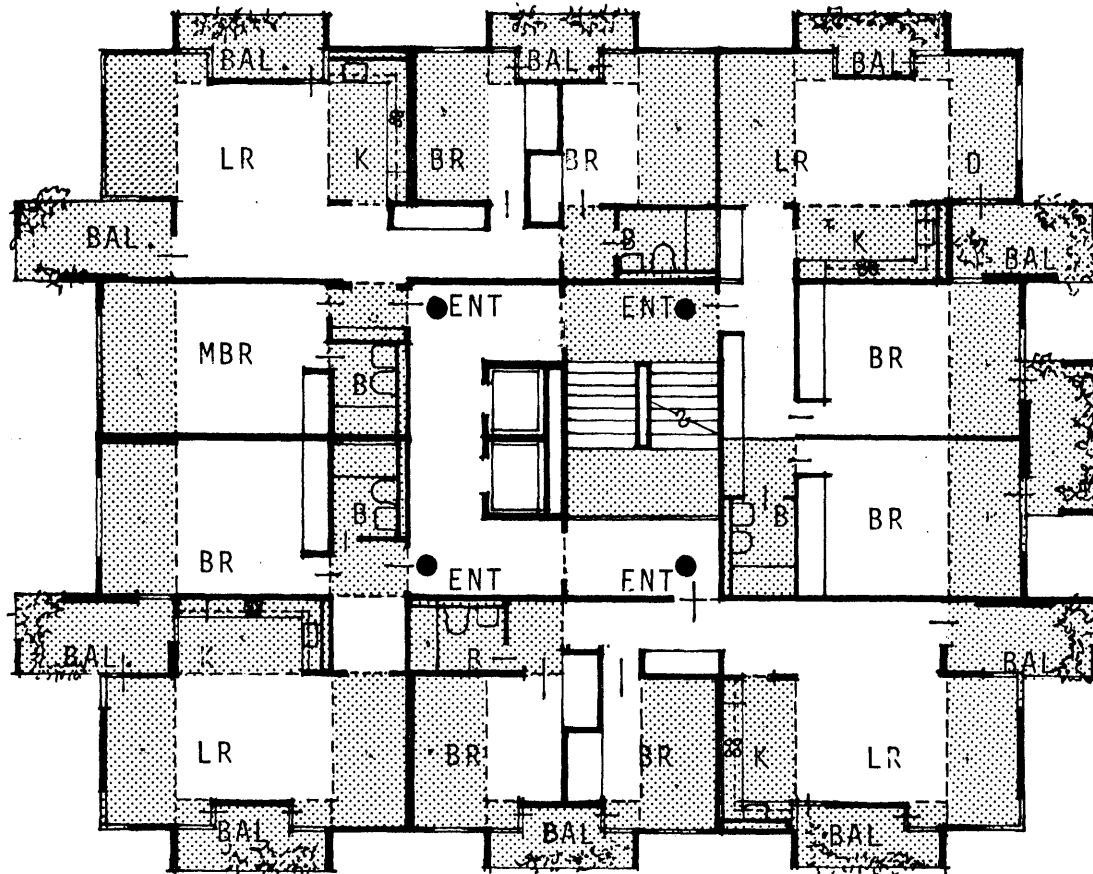
■ This floor plan shows an elevator supported high-rise tower building.

■Interior perspective of a living room in a tower apartment.(A7)

BALCONY

BALCONY

BED ROOM

BED ROOM

CLOSET

LIVING ROOM

CLOSET

BALCONY

BATHROOM

DINING AREA

KITCHEN

ENTRANCE

CORRIDOR

0 2 6 12
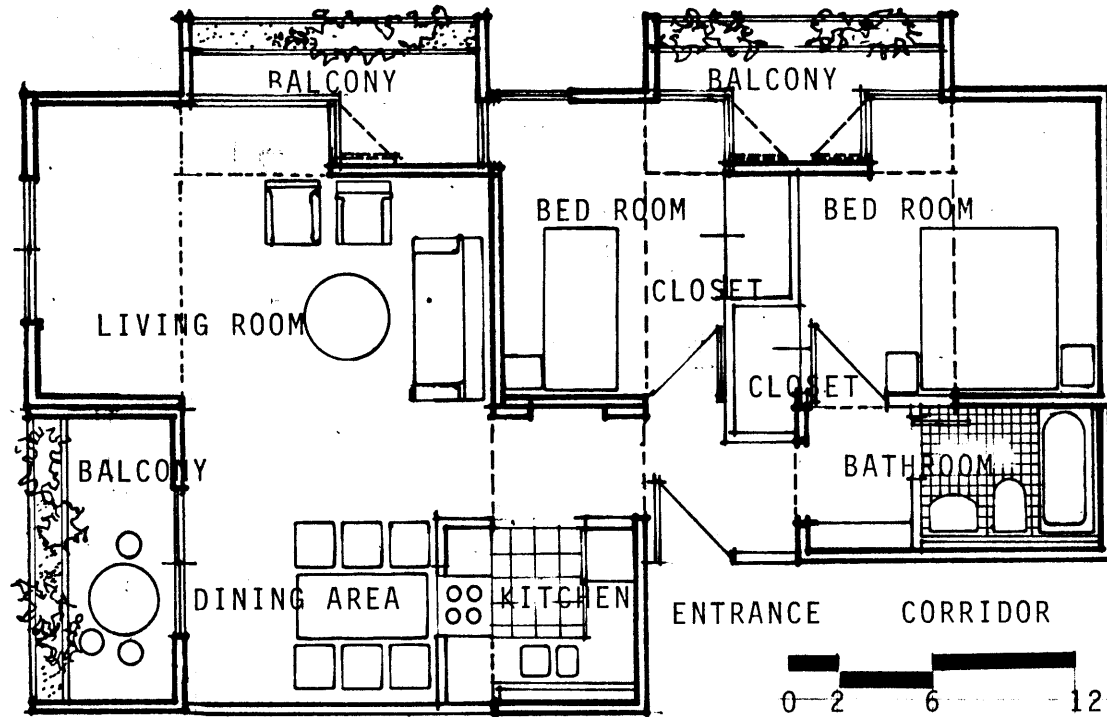
■Two bed room unit in the tower apartment.(double aspect)

SLEEPING AREA

SLEEPING.

BALCONY

BALCONY

LIVING

LIVING-DINING

DINING

KITCHEN

KITCHEN

BATH

S   B   B   S

LR   LR   LR

K   K   K

D   D   B

LIVING -
DINING AREA

KITCHEN

0   2   6   12
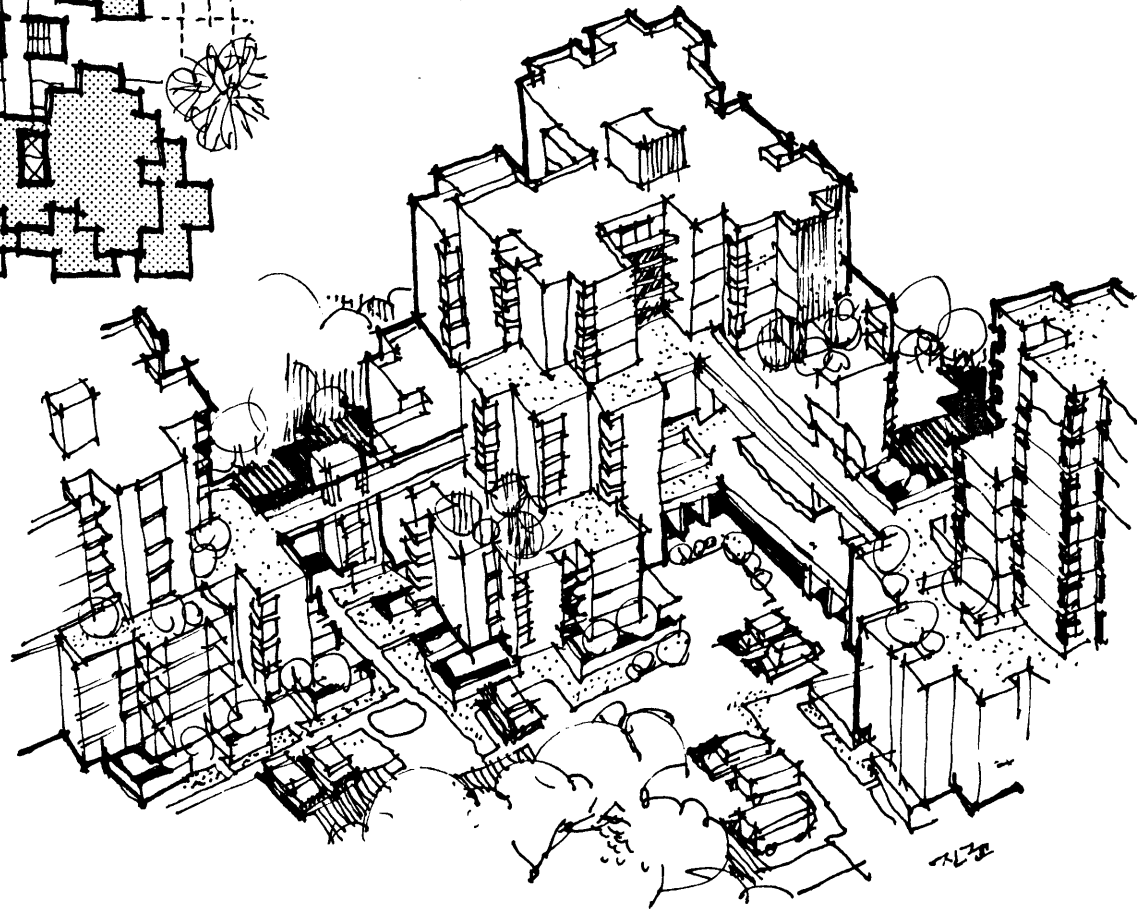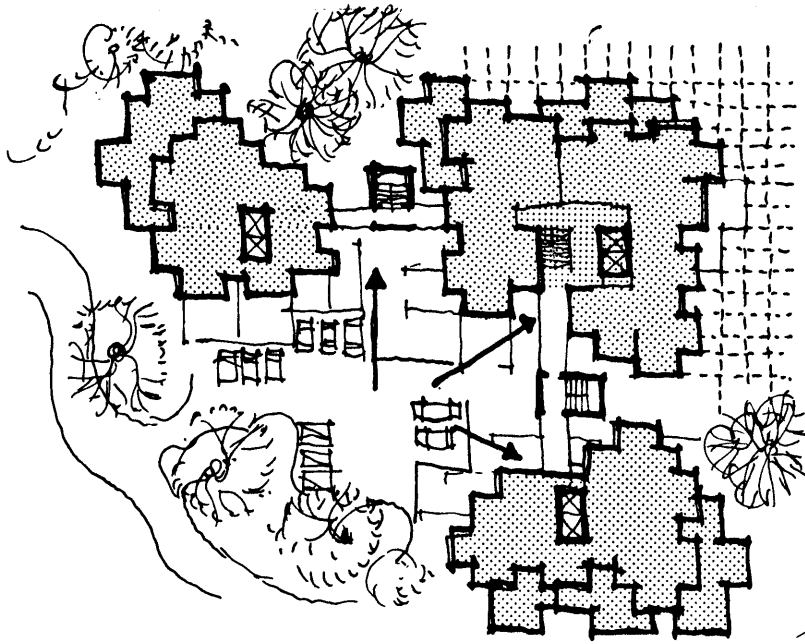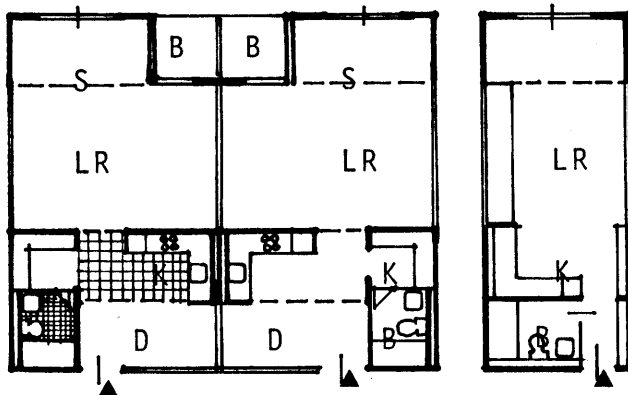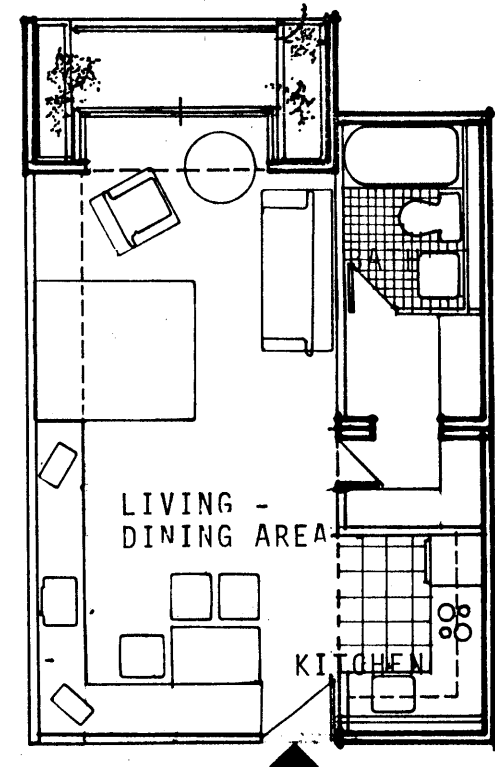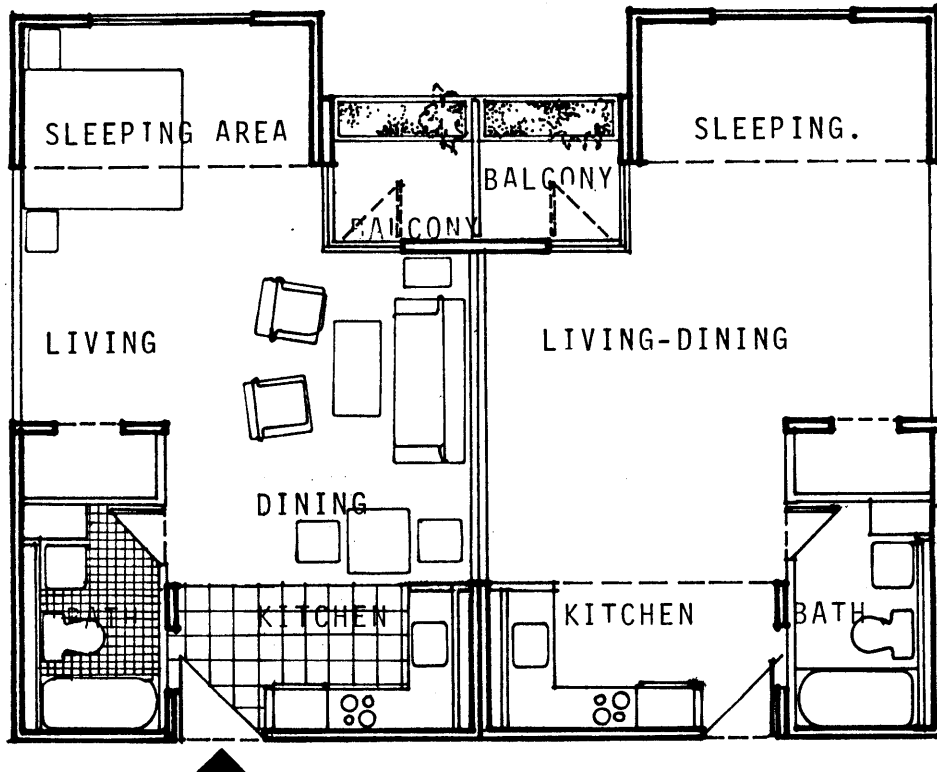
■Efficiency units in a corridor type apartment.

a12

LIVING ROOM

BALCON

BED ROOM

BED ROOM

DINING AREA

BATHROOM

KITCHEN

HALL
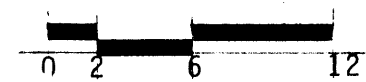
CORRIDOR

0 2   6   12
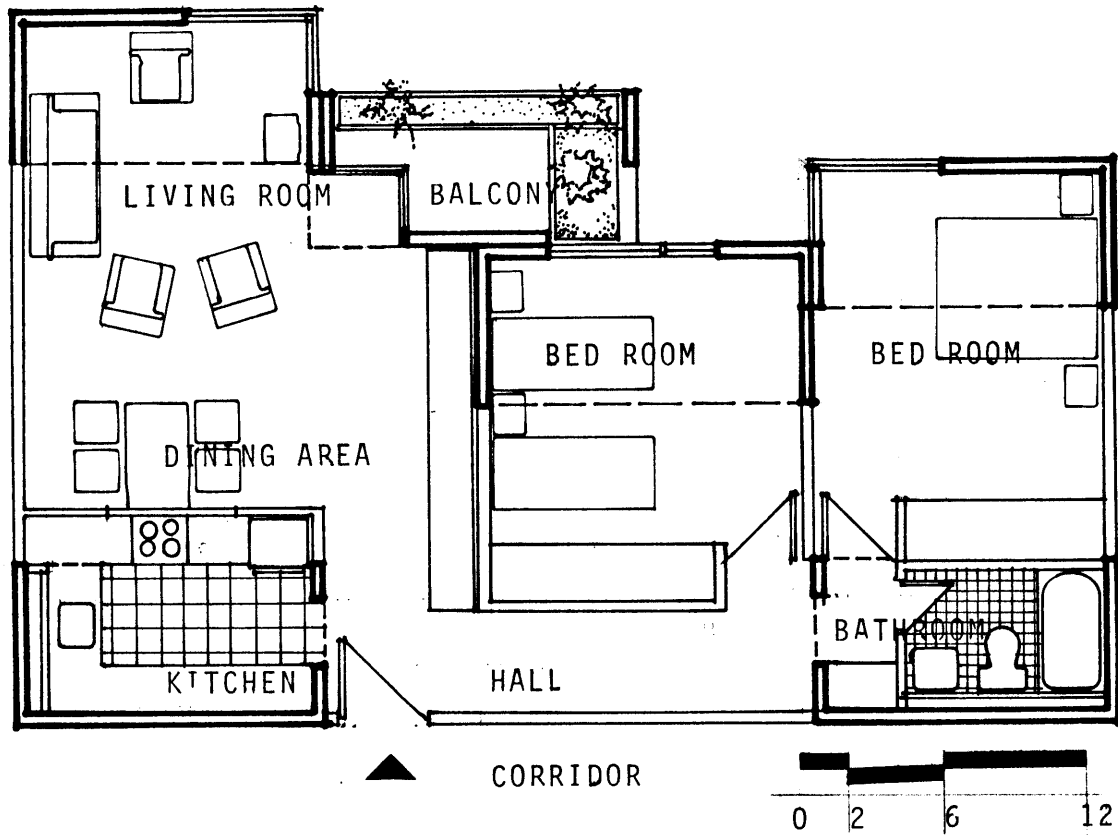
■Two bed room unit plan for corridor type apartment.

al3

BALCONY

BED ROOM

BED ROOM

LIVING ROOM

BED ROOM

BATH

DINING

KITCHEN

HALL

BATH

ENTRANCE

0 2   6   12
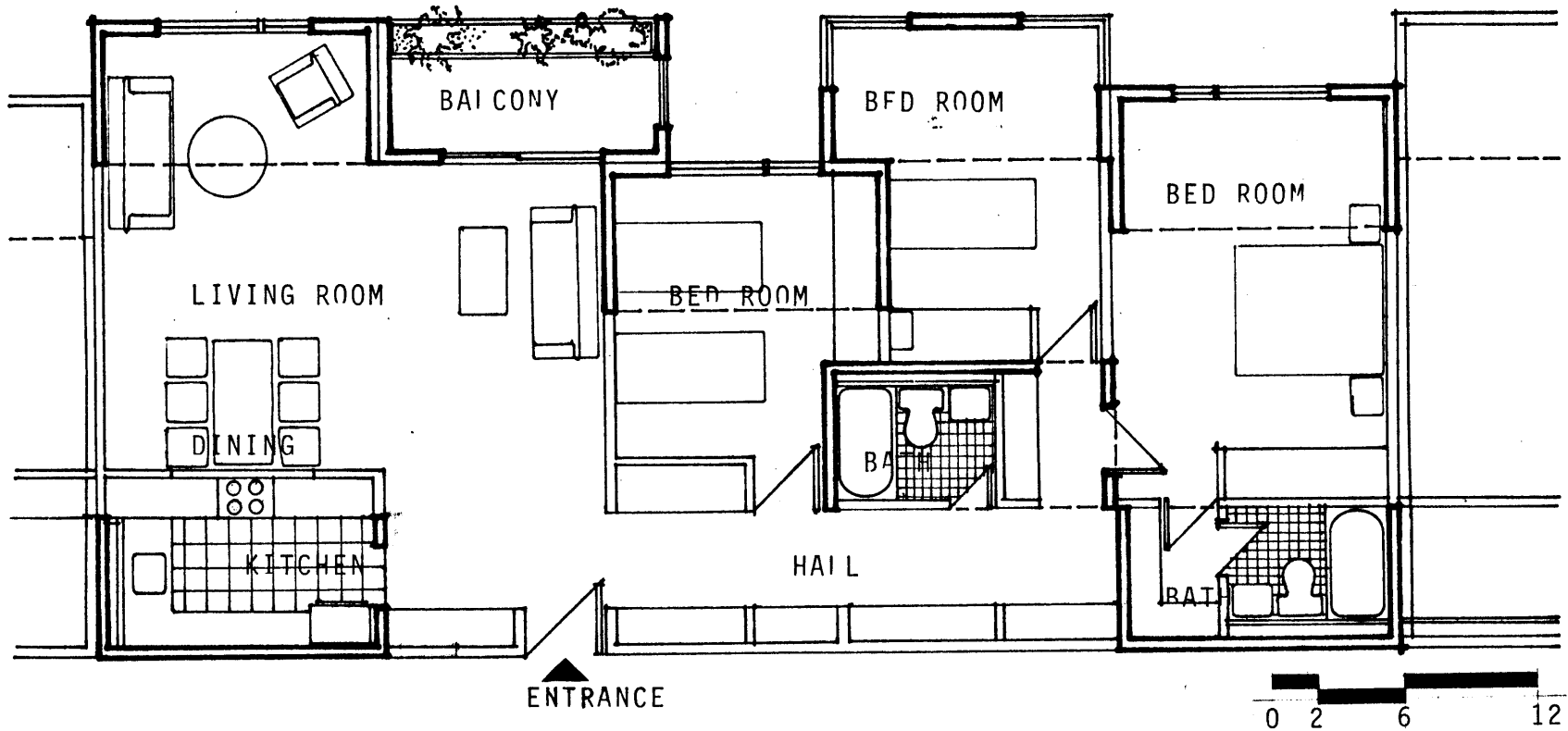
■Three bed room unit plan for double loaded corridor type building.

al4

LIVING ROOM BED ROOM

KITCHEN BATH

LIVING ROOM KITCHEN BED ROOM

HALL BATH
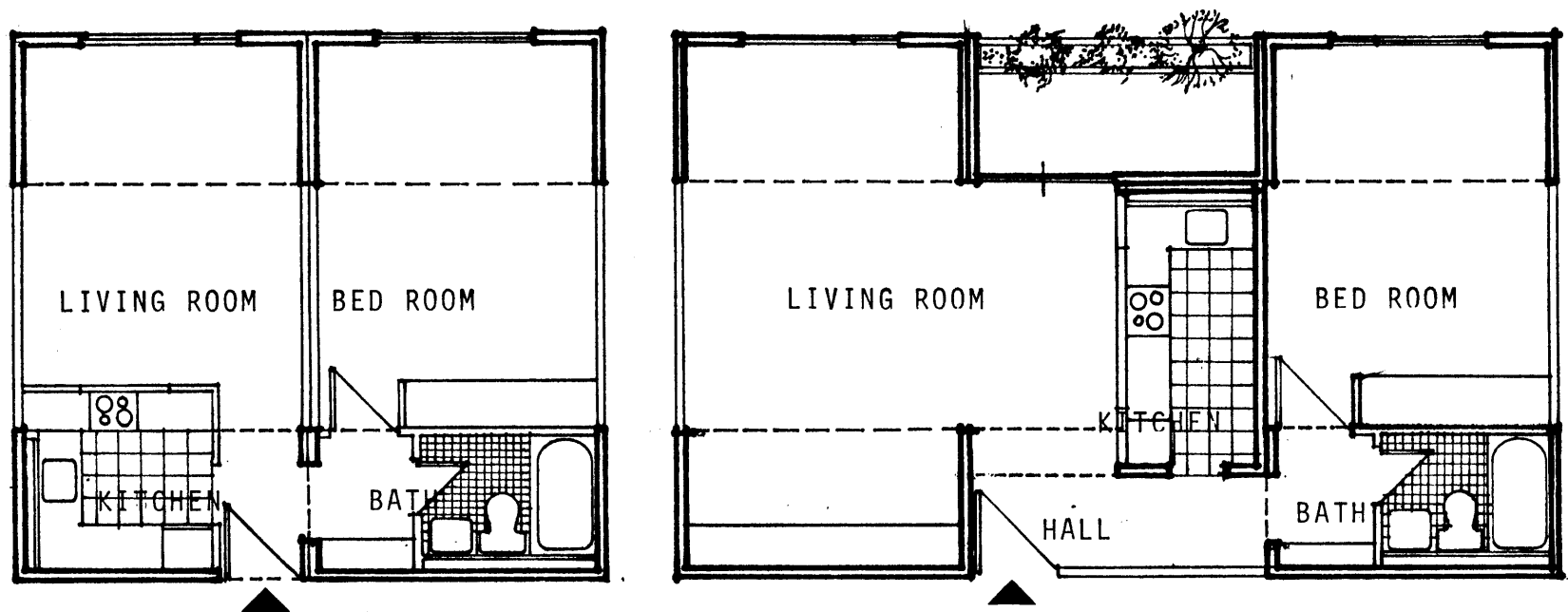
■One bed room unit for corridor type aprtment building.double loaded configuration.

0 2 6 12

al5

LIVING ROOM

BALCONY

BED ROOM

BATHROOM

KITCHEN

LIVING ROOM

BALCONY

KITCHEN

BATHROOM

BED ROOM

0   2   6   12
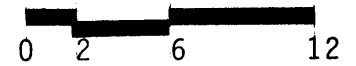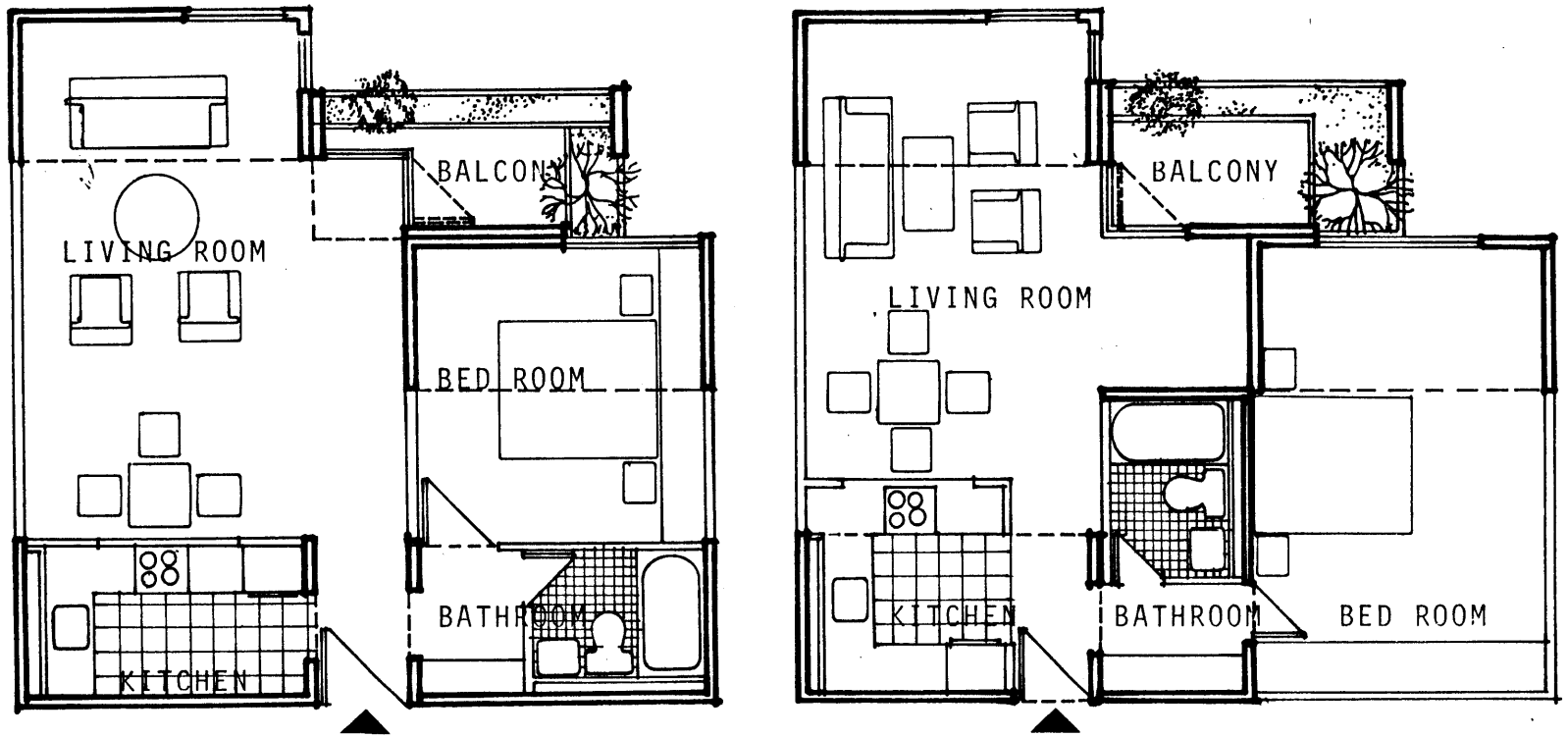
■One bed room unit plans for double loaded corridor apartments.

a16
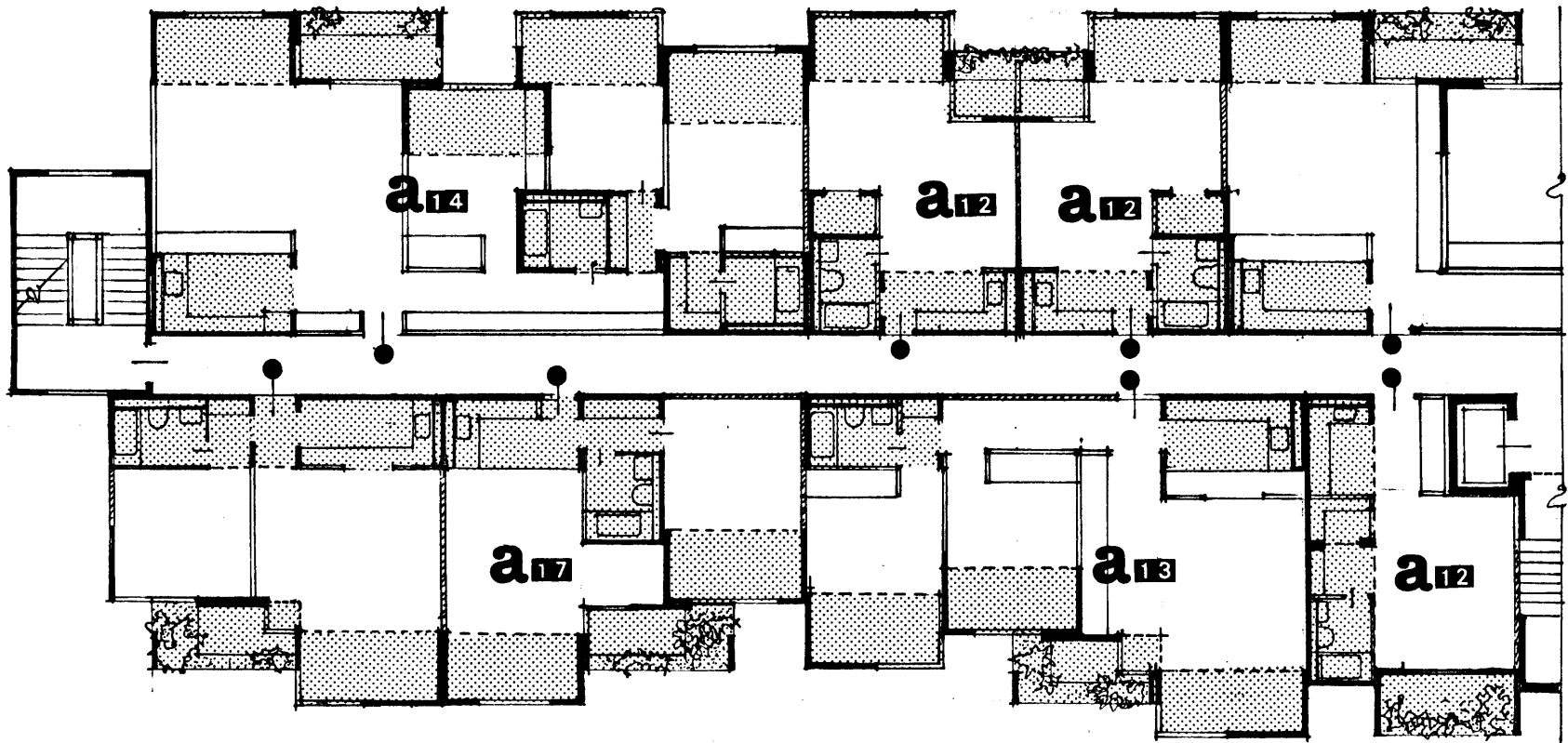
■ Floor plan showing double loaded corridor type apartment.

a17

BUILDING SECTION

SLAB
SLAB

SLAB
SLAB

SLAB
SLAB

SLAB
SLAB

SLAB
SLAB

SLAB

9'-0"

9'-0"

9'-0"

9'-0"

2'-0"

6'-6"   6'-6"   6'-6"

ENVELOPE BOX   BATHROOM BOX   ENVELOPE BOX

al8

6' - 6"

6' - 6"

6' - 6"

13' - 0"

13' - 0"

13' - 0"
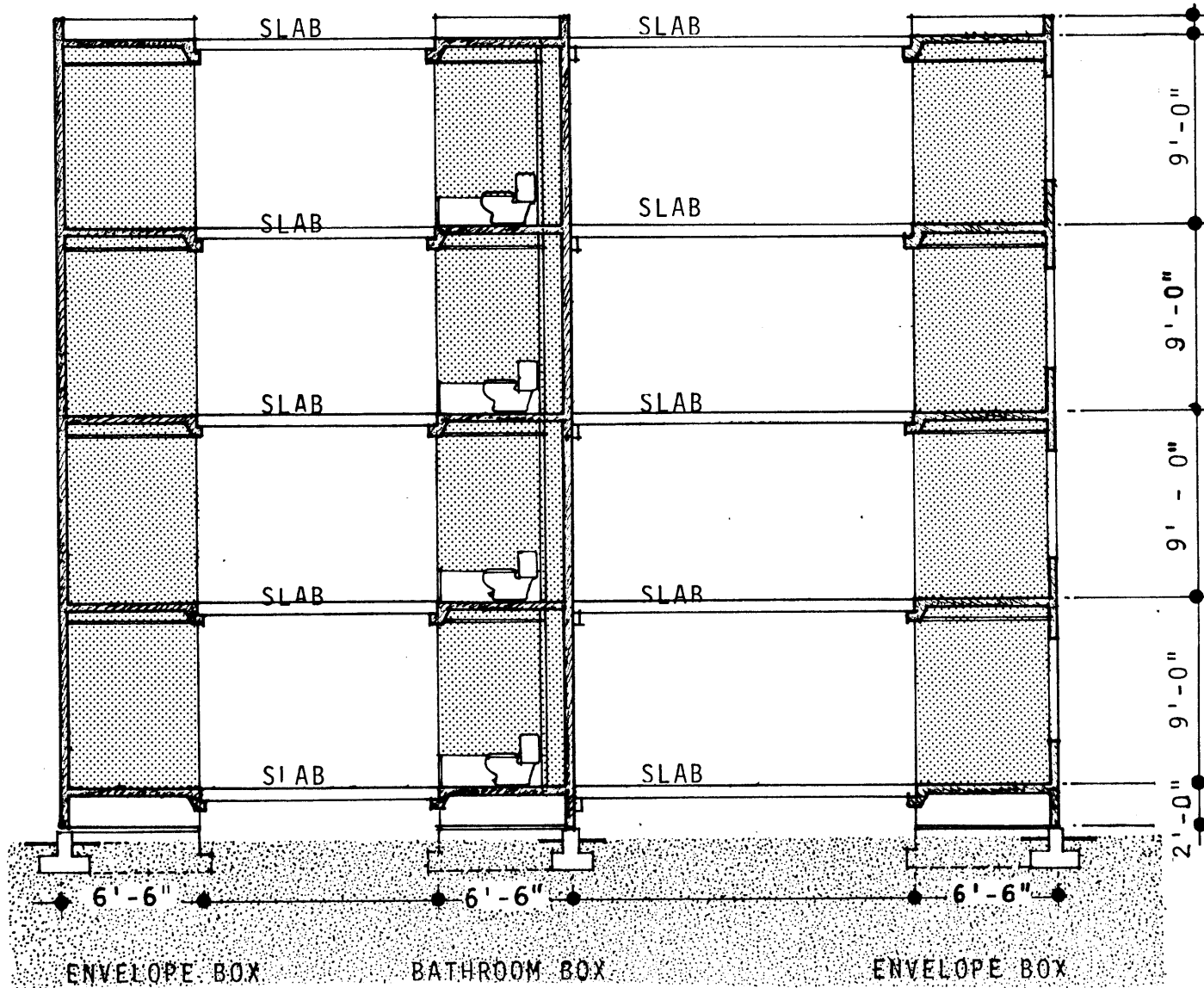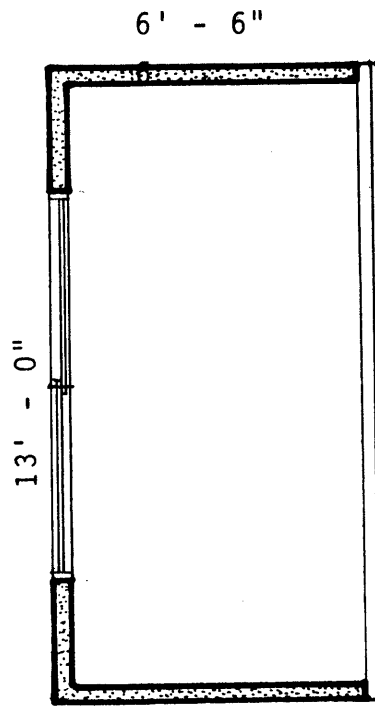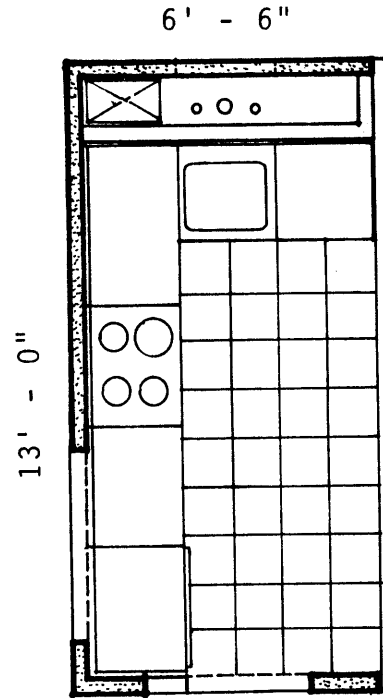
ENVELOPE MODULE

KITCHEN MODULE
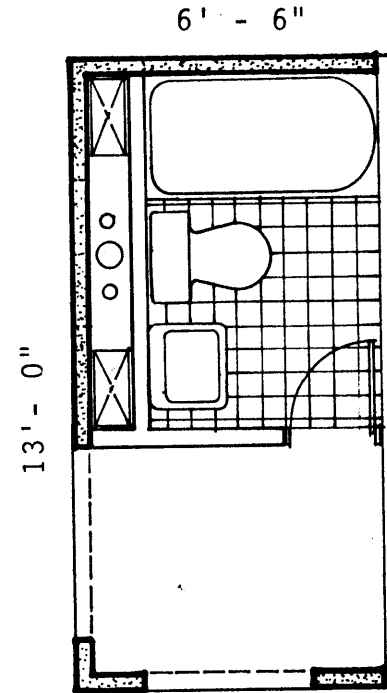
BATHROOM MODULE

■ PLAN OF BOXES scale: ¼"=1'-0"

a19

concrete 4"
air space 1½"
rigid insulation 1"
steel stud 2"
gypsum board 1½"

floor: hollow core concrete plank

6'-0"

9'-0"

9'-0"

39'-0"

9'-0"

9'-0"

1'-6"

1'-6"

6'-0"

13'-0"

3'-6"

3'-6"

6'-6"

a

a

b

a 20

13'-0"

6'-6"
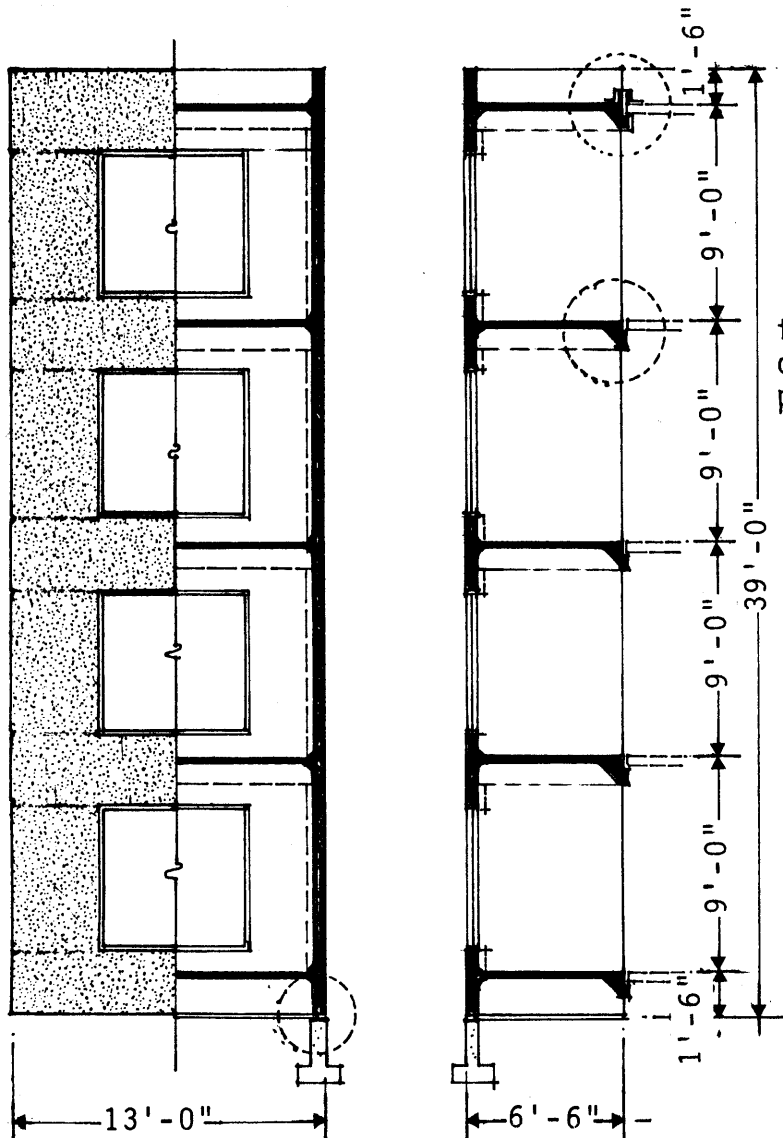
■ SECTIONAL ELEVATION "B"
   scale: 1/8"=1'-0"

■ SECTION "A"
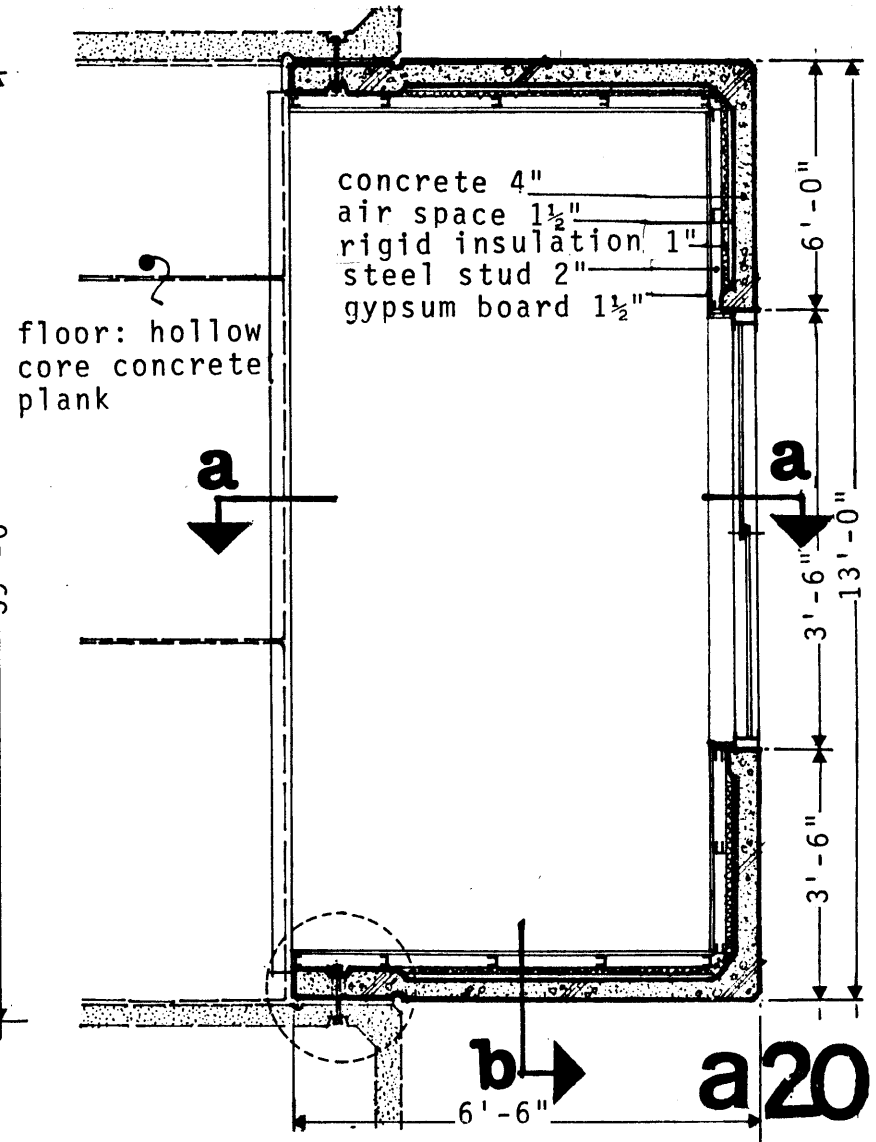
■ PLAN OF AN ENVELOPE BOX
   scale: 3/8"=1'-0"

DETAILS

b 0

AXONOMETRIC

b 1

	■BASIC MULTI-STORY SECTIONALS (SPACE MODULES)	■VARIATIONS
■ENVELOPE MODULE 10'x10'x36'		
■KITCHEN MODULE 10'x10'x36'		
■BATHROOM MODULE 10'x10'x36'		STAIR COMPONENT

SYSTEM B

b 2

BOX BOX
BOX   BOX
SLABS
BOX   BOX
BOX BOX
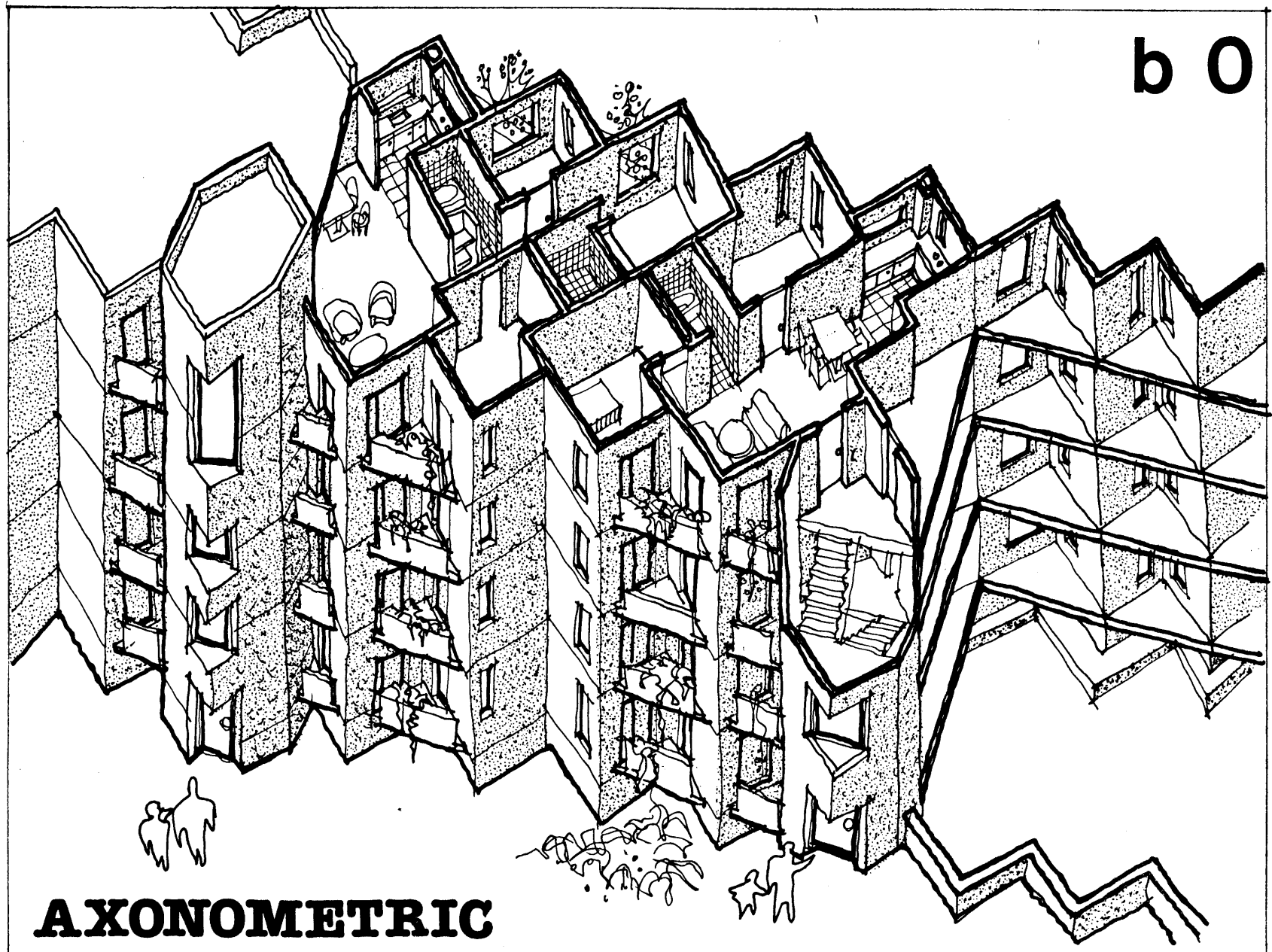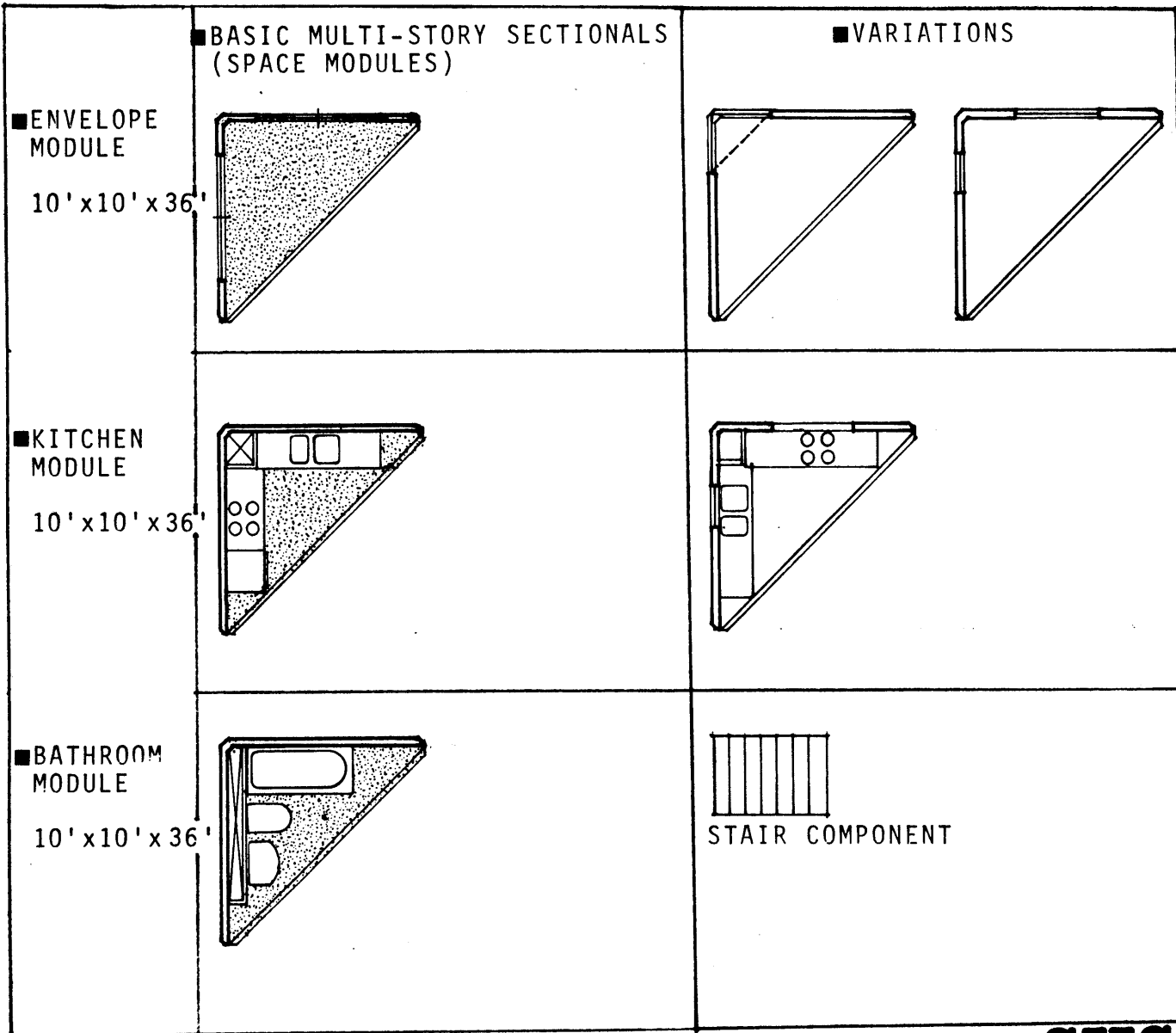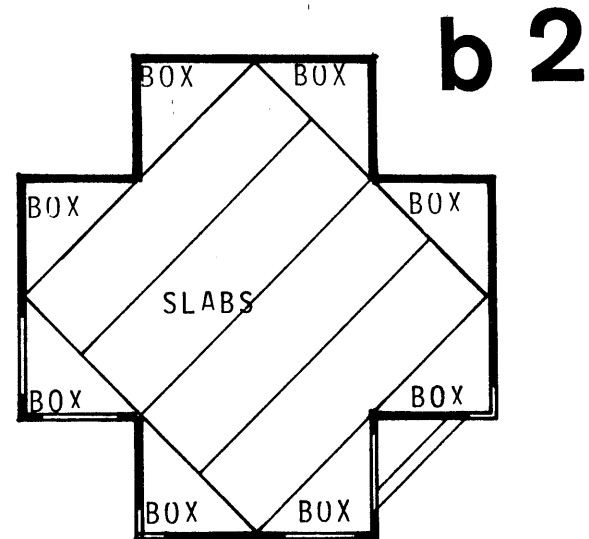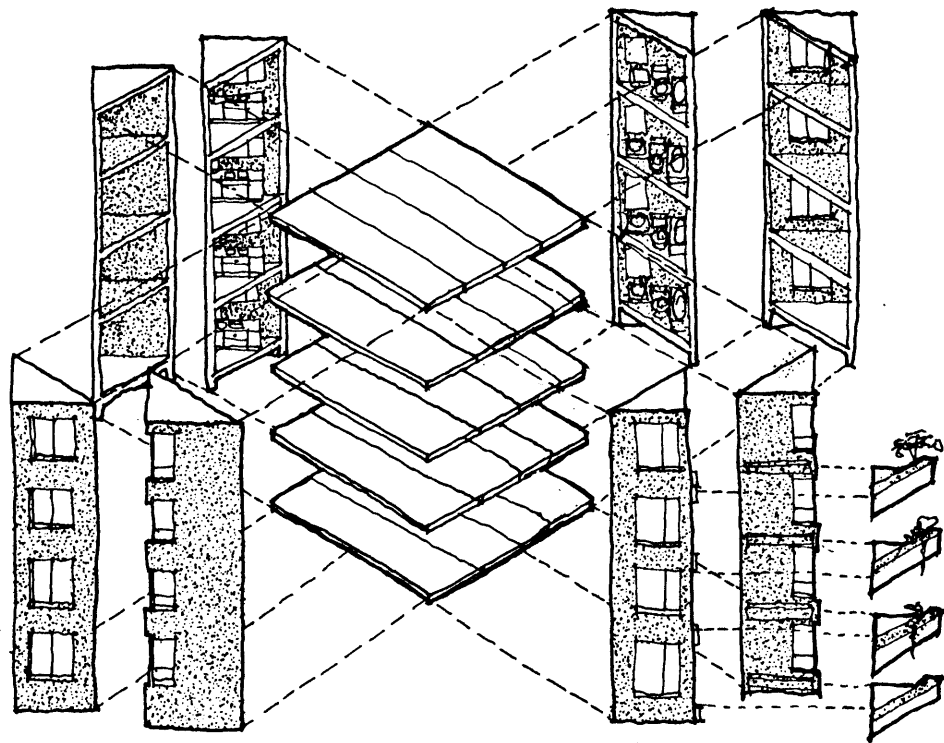
DIVISIBILITY

b 3
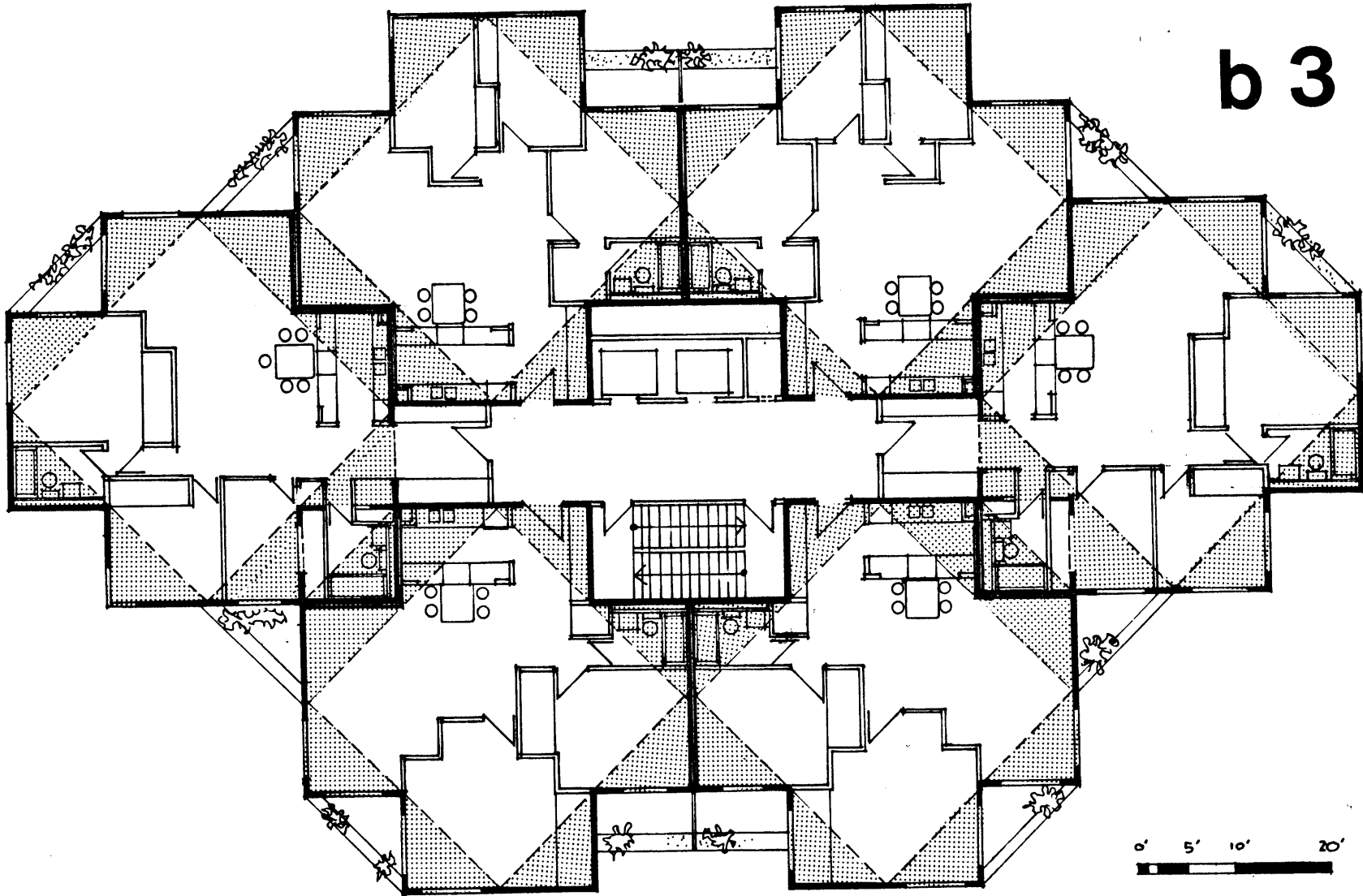
■ HIGH-RISE APARTMENT COMPOSED OF TRIANGULAR PRISM MODULES.

b 4

LIV.-DINING

BED RM.

BED RM.

BED RM.

BED RM.

BED RM.

LIVING RM.

■ LOW-RISE WALK UP

0   4   12   24

b 5

BOX SLAB BOX SLAB BOX

DIVISIBILITY

b 6

VARIABLE

BR

BR

BR

K

BR

B

C C

LR

BR

BR

K

LR

B

K

C

B

BR

BR

LR

LR

0 4 12 24

■ LOW-RISE WALK UP

9'-0"

9'-0"

9'-0"

9'-0"

| 7'-1" | variable | 7'-1" | variable | 7'-1" | 7'-1" |
| box | slab | box | slab | box | |
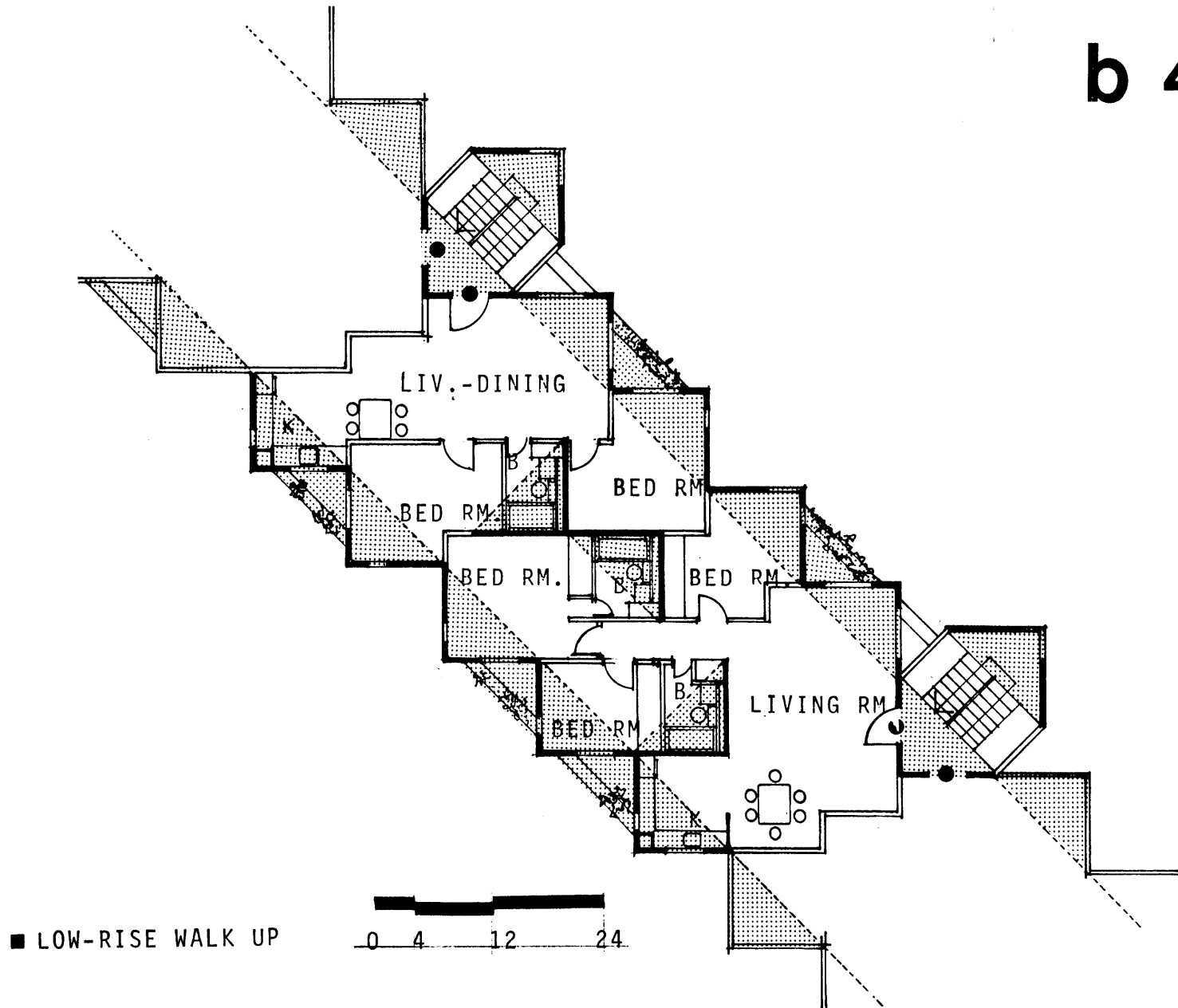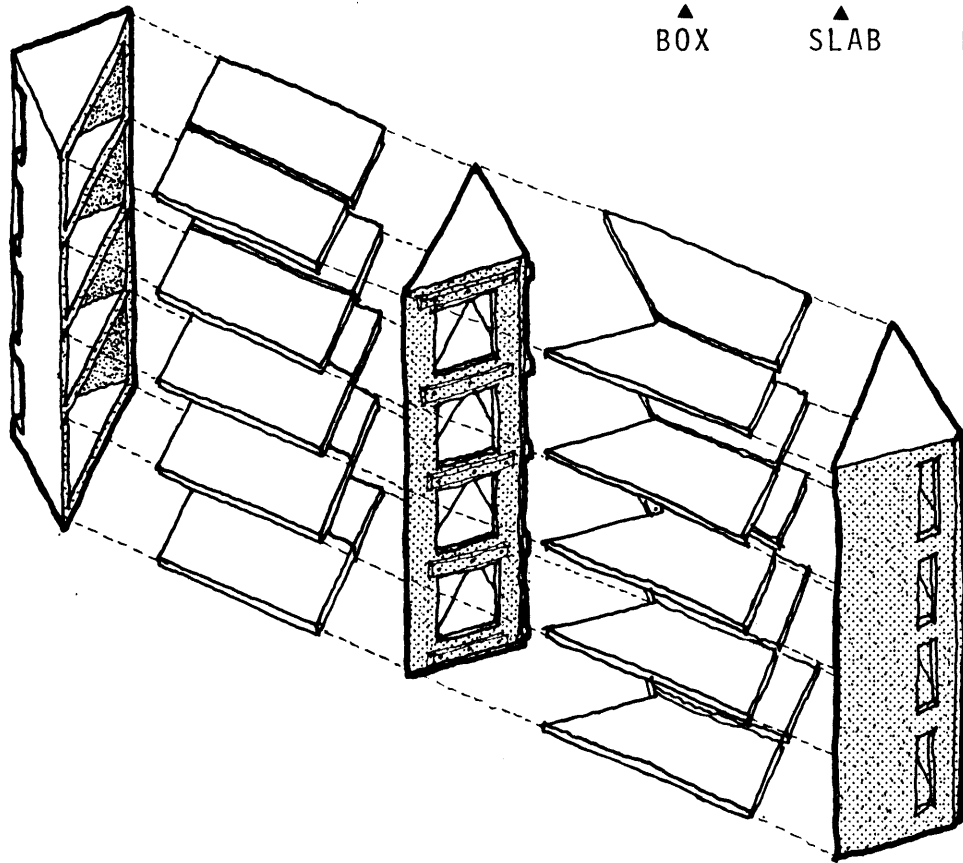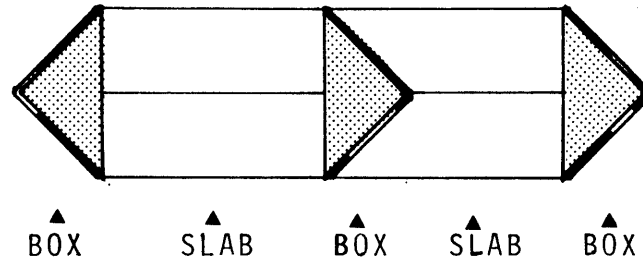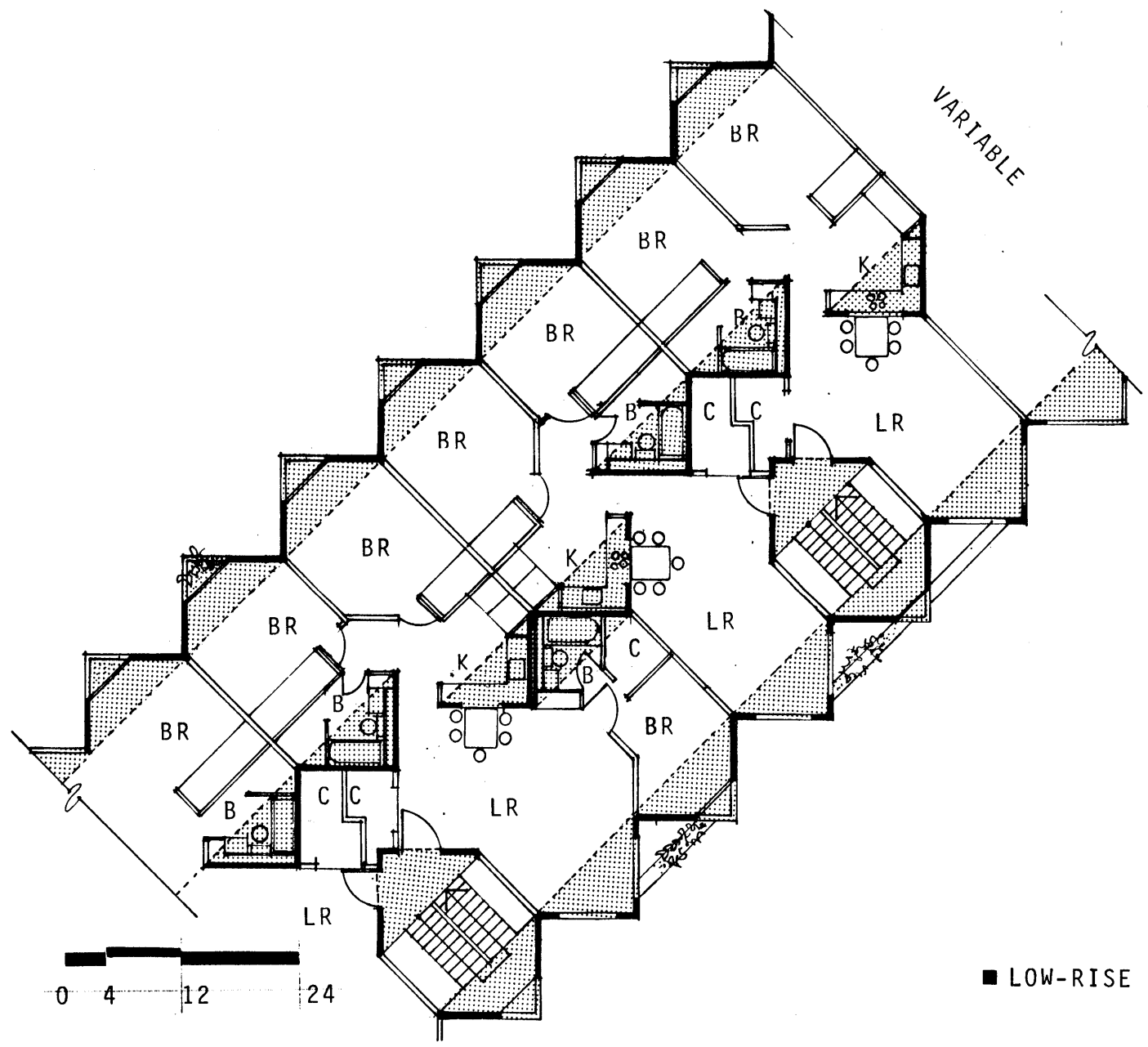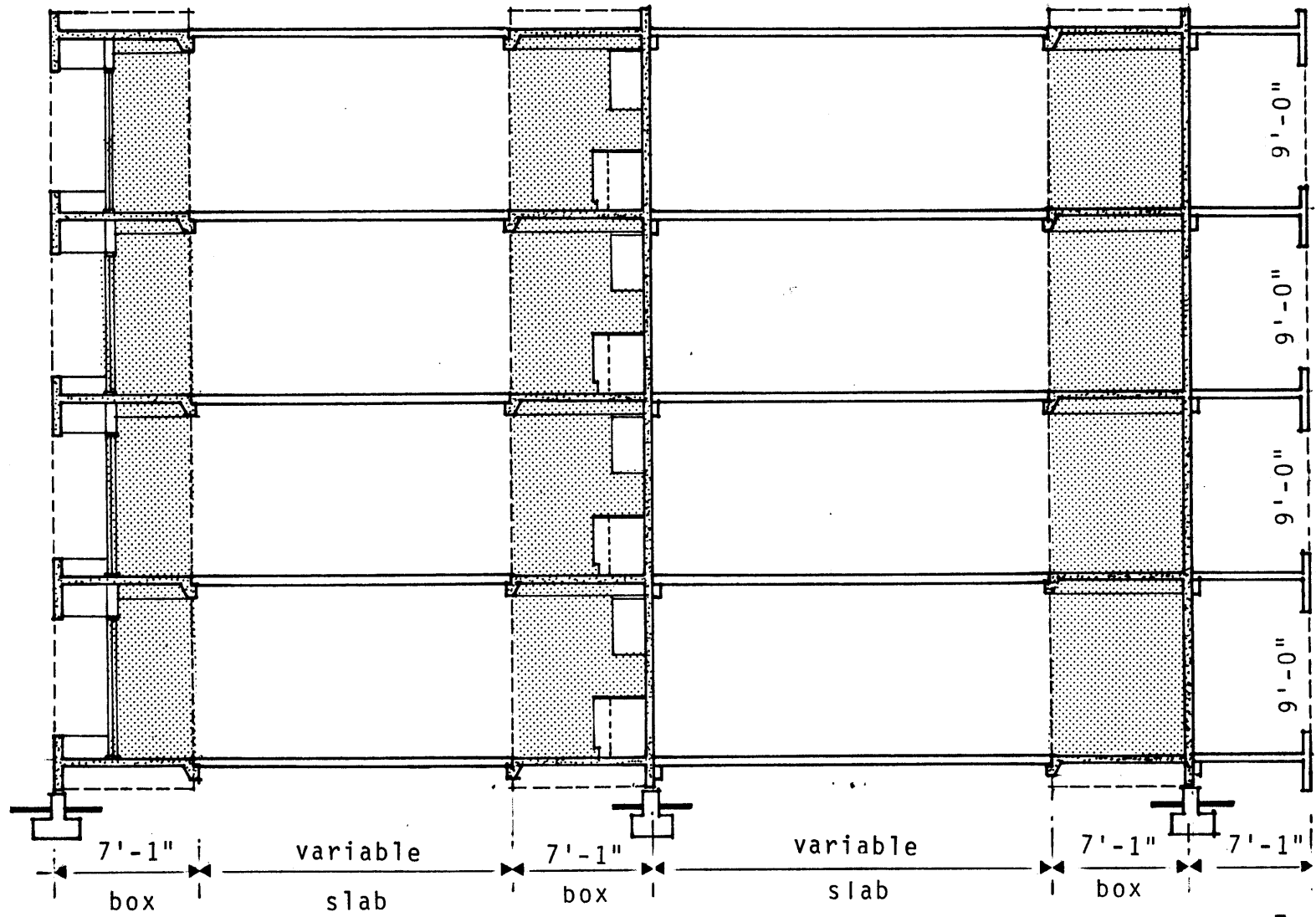
■ BUILDING SECTION   scale: 1/8"=1'-0"

b 7

1'-0"
9'-0"
9'-0"
9'-0"
9'-0"
1'-6"

7'-1"

14'-2"

10'-0"

10'-0"

C

C

■ PLAN OF A BOX
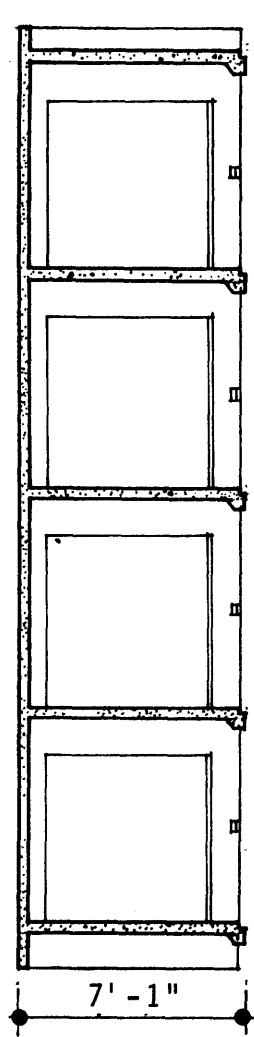
Scale: ¼"=1'-0"

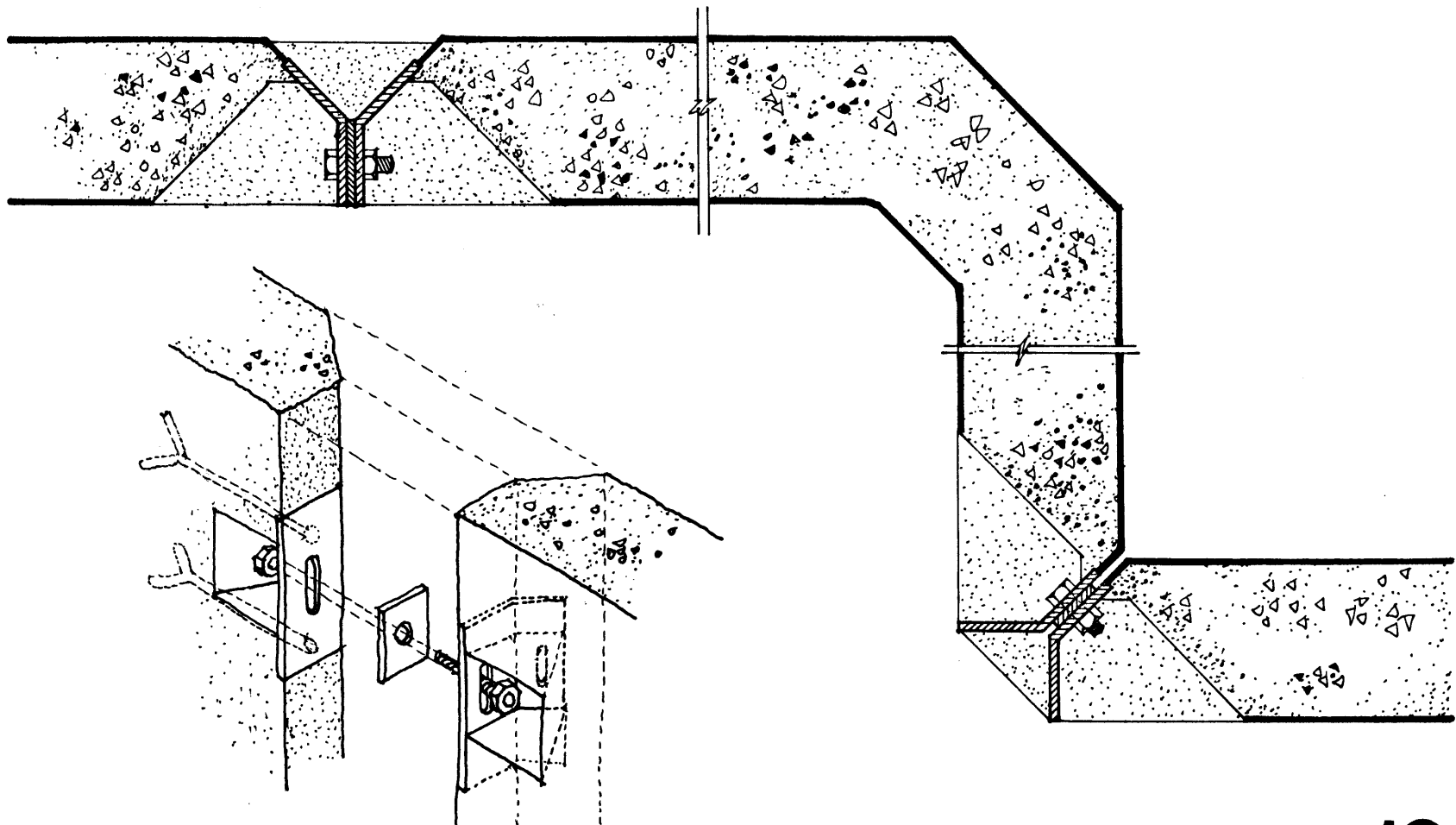■ SECTION AND AN ELEVATION OF A BOX
  Scale: 1/8"=1'-0"

■ ISOMETRIC VIEW

b8

10'-0" 10'-0" 10'-0"

4" 4"

SECTIONAL see
detail SECTIONAL

10"-0"

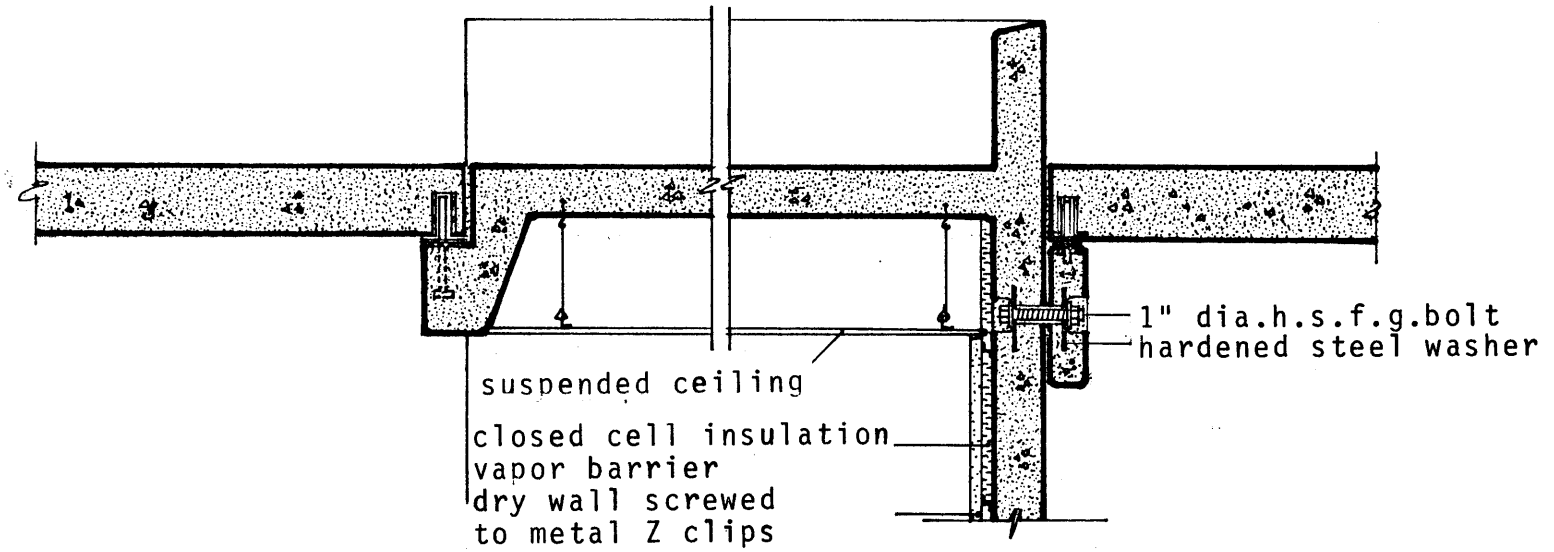FLOOR PLANK
CONCRETE SLAB

see detail SECTIONAL

10"-0"
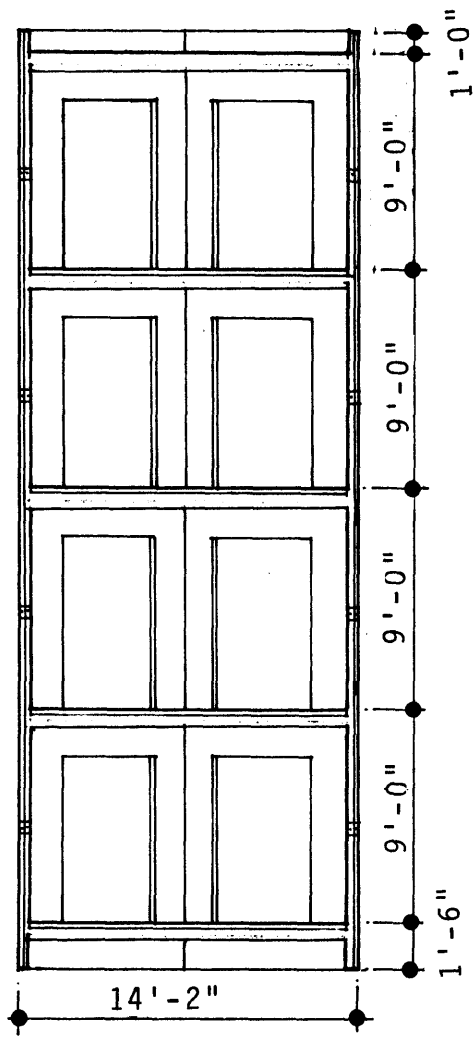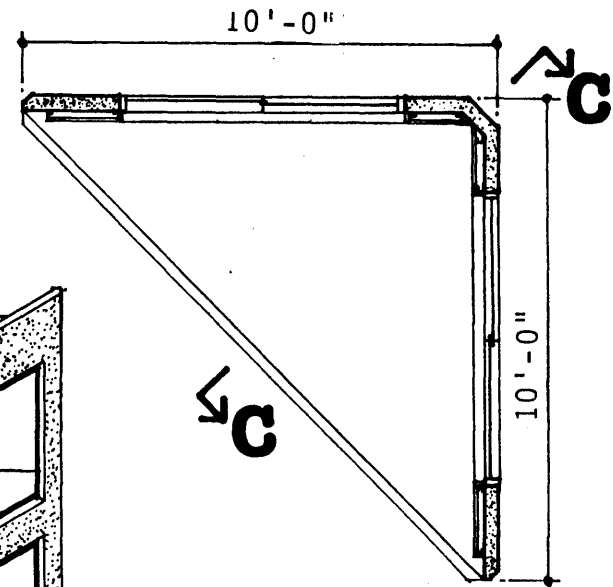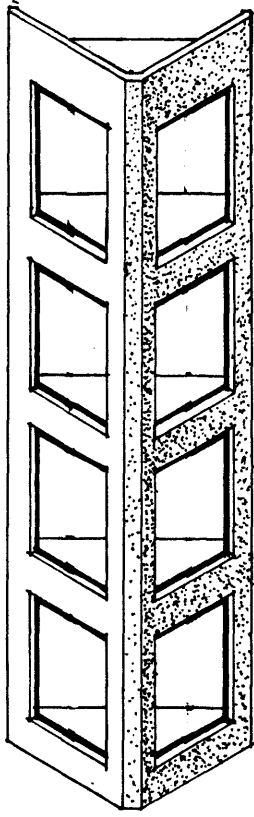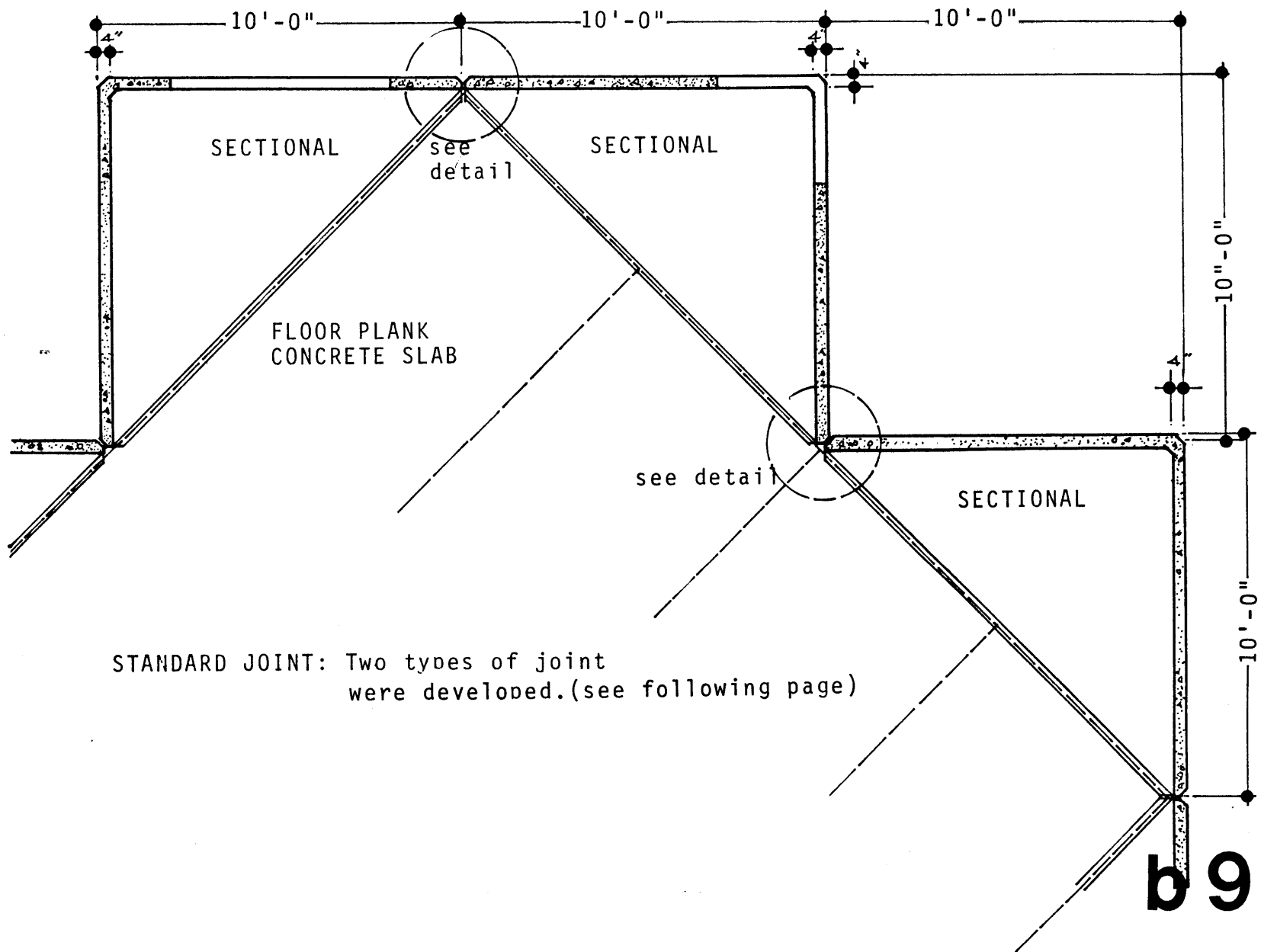
STANDARD JOINT: Two types of joint
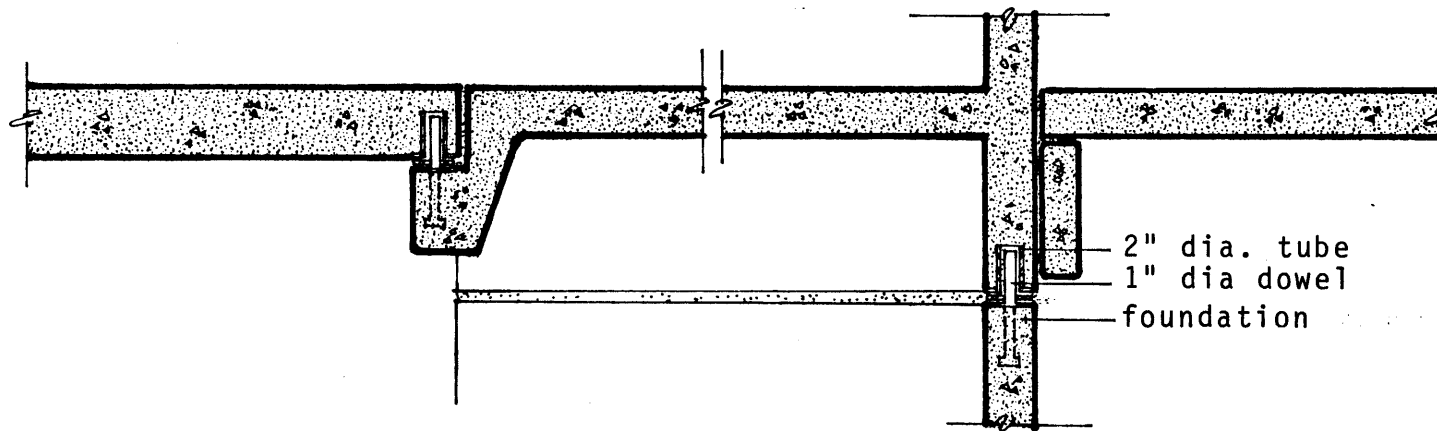were developed.(see following page)

b9

70.

■This drawing shows how lateral connection are made by dry joints. Nuts to be welded after the unit is aligned,and then concrete is filled.

b10

suspended ceiling

closed cell insulation
vapor barrier
dry wall screwed
to metal Z clips

1" dia.h.s.f.g.bolt
hardened steel washer

■ JOINT DETAIL BETWEEN THE BOX AND SLABS   Scale: 3/4"=1'-0"

2" dia. tube
1" dia dowel
foundation

■JOINT DETAIL BETWEEN THE BOX AND FOUNDATION

b11

SCOPE: About the future development of industrialized building

Carlo Testa has an opinion that more far-reaching may be

developments in the demountability and transportability of

the building itself, and even of complete town. He writes

that the real necessity for this requirement of "flexibility

in time" has not been proved yet, but the very mobility of

the society strongly indicates a growing interst in that

feature. He also foresees that;

Testa, C, The Indust-
rialization of Buil-
ding , Van Nostrand
Reinhold,1972, p.180

The requirement for "flexibility in time" will modify
the present essence of a building (a static structure)
and transfor it into a dynamic structure. Requirements
of this kind are already in existence for schools, public
buildings, offices and hospitals, but in order to
become meaningful these requirements will have to be
extended to the complete "town system".

Taking the broadest possible view of ecologists' theory

the future may find out the necessity of requirement(that

Testa hasn't seen)more urgent an realistic.

R.Meier mentions on the future form of housing:

Meier,R.,"FUTURES FOR
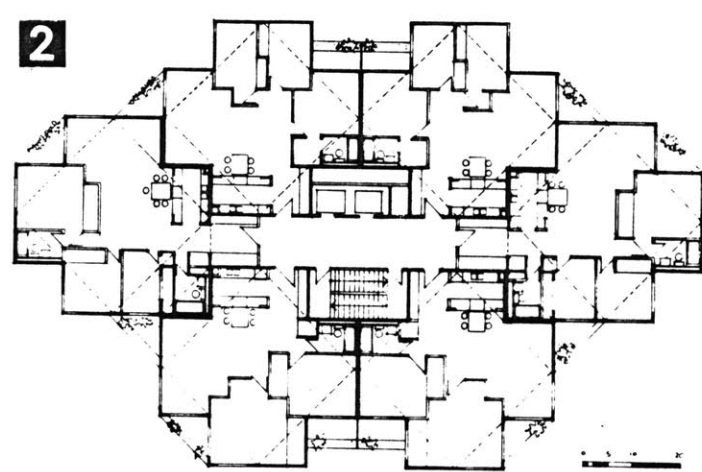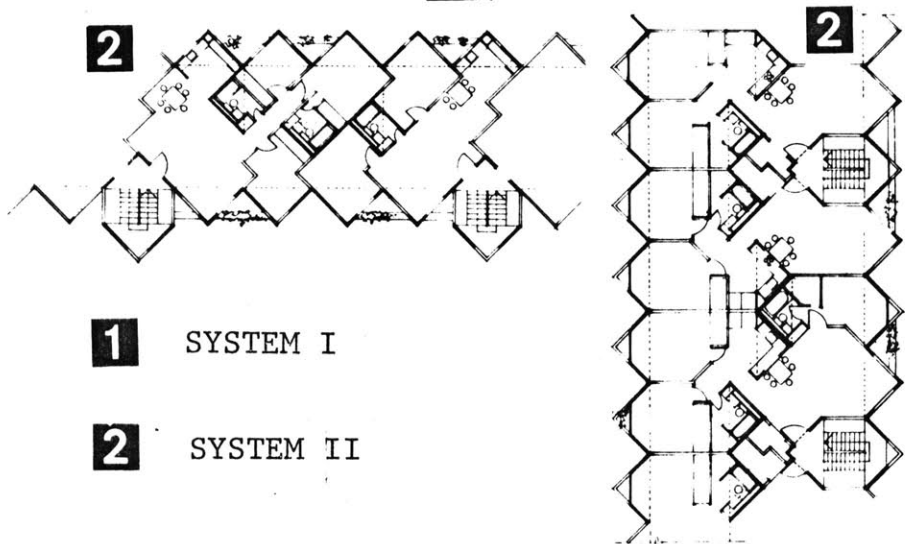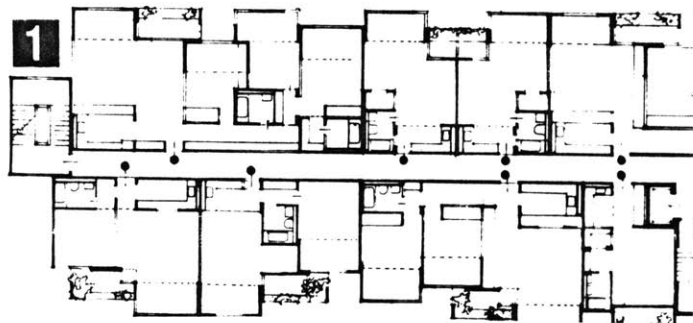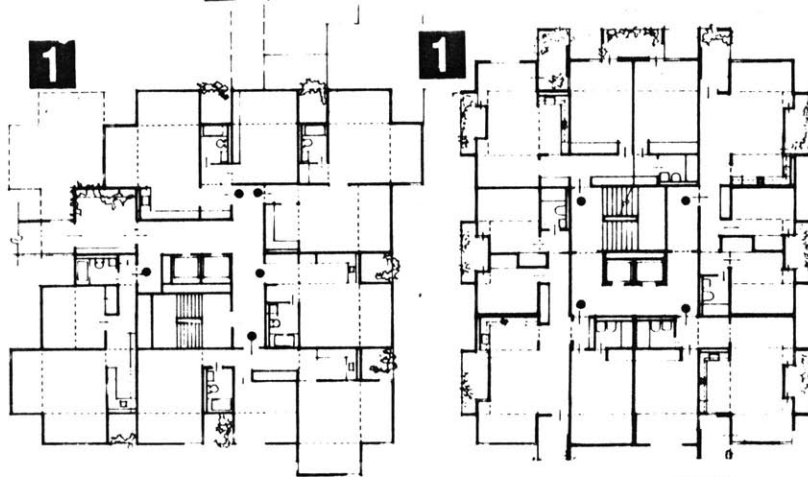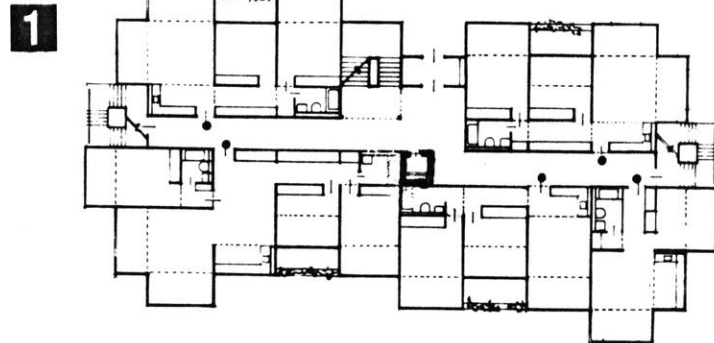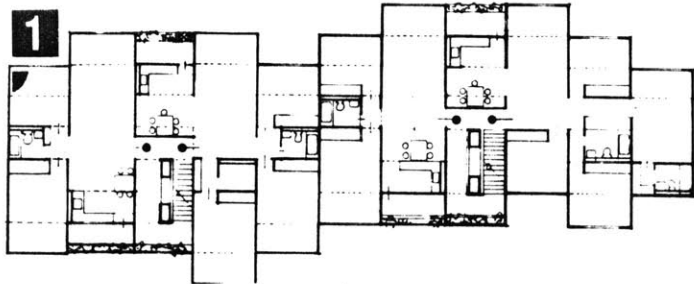HOUSING", from THE
FORM OF HOUSING,Van
Nostrand Reinhold,1977
p,270

Despite strong consevative forces in the institutions
responsible for the provision of housing in North America,
the need to cope with global shortages, massive catastrophes
and harsh environments should stimulate diversity in form.
--- The necessary economies in the use of resources are
best achieved through clustering of dwellings to economize
on vehicular use.---

best achieves through clustering of dwellings to economize on vehicular use.---

It has been forecasted that more turbulent environment will be formed by the conditions in climatic change of the Earth, and that a new Ice Age is due in our era. However, this kind of extremes is certain to stimulate huge migration, followed by the construction of habitat in new locales.

The present situation in the international political environment is so terrifying it paralyzes all rational considerations. Mishandling of neuclear energy is another possible cause of the huge scale migrations. Will there not be possible solutions to bring their houses to a new place to avoid the refugee camp?

In terms of "flexibility in time" the Multi-Story Sectionals, with its high degree of demountability, can provide a useful idea for future housing. For instance, one possible solution is making the surface of the envelope into a sun collecting device, etc. Space grid structure is applicable to make the modules lighter. Potentials will remain to be developed.

1   SYSTEM I

2   SYSTEM II