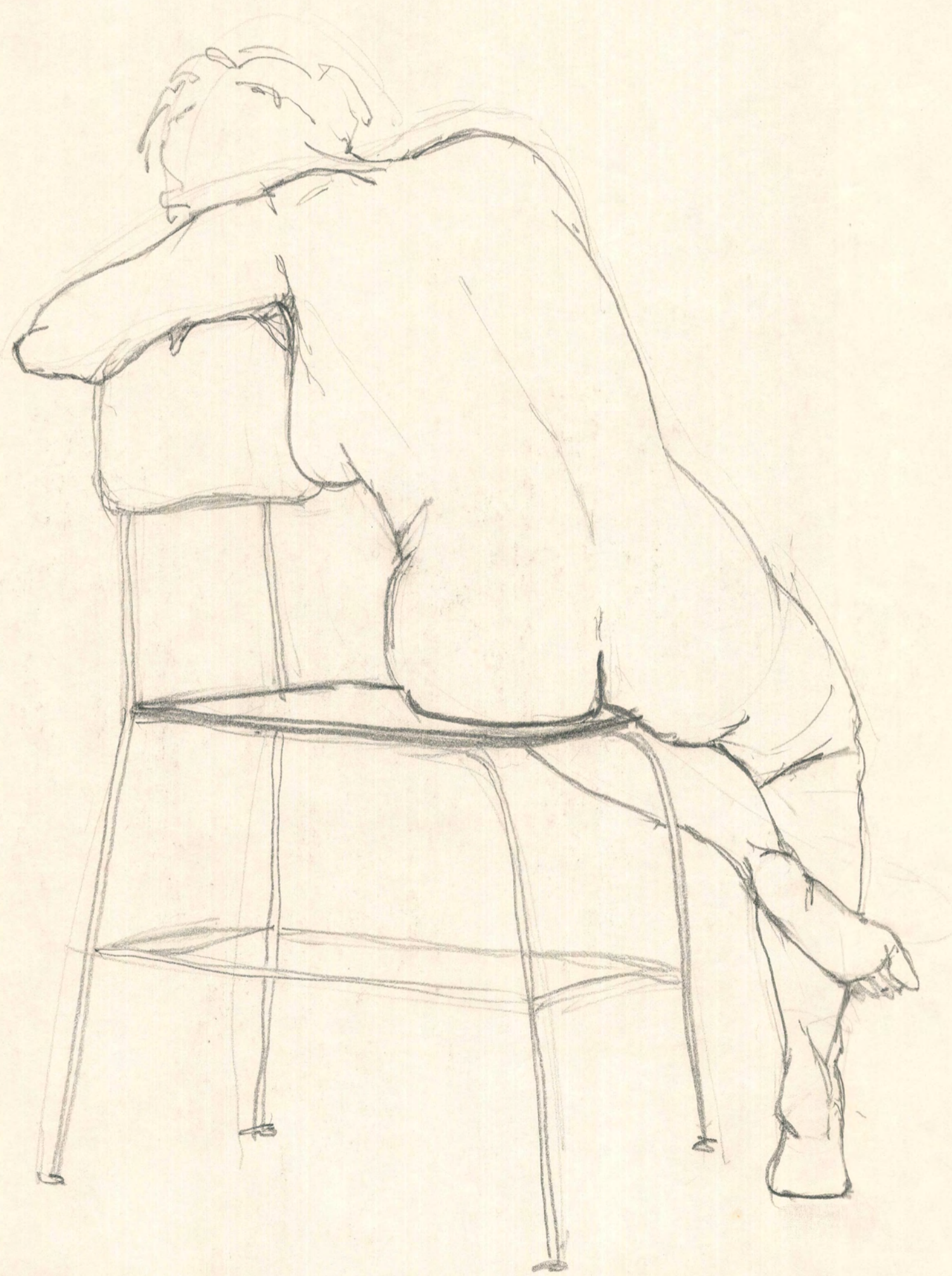




1891

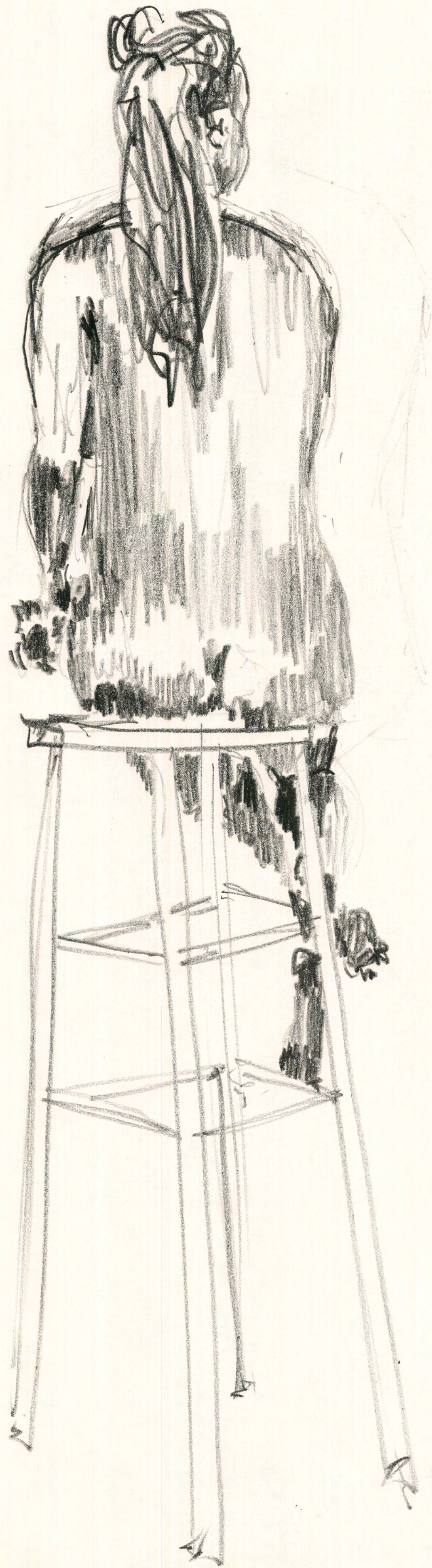


Edvard Munch
1891





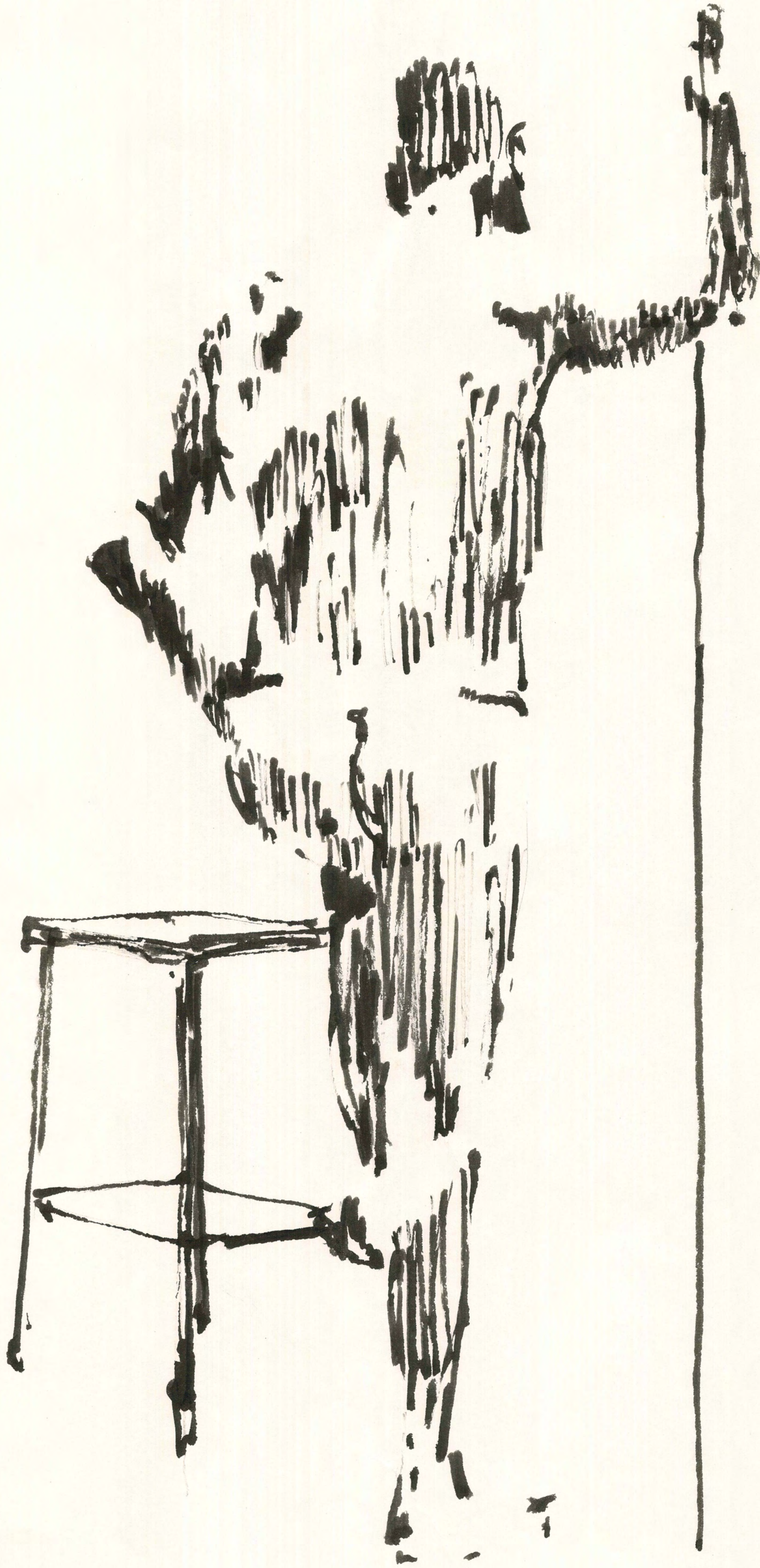
A



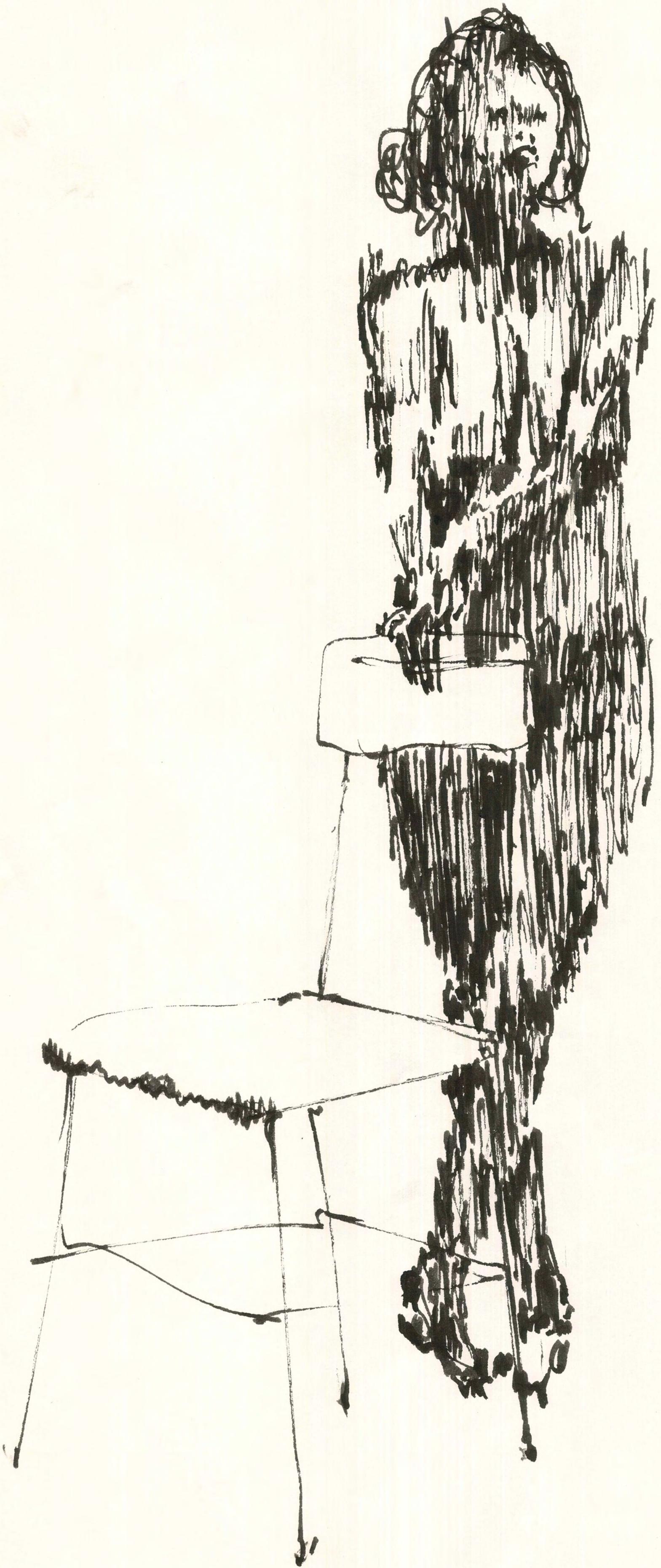


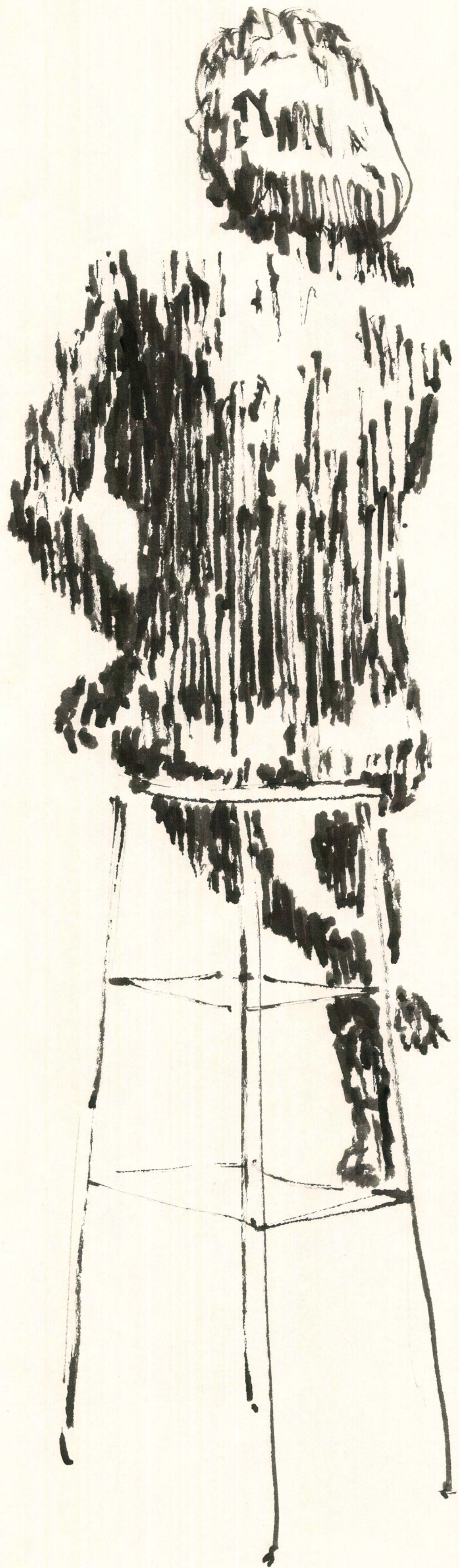






158'
136'





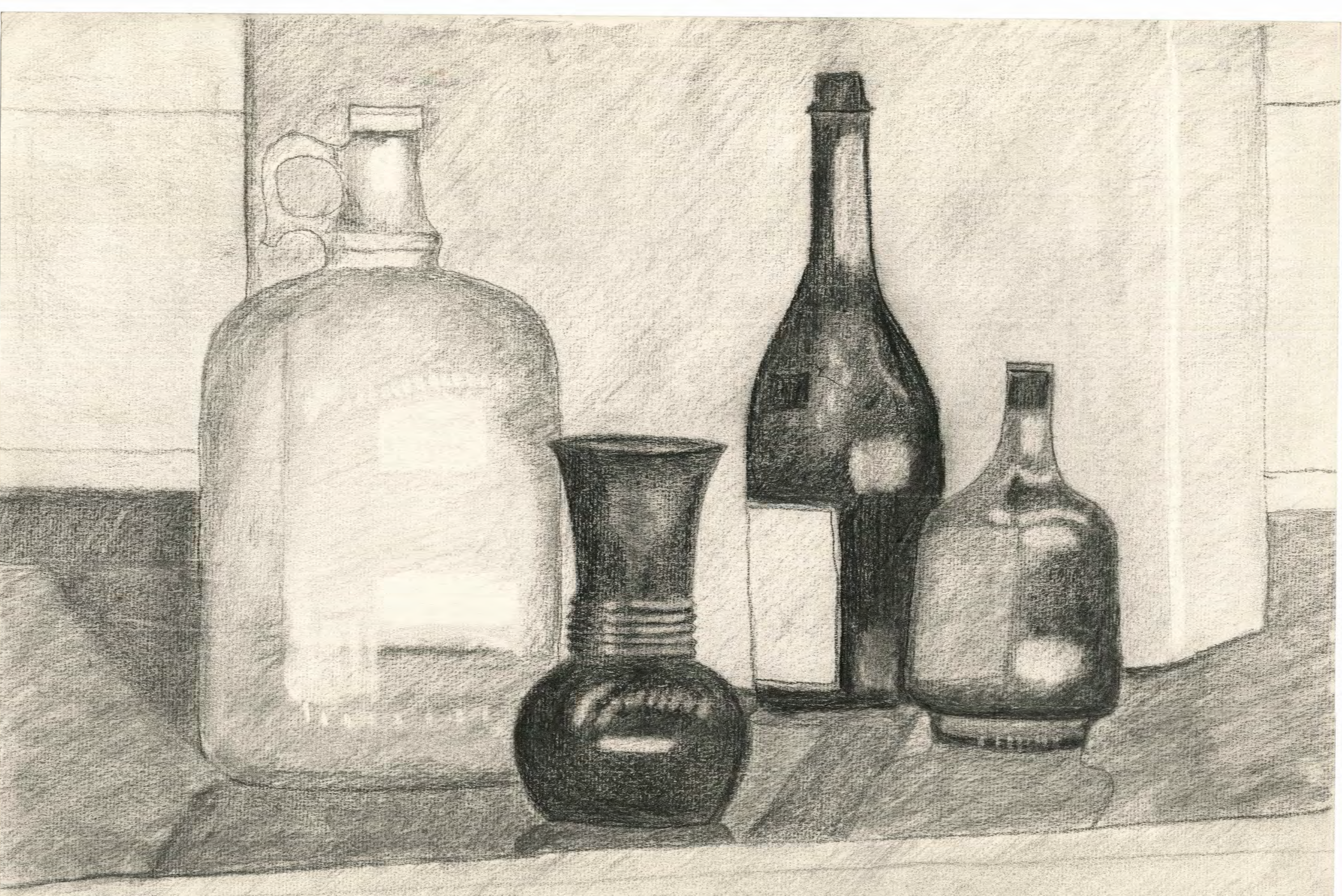


A



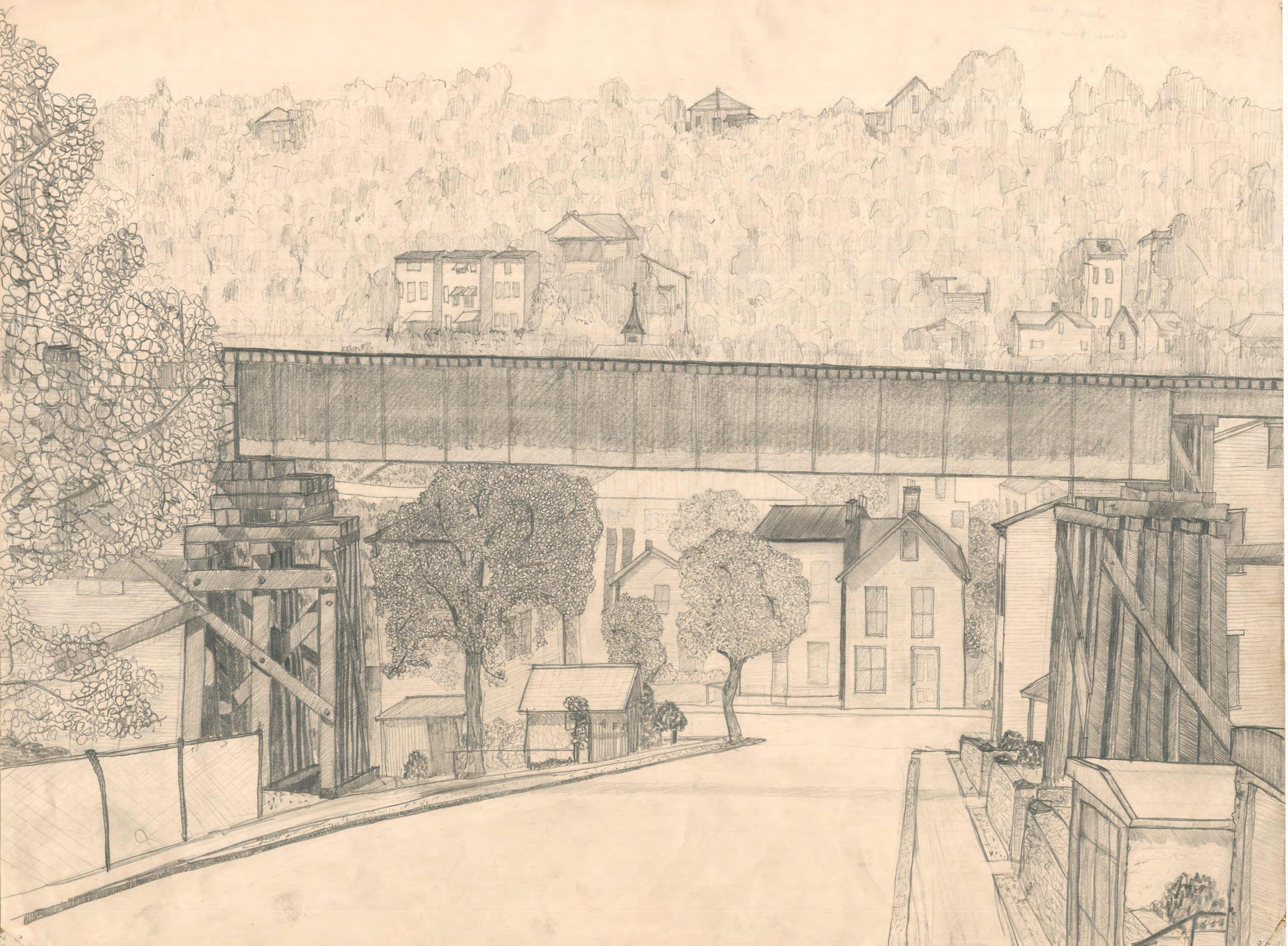
Handwritten red signature or mark in the upper right corner of the drawing.





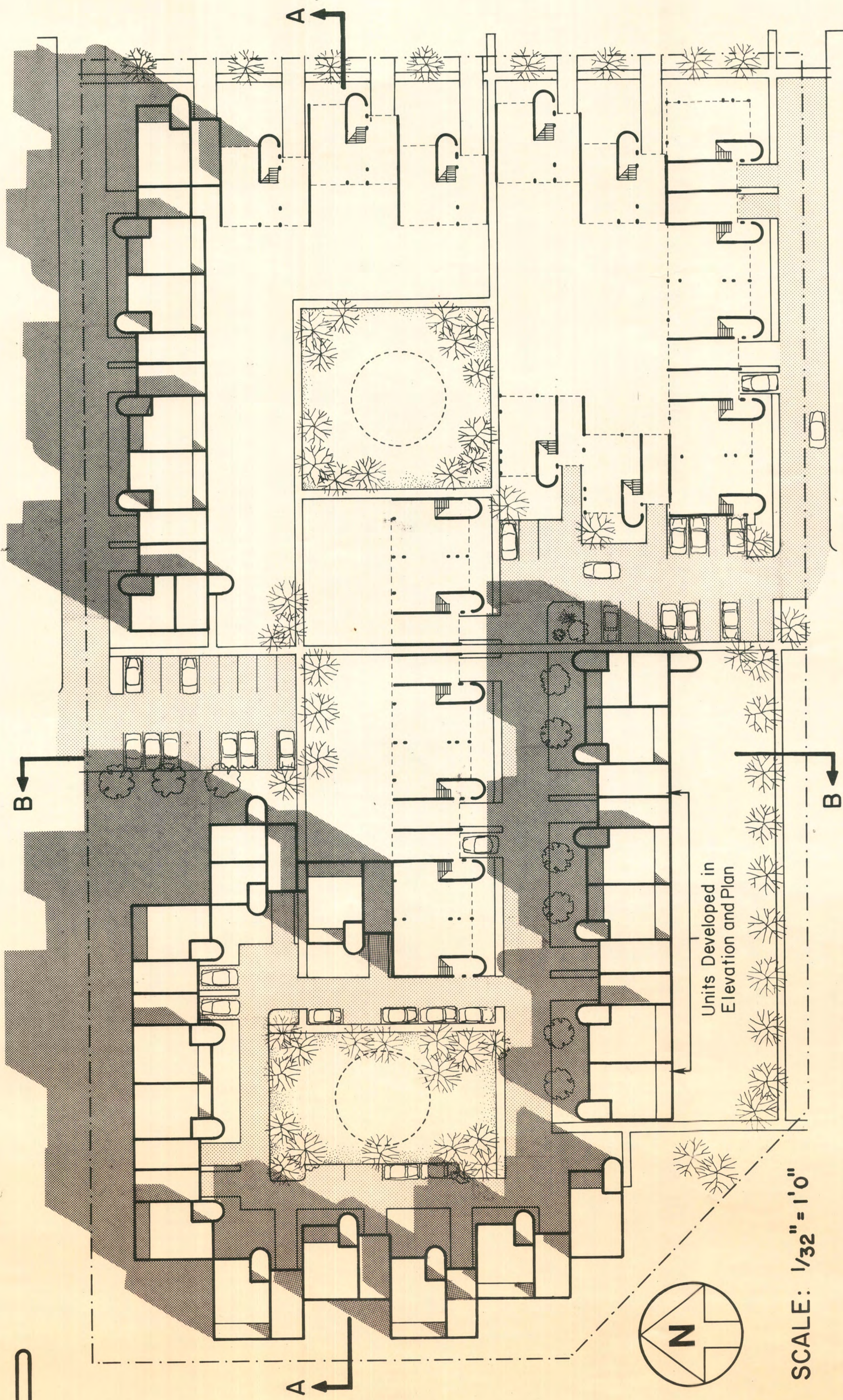


Sketch 2576
1881
View from [unclear]



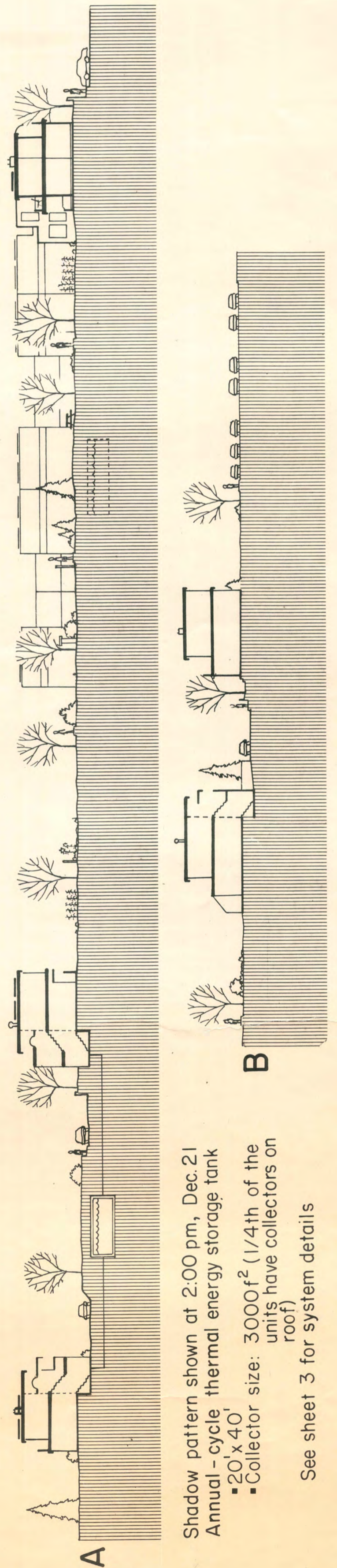
MITOCHONDRIA

METABOLIC ENGINES WITHIN
CELLS WHICH CONTAIN ENZYMES
NECESSARY FOR ENERGY-
LIBERATING REACTIONS



Units Developed in
Elevation and Plan

SCALE: 1/32" = 1'0"



Shadow pattern shown at 2:00 pm, Dec. 21
Annual - cycle thermal energy storage tank
▪ 20' x 40'
▪ Collector size: 3,000 f² (1/4th of the
units have collectors on
roof)

See sheet 3 for system details

SUPPORT HOUSING

"What we must look for, in place of prototypes which are collective interpretations of individual living patterns, are prototypes which make individual interpretations of the collective patterns possible, in other words, we must make houses alike in a particular way, such that everyone can bring into being his own interpretation of the collective pattern...."

- Hertzberger

User Participation
Flexibility
Shared Infrastructure

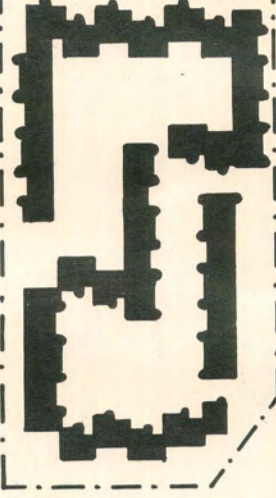
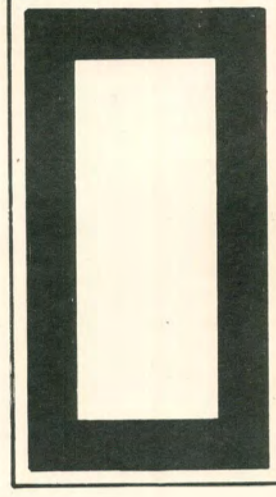
SOLAR ACCESS PERMANENCE

SITE TRANSFORMATION

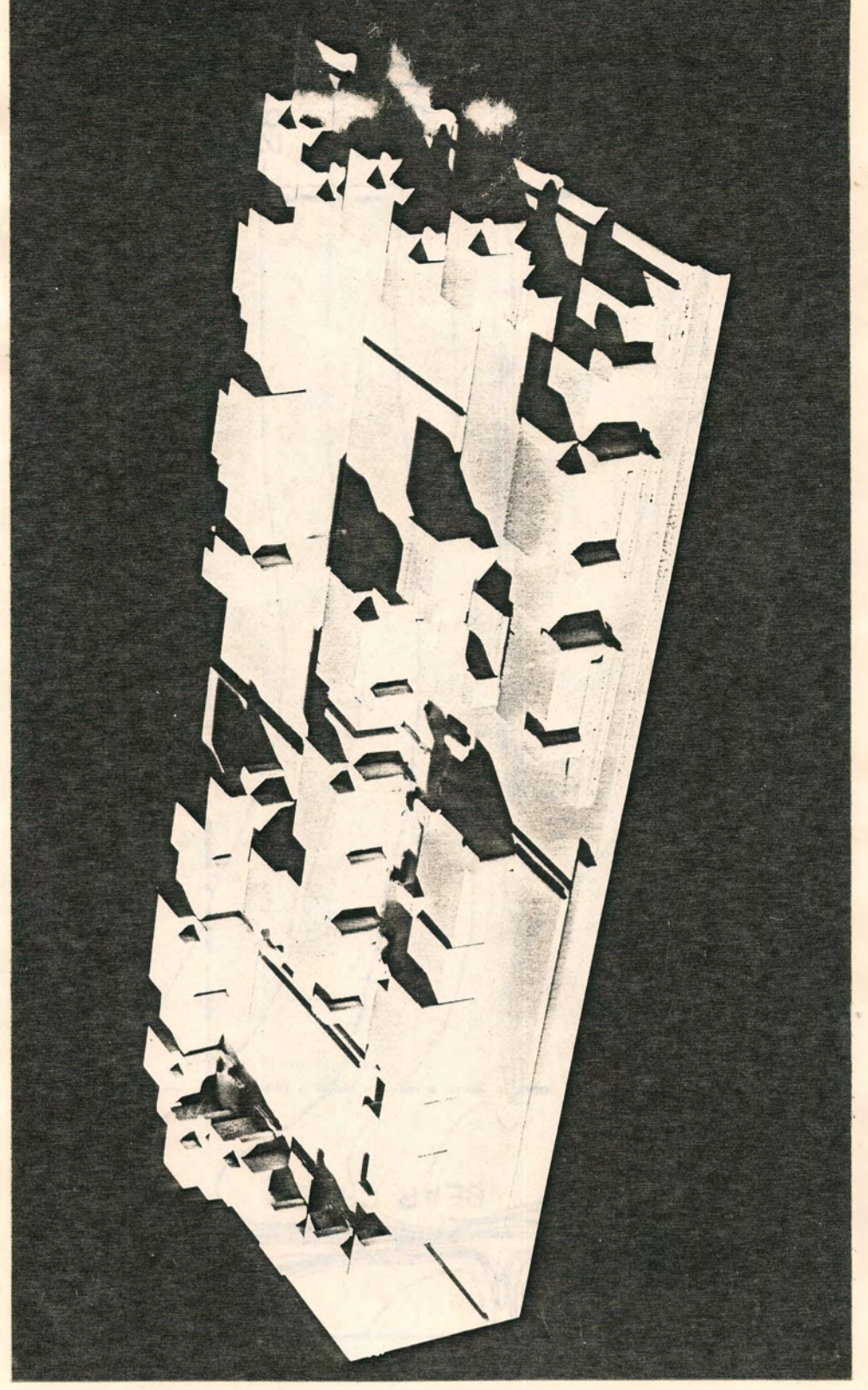
Model Given

Diversity of community character is encouraged by reducing courtyard size and varying conditions for degrees of activity.

Articulation of plan develops in response to solar access, interior lighting, entrances, garages, and family size.



"Tenure Type": direct ownership (urban suburbanites)
Dwelling Unit Mix: 10% 4-br., 50% 3-br., 20% 2-br., 20% 1-br.

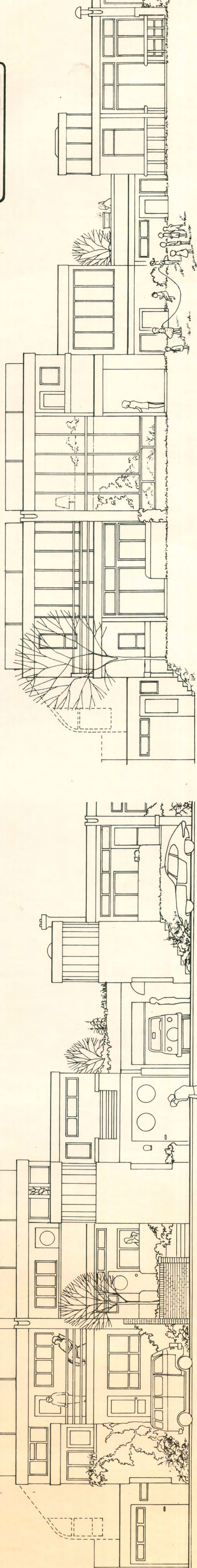


SUPPORT HOUSING

ARCHITECTURAL DESIGN STUDIO
SPRING, 1982
CATHERINE VERHULST

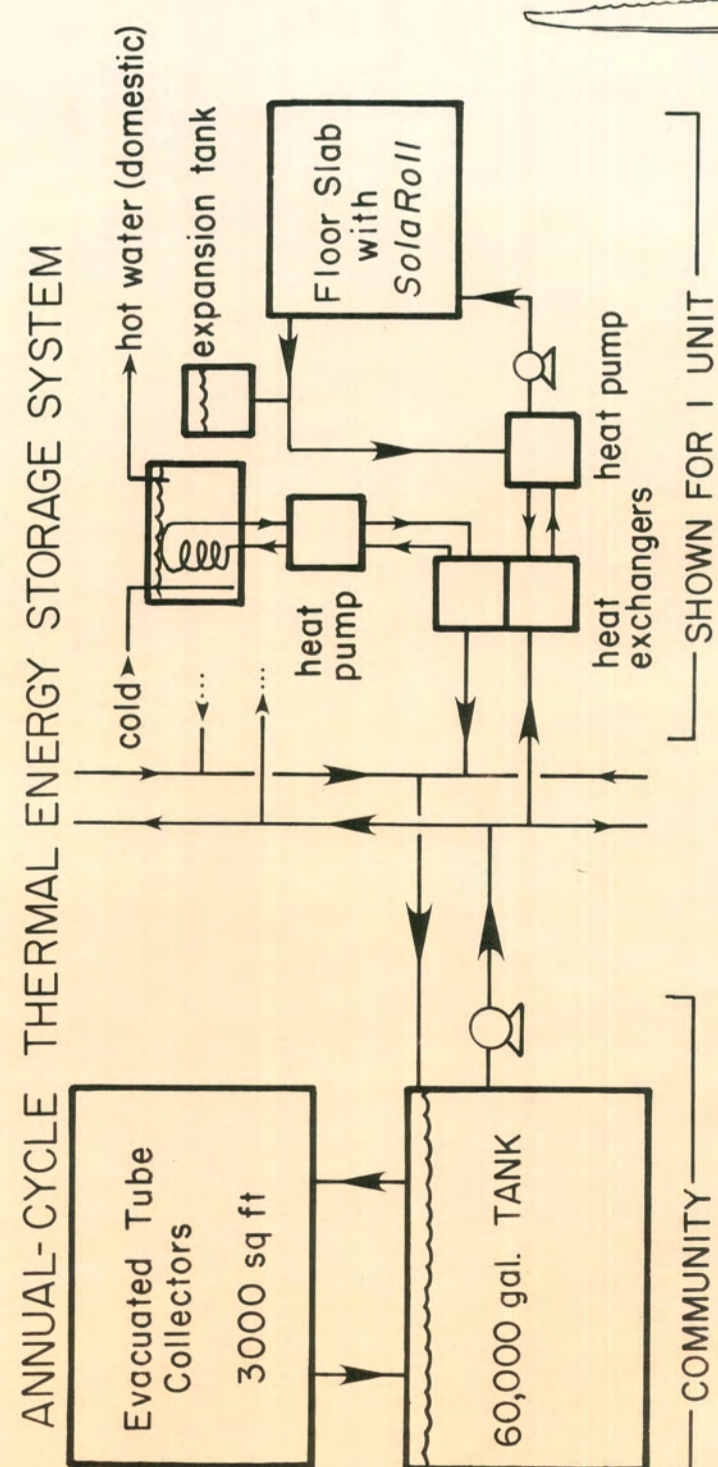
ENVIRONMENTAL DESIGN COLLEGE
UNIVERSITY OF COLORADO
BOULDER, COLORADO

INFILL

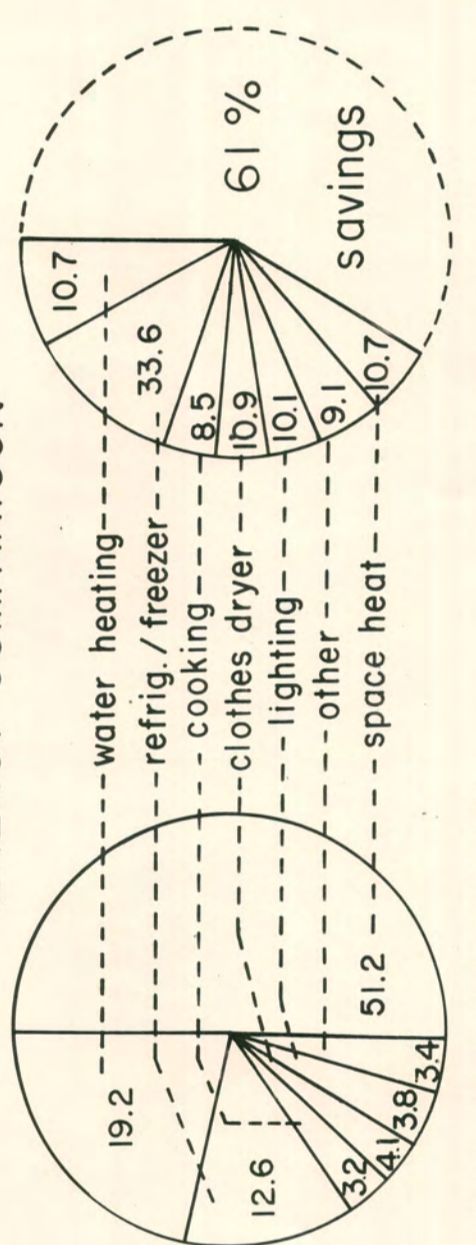


North Elevation

South Elevation

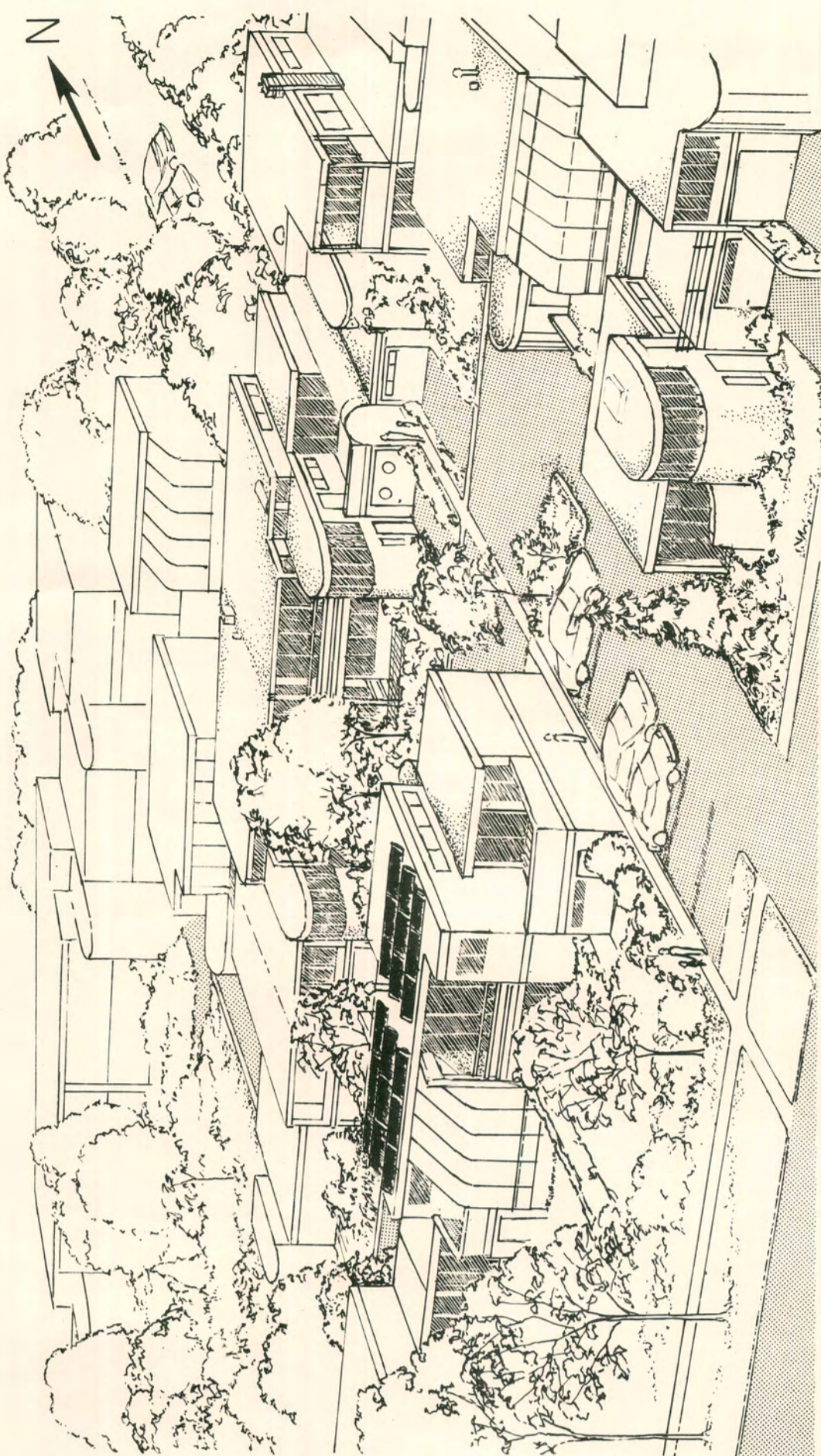


ENERGY COMPARISON

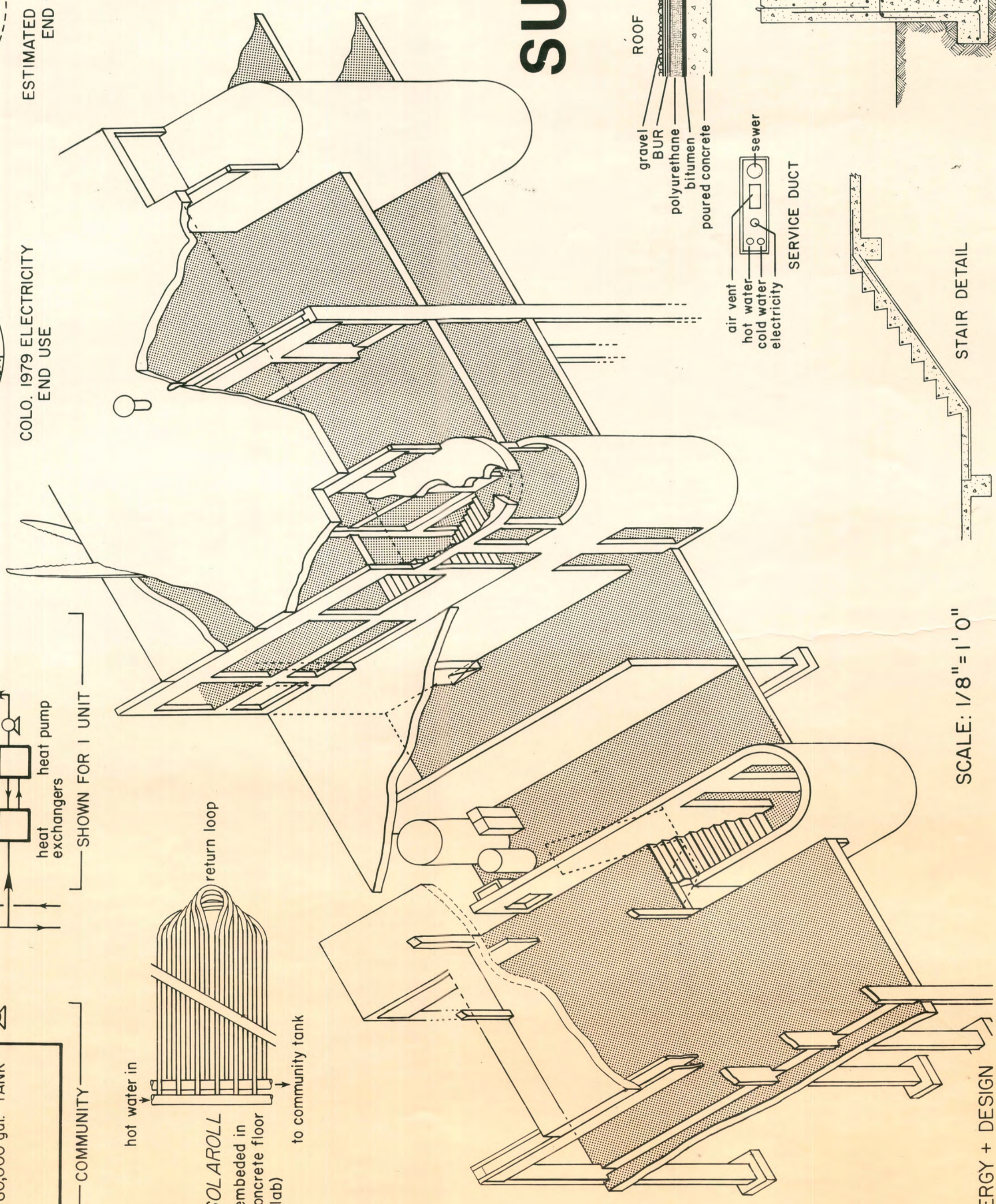


COMPUTER CALC. FOR PASSIVE SYSTEM

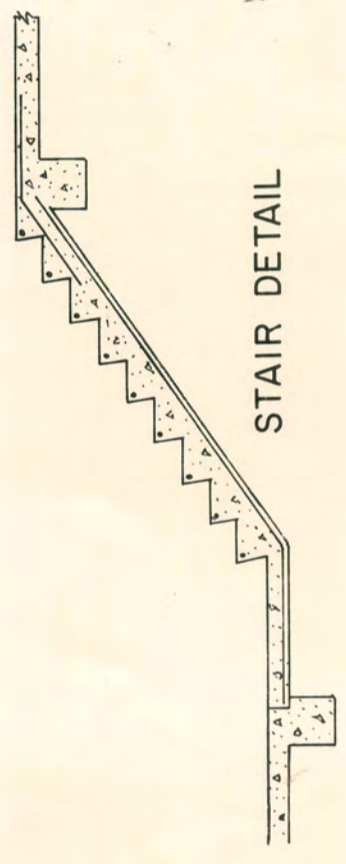
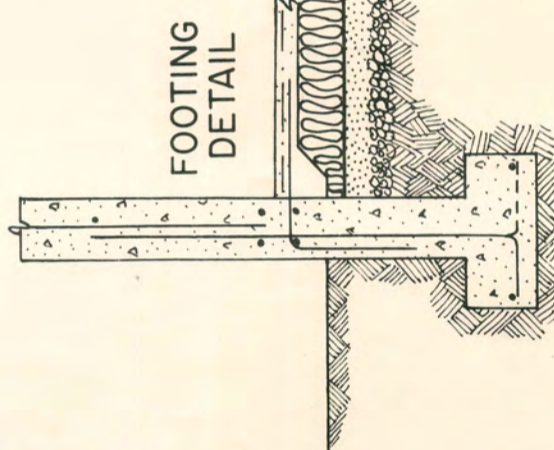
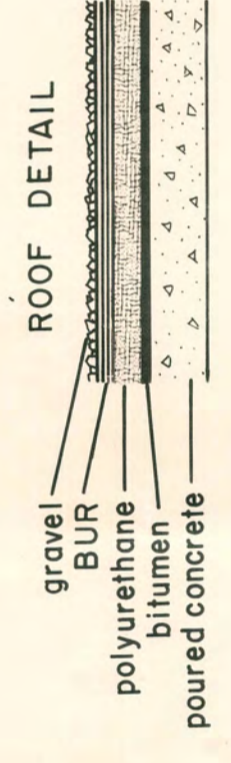
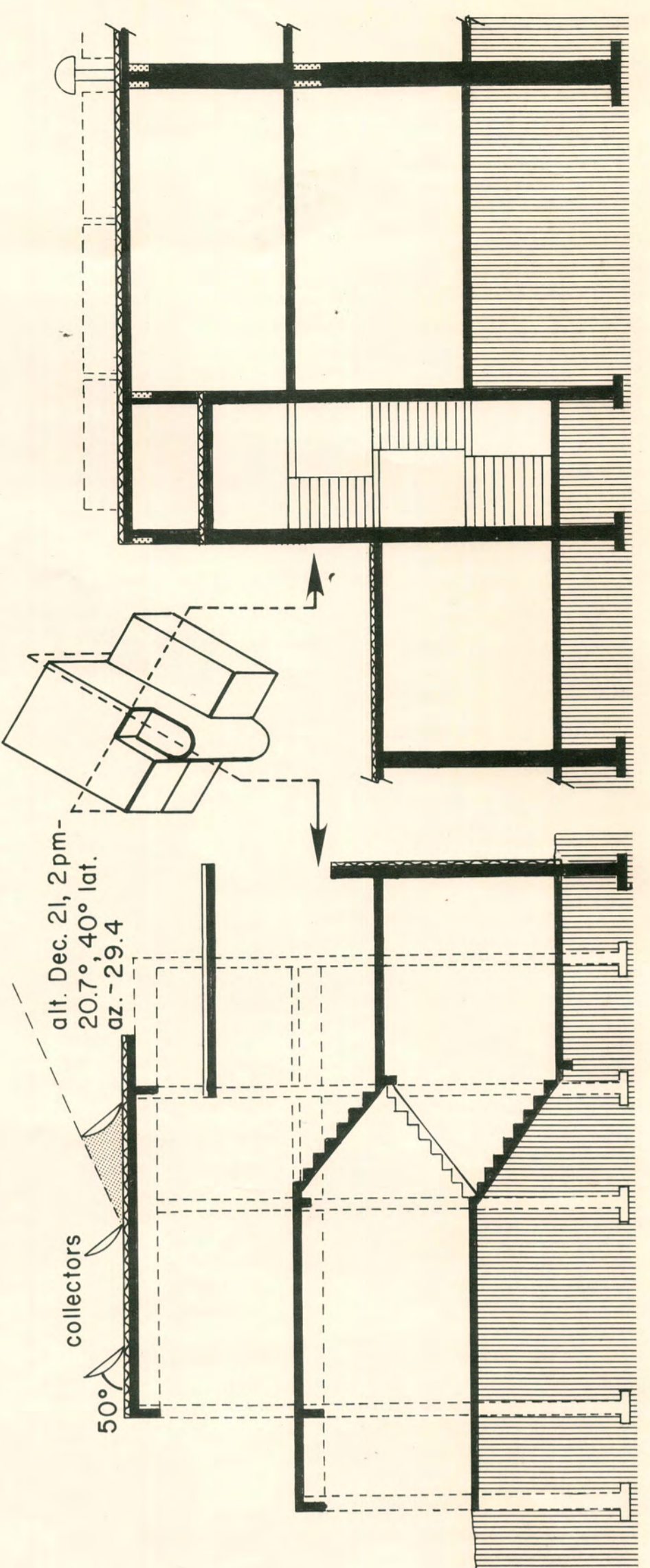
Annual heat load: 27 MMBtu/Yr
 Optimal Collector Size: 226 sq ft
 Solar Fraction: 70 %



Interior Street Entrance



SUPPORT SYSTEMS



SCALE: 1/8" = 1' 0"

3 ENERGY + DESIGN

SUPPORT HOUSING

ARCHITECTURAL DESIGN STUDIO
 SPRING, 1982
 CATHERINE VERHULST

ENVIRONMENTAL DESIGN COLLEGE
 UNIVERSITY OF COLORADO
 BOULDER, COLORADO

A physical design proposal is solicited to guide the development actions of a resident's association in a two block area of a typical midwestern city in the United States.

The resident's task force has been elected and with the help of volunteer professionals has developed the following objectives and criteria:

Resident Objectives

1. Meet the needs of lower and moderate income residents in dwellings which lend themselves to 'home-ownership'.
2. Maintain all existing single-family owner-occupied masonry houses in sound condition.
3. Rehabilitate or restructure all existing and structurally sound multi-family buildings which are both occupied and vacant.
4. Maintain all existing institutional buildings.
5. Either maintain or remove existing single-family masonry houses which are vacant.
6. Remove blighted and abandoned commercial and industrial buildings and replace with local service commercial or social service facilities.
7. Provide new dwellings which will be congruent with the socio-cultural values and life-styles of the residents.
8. Structure the two block area to encourage identity, autonomy, supervision, and vehicular safety without making it into an unfriendly, impenetrable bastion.

Logistics

1. Provide a minimum of 100 new and rehabilitated dwellings, to meet the following household distribution and space requirements: 20% (600 sq. ft.), 1-2 persons; 30% (750 sq. ft.), 2-4 persons; 20% (950 sq. ft.), 4-6 persons; 15% (1,250 sq. ft.), 5-8 persons and 15% (1,400 sq. ft.), 8-10 persons.
2. Provide a maximum of 5,000 sq. ft. of rentable commercial or service facility area, which lends itself to rental in increments of 500 sq. ft. (not narrower than 15 ft.) and construction in at least two (2) phases. Provide 5 parking spaces per 1000 sq. ft. of sales space and service delivery area.
3. Provide one half acre of common recreation space.
4. Provide off-street parking of 1.2 cars per dwelling or 1.5 cars per dwelling (excluding commercial parking) for the total area.

Design Objectives

The thrust of the approach taken here is to enable the householder to reenter the housing process as a participant.

To do this requires a realignment of roles and processes, and some rules to coordinate the many actors who are involved in housing.

An architecture of participation differs from the architecture that most of us are familiar with. The architect's role must change. The dwelling is no longer the result of an architect's design. Instead, a dwelling is the result of many specialists and many non-specialists acting and making decisions. The result is and should be unpredictable in detail; the rules have been set, the ball thrown, and people start playing the game.

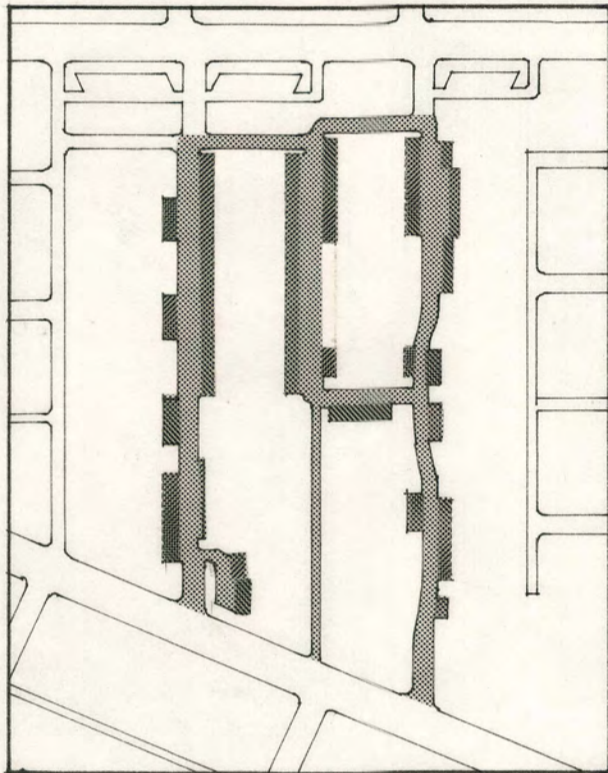
To formalize this idea about how dwelling environments should be built, two aspects must be understood. One is to persuade people to play the new game. This means entering politics. The second is to design things in which the individual householder can be involved.

The second aspect is the subject of this study.

Traffic & Parking

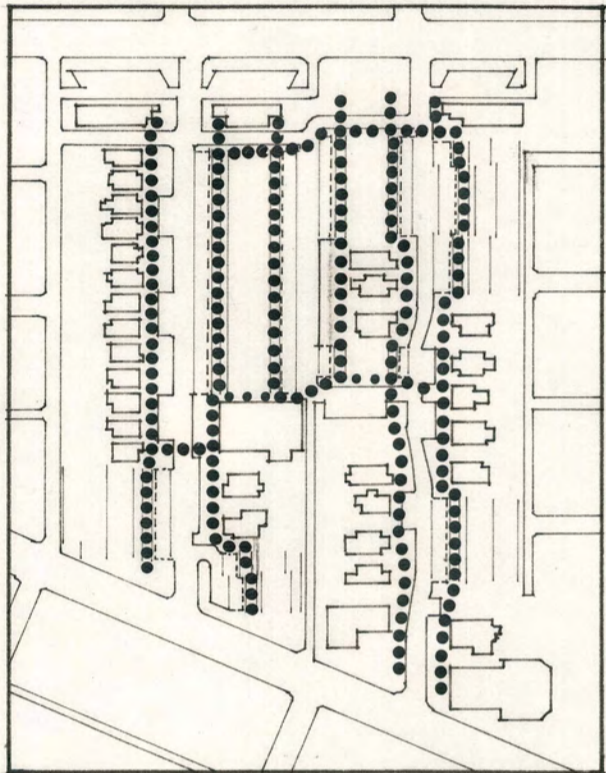
Vehicular accessibility to the residential environs is considered to be essential, but through traffic at this scale and in this particular setting is not necessary, except for fire equipment.

Where possible, parking will be sheltered, and close to the dwelling unit. Minimum space will be provided for vehicle storage and maneuvering, in accordance with the logistics and image statements in the program.



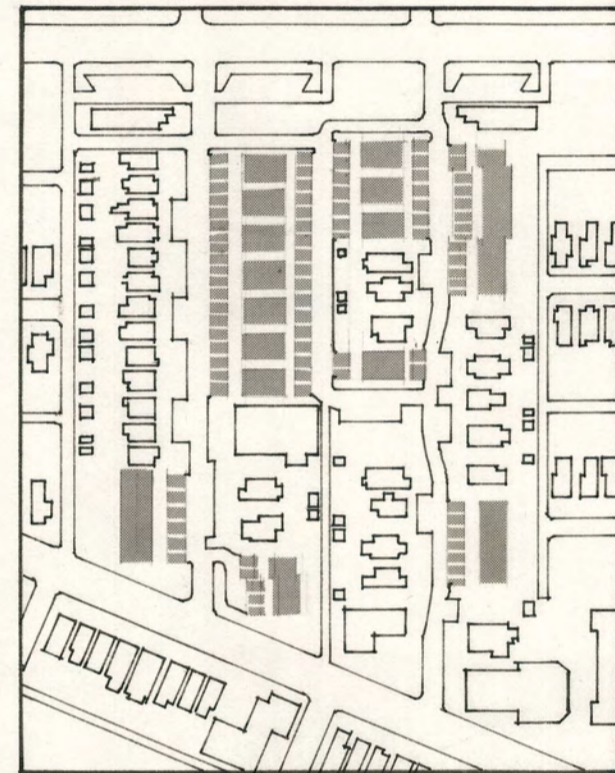
Pedestrian Paths

Pedestrian movement in this particular setting is seen as essentially internal, or at most limited passage through the site. The proximity of the parochial school indicates that school children will be traversing the site. These factors lead to three attitudes: one, that there should be some ability by residents to see who is walking by, thus giving some measure of control; two, that children should be able to move in safety within the residential environs; three, that the pedestrian environment should be rich in sensual and social learning experiences.



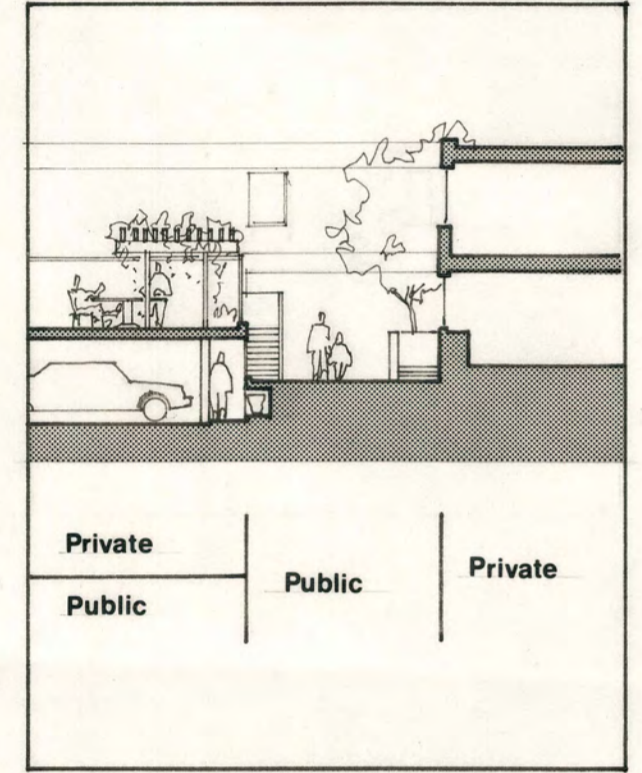
Urban Fabric

Residential environs in a relatively dense urban environment are seen as part of the continuous fabric of the adjacent residential settings, congruent in scale, life-style and social interaction expectations of the future residents.



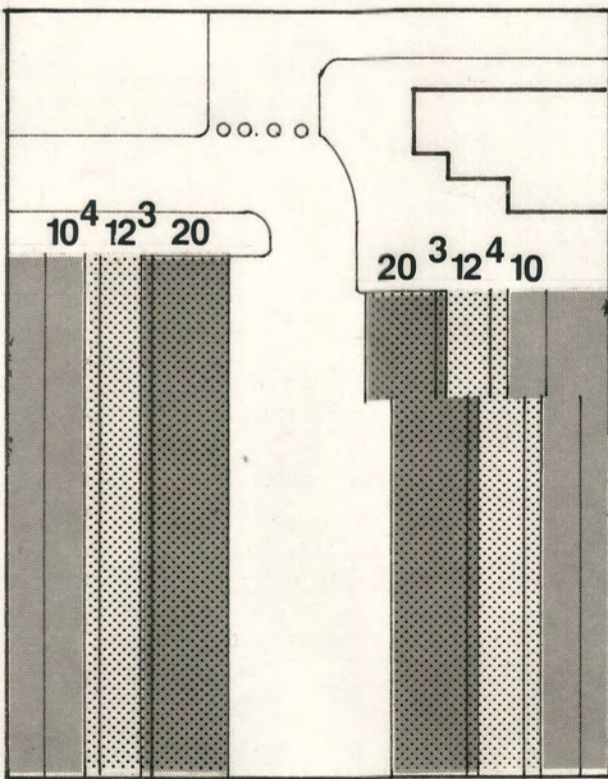
Private / Public

A scheme of relatively high density must be attentive to the uncreative conflict which often occurs where there is no clear distinction between public and private domains. The distinctions, however, are seen as amenable to modification by resident initiative.



Zones & Margins

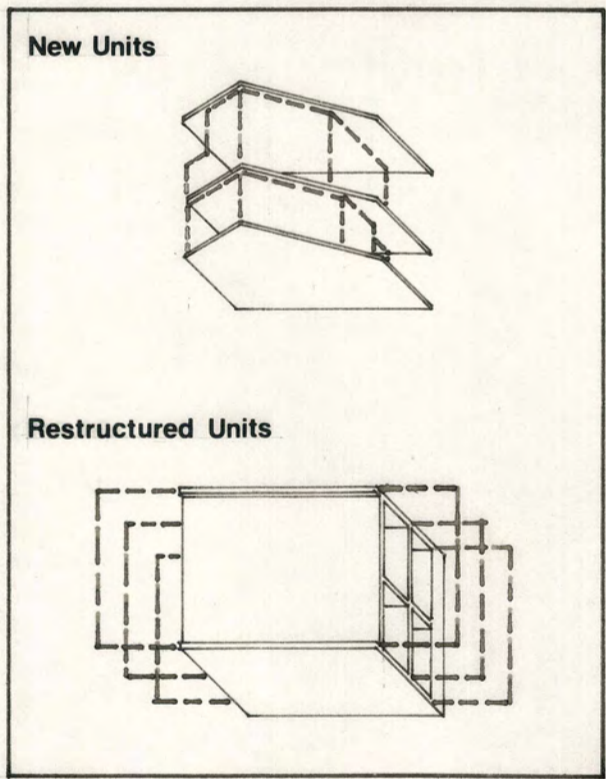
Zones and margins are designations of, respectively, the private domain and the public domain, and are used to structure the positioning of the building blocks within the residential environs, according to the choices of future residents.



Supports

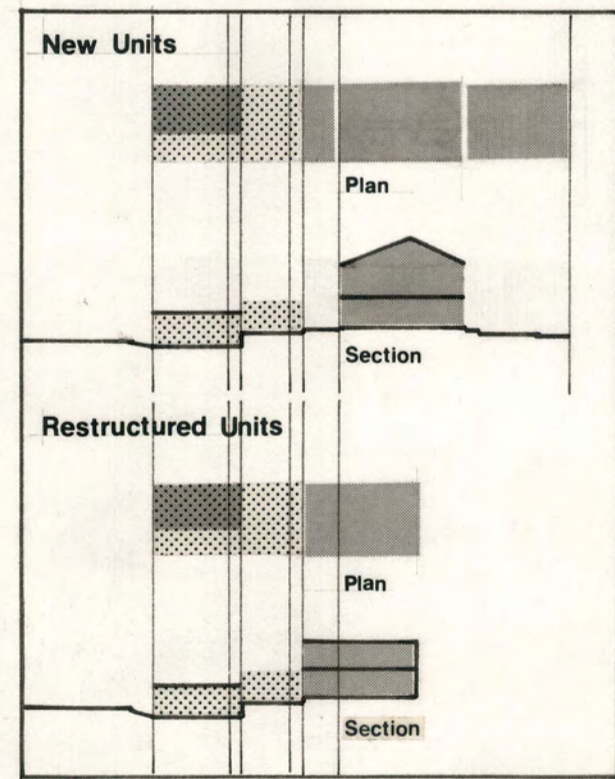
Supports are the physical elements and managerial processes which enable residents to operate in relative autonomy in restructuring and elaborating upon their dwellings. Supports are seen as 'fixes' which accommodate 'flux' in residential population mix and life styles over the years, making total rebuilding of dwellings from the ground up unnecessary, when obsolescence of the dwelling unit occurs.

Supports here include the existing masonry structures which are here being restructured, the 'party wall' between new units, the 'terrace out front' over the parking areas, and 'air rights' over the pedestrian path. Managerial processes are not discussed here.



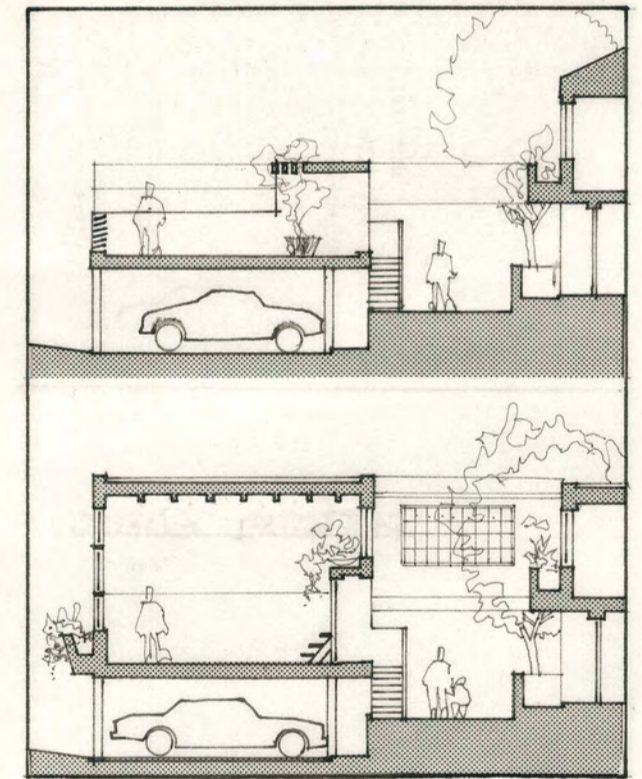
Building Blocks

The generic dwelling, new or restructured, is a combination of private dwelling, sheltered parking area, and an allocation of outside space on grade, over the parking area, or in both locations.



Dwelling Extensions

Extensions of dwellings enable residents to make additions or modifications to the physical setting in fitting with the chosen life-style and perception of appropriateness in the community context. Each resident is aware that when he adds to his dwelling, he adds to the community, thus enriching the residential environs. The outside space allocations are seen as autonomous pieces of real estate. The open space above the parking area can be physically connected to the dwelling, or it can be used as a 'terrace' or 'front yard'.



Dwelling Choice

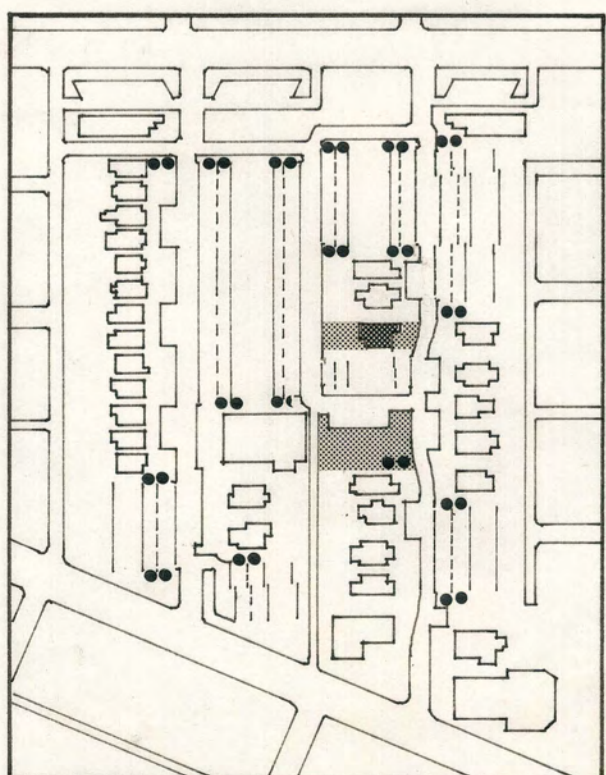
Choice of dwelling type and location within the system of zones and margins is to be accomplished through the provision of a range of dwelling unit configurations (plans and sections) and location possibilities. Future residents 'sign-up' for a dwelling type and size. Location is decided by a process through which each resident draws a location at random from a hat, after which trading or exchanging with incentives is possible.



Places of Concourse

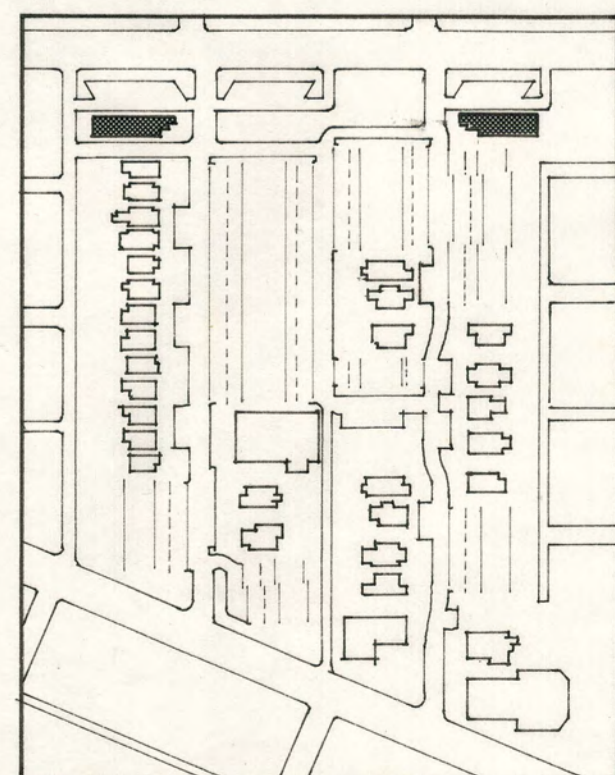
Places of concourse are seen here as necessary complements to the places of privacy that dwelling units provide. They are places for 'milling and mingling', and occur within the residential environs at various scales.

Interior activity space is provided to serve a community services function, within the immediate residential environs. In this particular setting, the community center is seen as complementing the church as a gathering and service center. In addition, outside recreation spaces are located in several places within and on the edges of the residential environs.



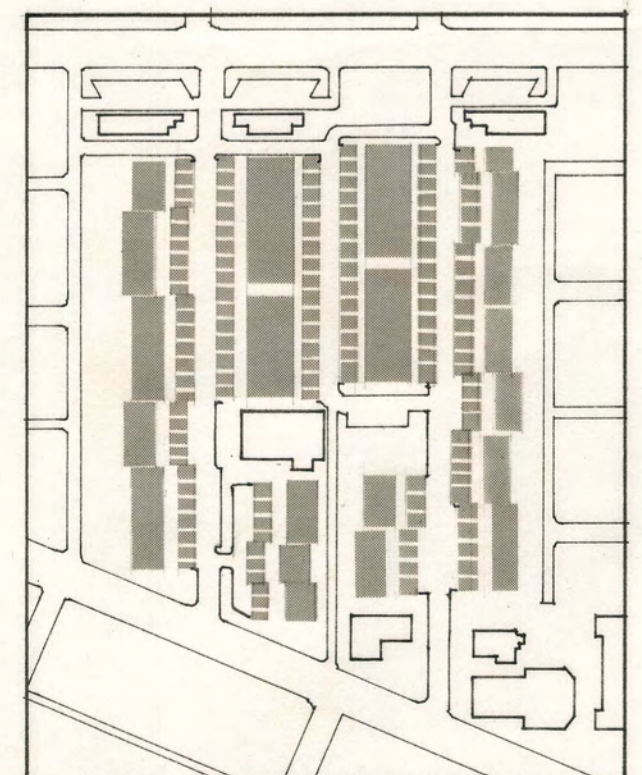
Small Commercial

The small commercial facilities adjacent to the residential environs are seen as buffer elements, shielding the dwellings from the heavily used road on the north of the site. They are also seen as filters of pedestrian movement, and as such are designed in response to the setting of zones and margins in the residential sector.

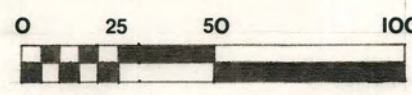


Extension of the Idea

Over time, physical conditions internal to the site may change, as existing dwelling units become obsolete. In this case, the concepts discussed here can accommodate new dwelling units within an extended system of zones and margins.

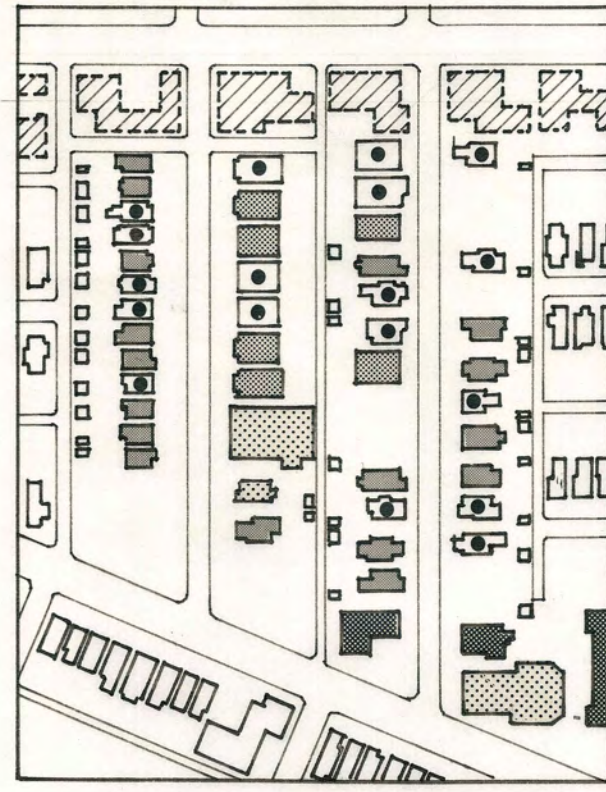
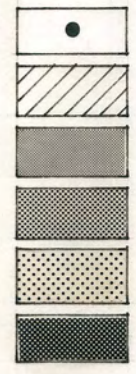


See Panel 5



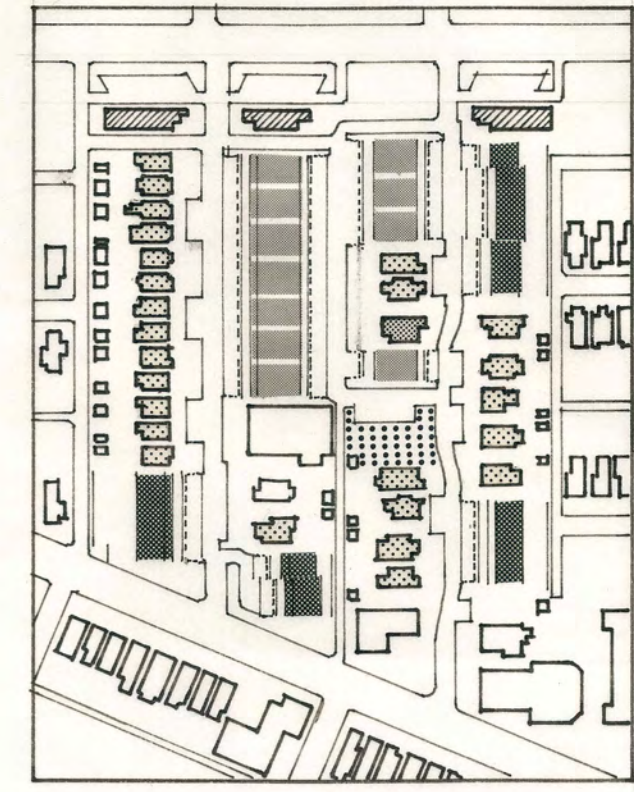
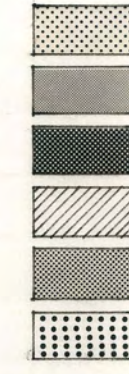
Existing Site Uses

- Vacant Dwellings
- Vacant Commercial
- Occupied Single Family
- Occupied Multi Family
- Church & Manse
- Parochial School



Proposed Site Uses

- Rehab. Single Family
- Restructured Multi Family
- New Dwelling Units
- Commercial Facilities
- Community Center
- Play Area



Site Plan

Dwelling Units

New Single Family	31
Restructured Units	58
Rehab Single Family	25
total	114

Parking

Covered	181
Open	55
total	236

Site Area

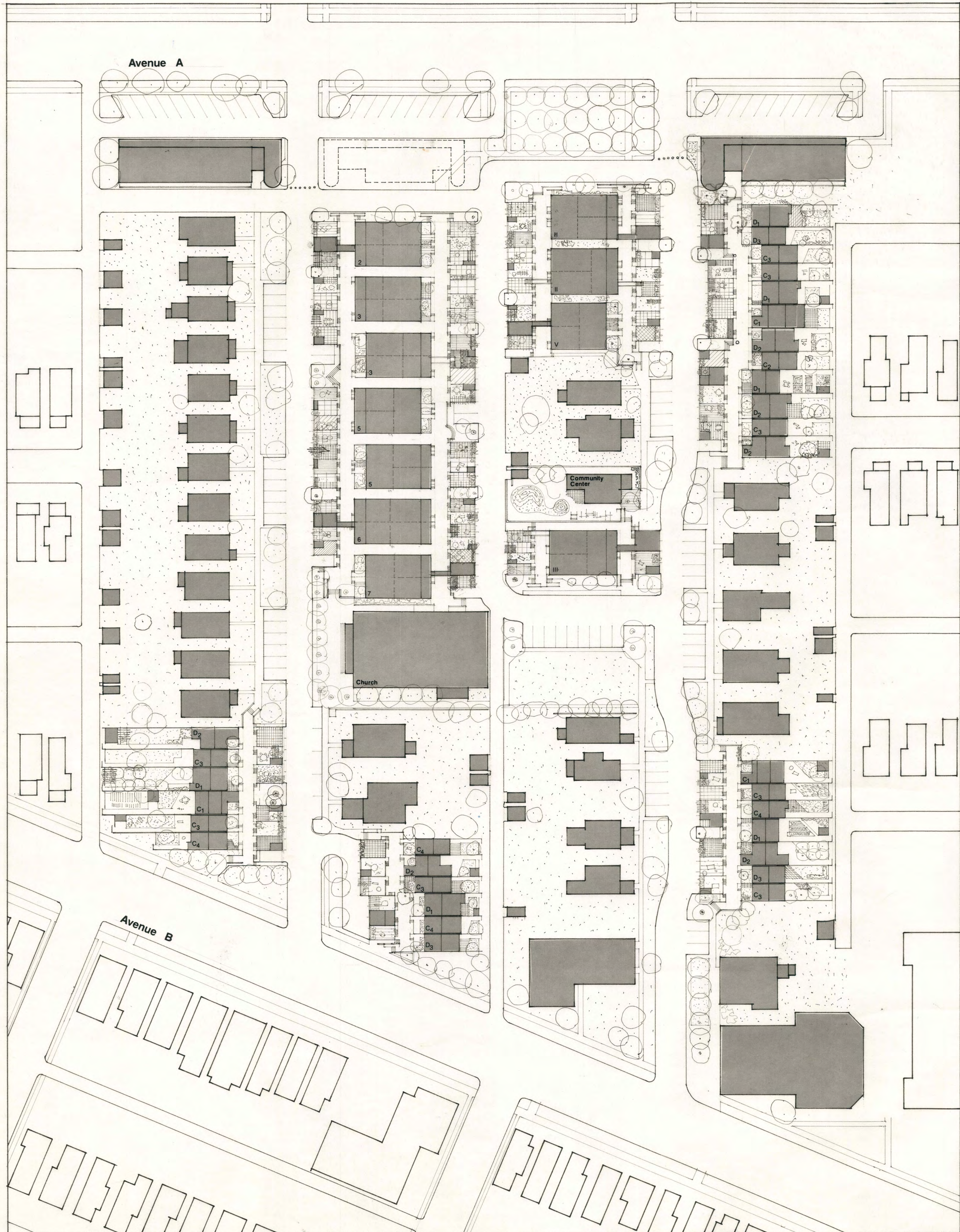
Acres 11.2

Density

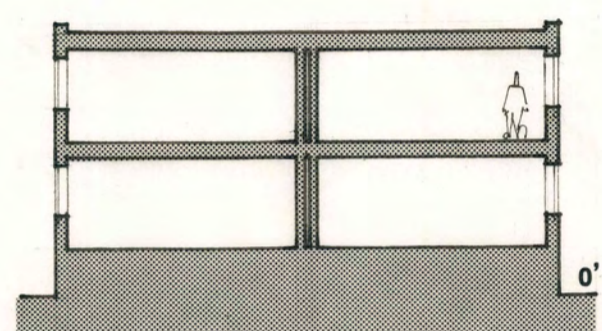
Within New Single Family Area 15 per A.

Within Restructured Area 30 per A.

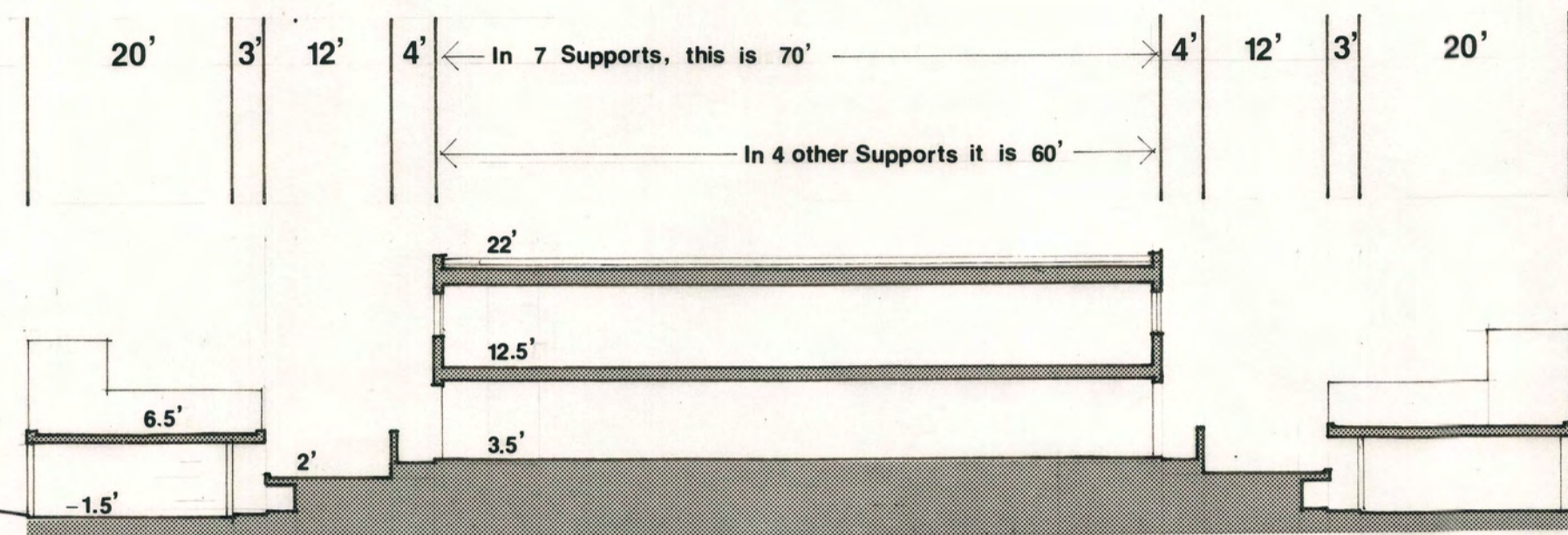
Mean of Entire Site 10 per A.



Building Blocks for Restructured Supports



Typical Cross Section

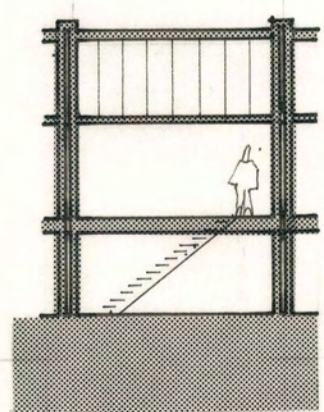


Typical Longitudinal Section

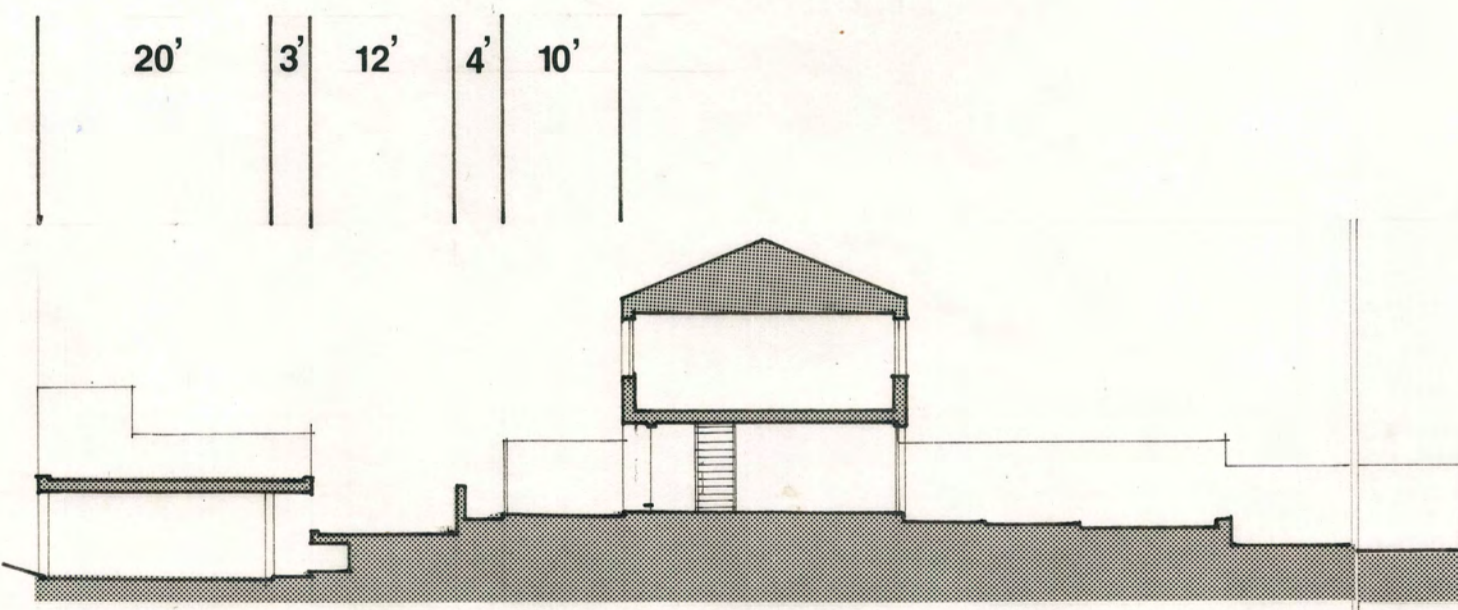
a	1	1	600	—
	2			
b₁	2	1	750	96
	1			
	4			
	UN			
b₂	2	2	750	—
	2			
	4			
	UN			
C₁	4	2	950	—
	2			
	6			
	UN			
C₂	4	2	950	120
	2			
	6			
	UN			
C₃	4	2	950	—
	2			
	6			
	UN			
d	5	3	1250	—
	3			
	8			
	UN			

Type	Family Numbers	Bedrooms	Enclosed Area sq ft	Front Court sq ft	Allocated Space over parking varies between 275 sq. ft. and 345 sq. ft..
U					
U					
U					

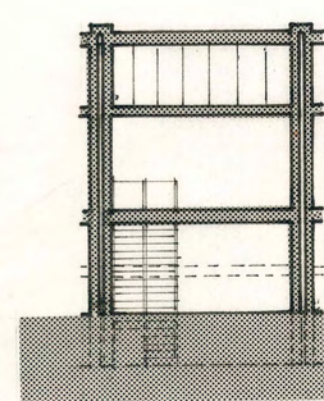
Building Blocks for New Supports



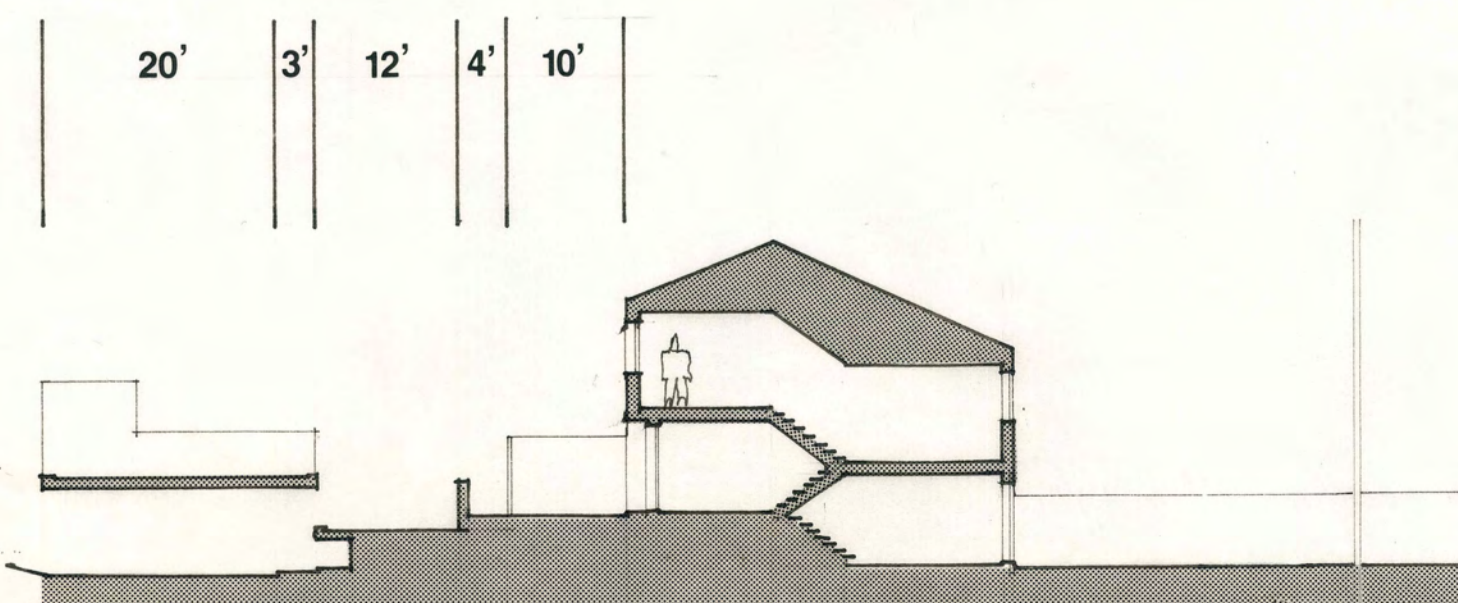
Typical Cross Section



Typical Longitudinal Section



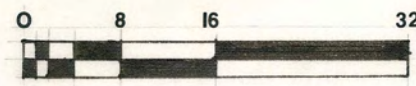
Typical Cross Section



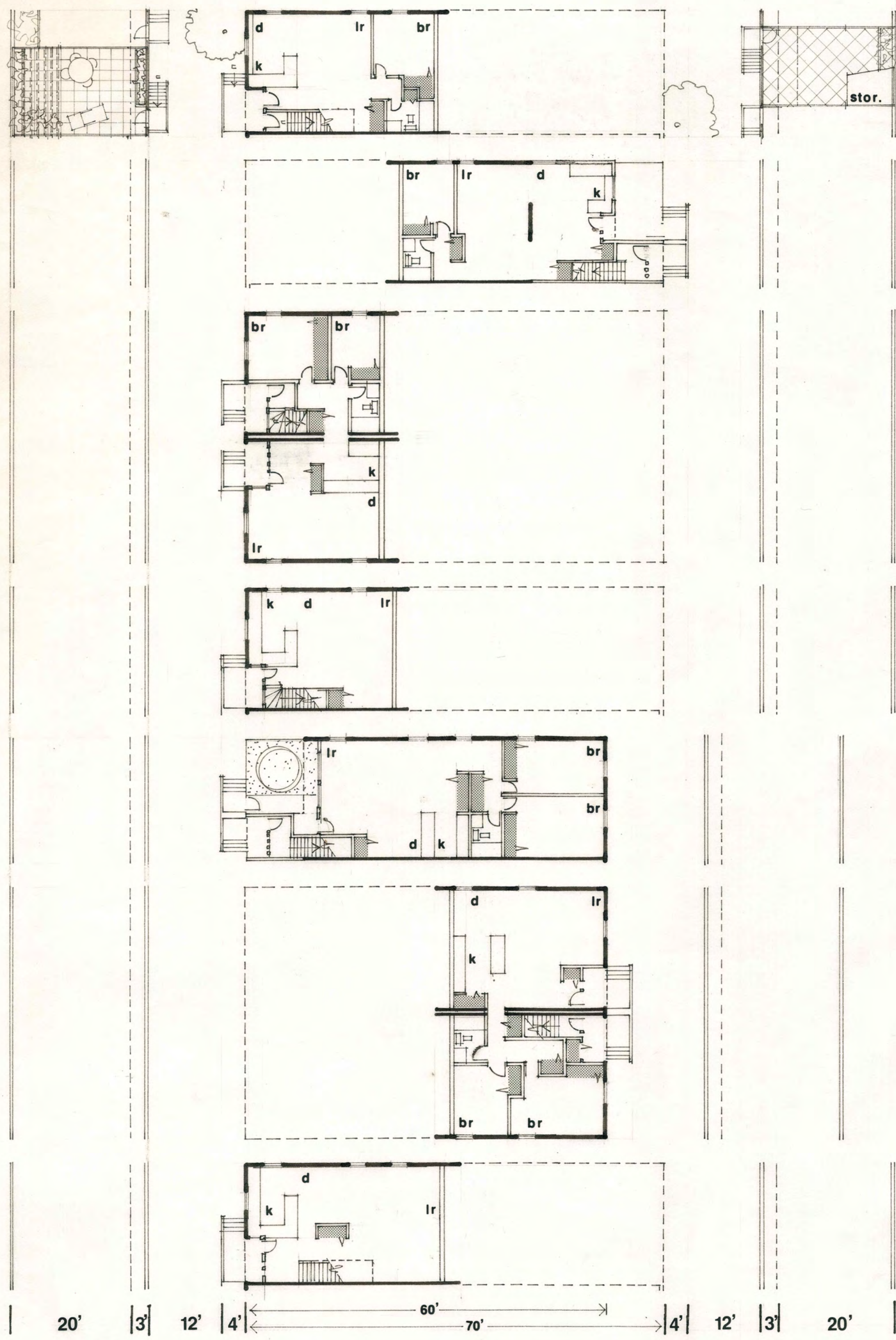
Typical Longitudinal Section

B₁	2	1	750	186
	1			
	4			
B₂	2	2	750	—
	2			
	4			
B₃	2	1	750	—
	1			
	4			
B₄	2	1	750	—
	1			
	4			
C₁	4	3	950	110
	3			
	6			
C₂	4	2	950	195
	2			
	6			
C₃	4	2	950	140
	2			
	6			
C₄	4	2	950	140
	2			
	6			
D₁	5	4	1250	200
	4			
	8			
D₂	5	3	1250	100
	3			
	8			
D₃	5	4	1250	140
	4			
	8			

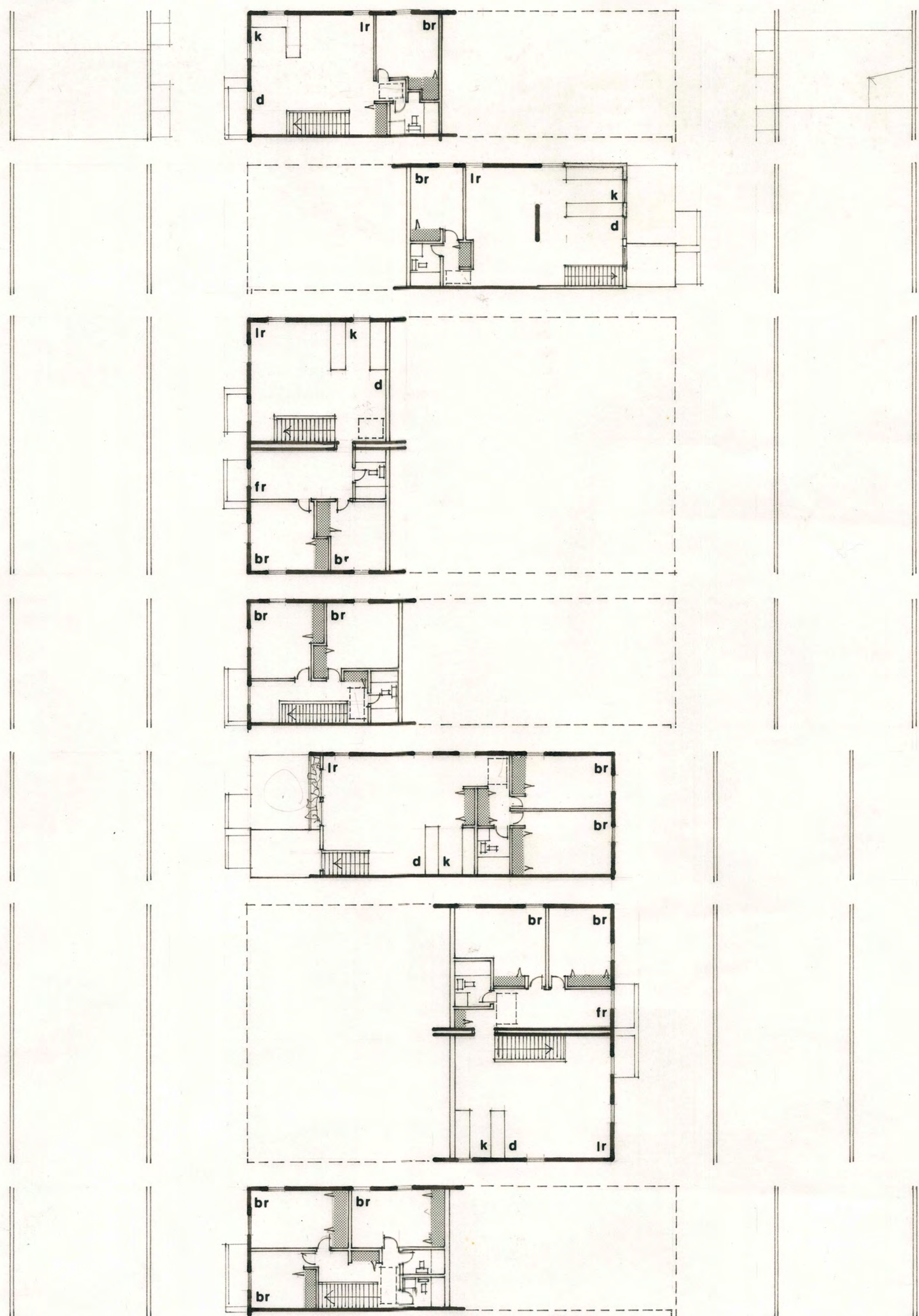
Backyards vary in size between 180 sq. ft. and 1275 sq. ft., depending on location.



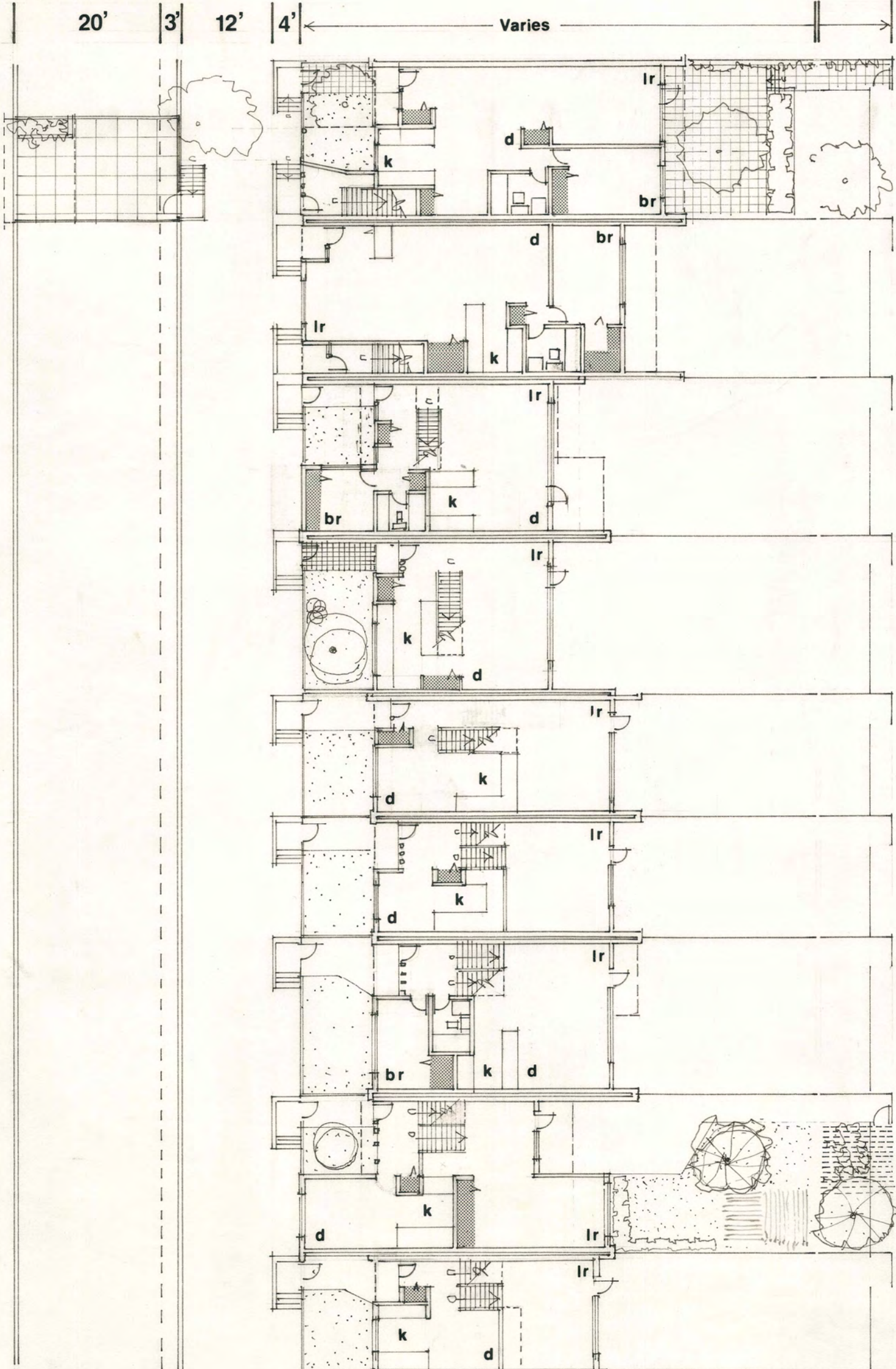
Ground Floor



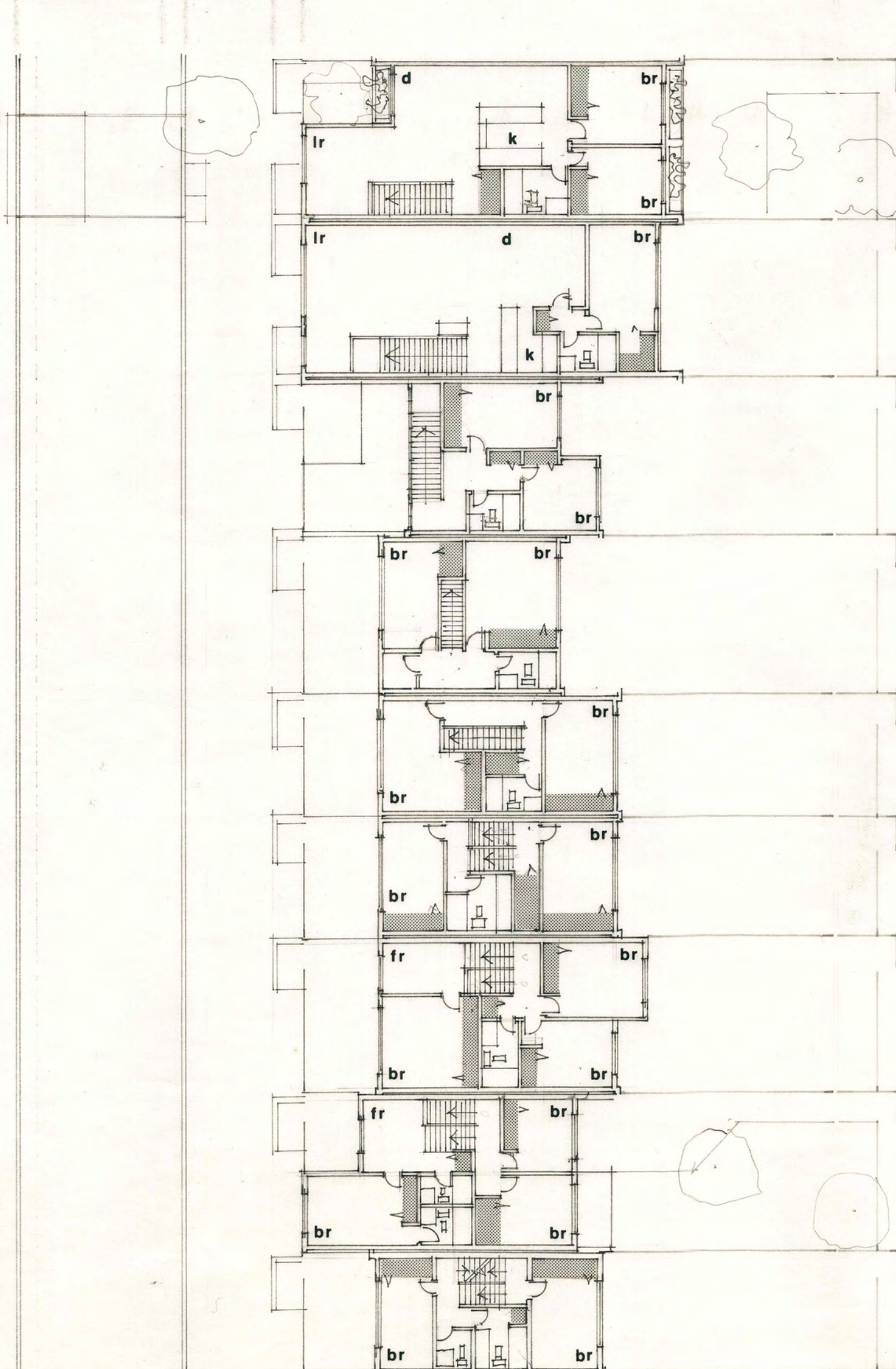
Second Floor



Ground Floor



Second Floor



Third Floor



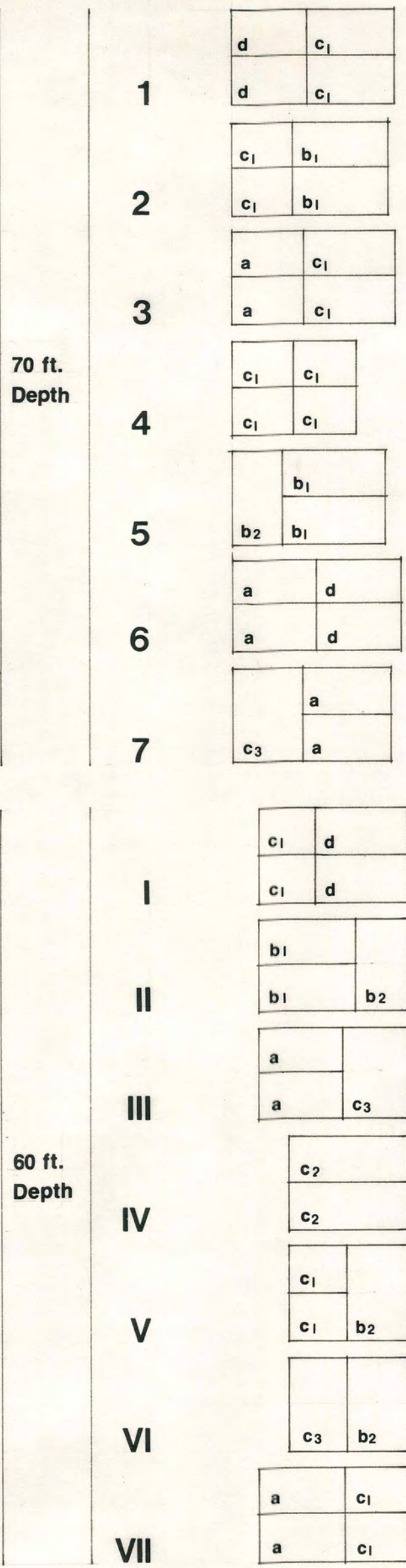
Step 1

Array all the available building blocks.
The building blocks have been arrayed on Panels 3 and 4.

Step 2

The building blocks designed as new units can be placed in linear arrangements in any sequence or combination. However, the common 'party wall' must accommodate the larger of the two adjoining dwelling units.

The building blocks that are designed to fit into the restructured supports can be assembled in a total of 14 combinations, 7 for the 70' deep support structures, and 7 for the 60' deep supports.



Step 3

Develop a chart showing the available numbers of all unit sizes required in the program, and their relationships to new and restructured support structures, and to the rehabilitated dwelling units.

Unit Size	Existing Single Family Rehabilitated No. of Building Blocks for New Supports	No. of Building Blocks for Restructured Supports		No. of Units Required in Program
		60'	70'	
600	B 1,2 B 1,2	a	a	IV 20
		b1	b1	
		c1	c1	
		d	d	
750	C1 C2 C3 C4	i	b1	IV 30
		c1	c1	
		c2	c3	
		c3	c3	
950	D1 D2 D3	d	d	IV 15
		c1	c1	
		c2	c2	
		c3	c3	
1250	E1 E2 E3	e1	e1	IV 15
		e2	e2	
		e3	e3	
		e4	e4	
1400	25			≥ 15

Step 4

The process of satisfying the required minimum number of dwelling units begins with the composition of units within the restructured supports, since this is the only place that the 600 sq. ft. units can be located, and because there are more site constraints on these support structures.

Continue the process by studying trial combinations of restructured support types. After satisfying the required number of smaller units within the restructured supports, various trade-offs can be studied in distributing the larger unit sizes between new and restructured support structures.

Unit Size	60' Deep Supports	Trials					
		1	2	3	4	5	6
		1	II	II	II	II	I
2	II	II	II	III	II	III	
3	III	VI	III	V	II	IV	
4	V	VII	VII	VII	VI	VII	
600		4	4	8	8	0	8
750		14	14	12	8	14	6
950		4	4	4	6	4	8
1250		0	0	0	0	2	0

60' Deep Supports	1	2	1	2	2	3	2
	2	3	2	2	2	3	2
	3	3	3	3	3	5	3
	4	5	5	4	5	5	5
	5	5	6	5	5	6	5
	6	6	7	6	6	7	6
	7	7	7	7	7	7	7
	600	16	16	12	12	20	12
750	16	10	14	20	12	20	
950	8	10	12	10	8	8	
1250	2	4	2	2	2	2	

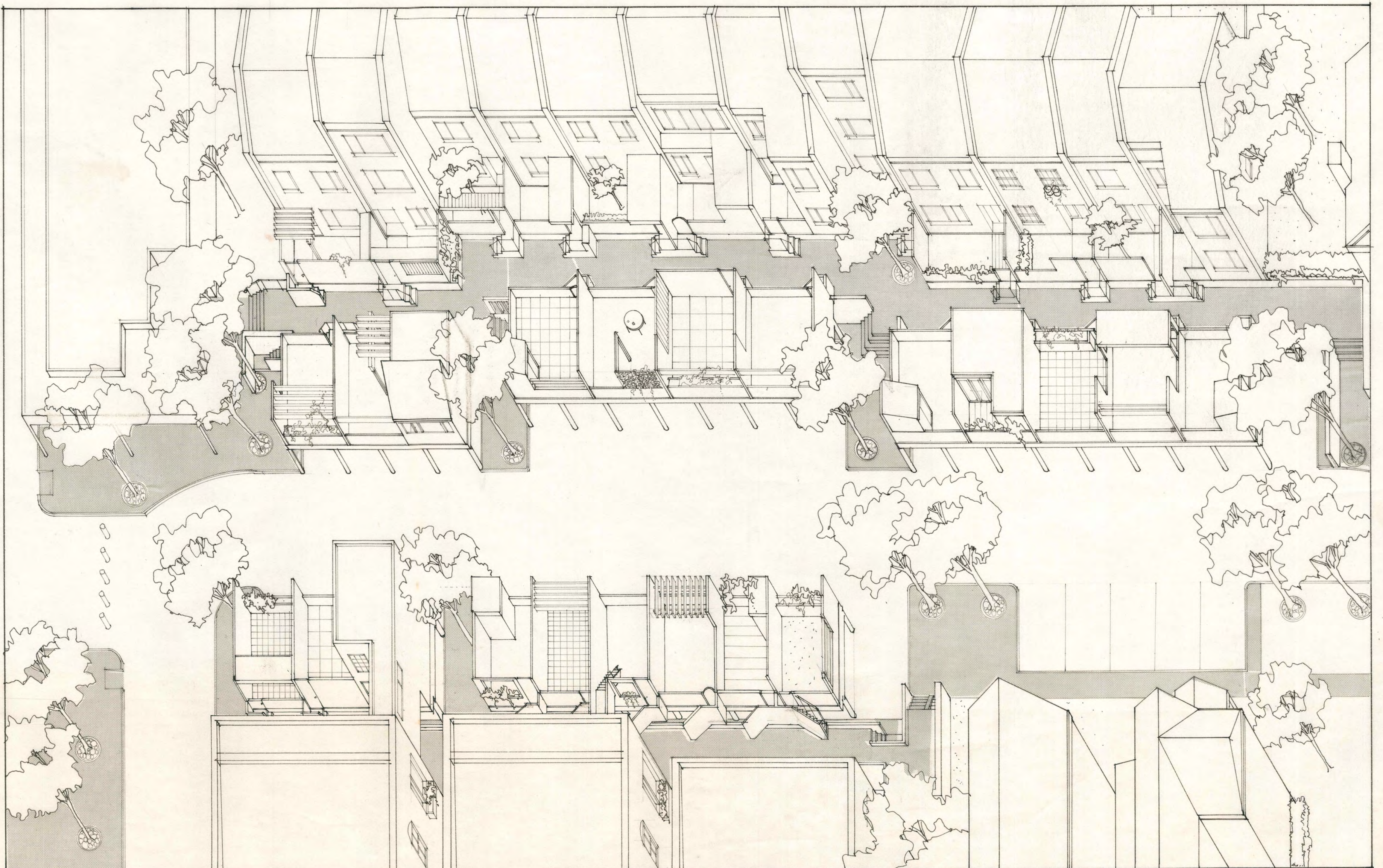
Total	1	2	3	4	5	6
600	20	20	20	20	20	20
750	30	24	26	28	26	26
950	12	14	16	16	12	16
1250	2	4	2	2	4	2

Step 5

The minimum number of required units of various sizes can be attained in several alternative distribution patterns. The site plan on Panel 2 shows one such pattern.

All of the 1400 sq. ft. units required in the program are accommodated in existing single-family units, which have been rehabilitated as necessary.

The other required units are placed according to a choice process, within either restructured or new support structures.



Shell / Infill Studies

case studies of RESIDENTIAL OPEN BUILDING

SHELL / INFILL HOUSE

Since the formation of the SAR (Stichting Architecten Research) in Eindhoven, the Netherlands, in 1964, John Habraken has focused on a number of fundamental questions concerning "the act of housing". For years, the focus of the SAR and architects who applied the SAR design methods in practice was on multi-unit housing. This was true in Europe and in Japan, two places where most of the pioneering work was done.

At a certain point, the discussion had to expand to include the detached dwelling. For one reason, the detached dwelling remains the dwelling of choice in Europe and Japan outside the dense urban centers. For another thing, the methodological challenge was there to be met: How would the principles of distinguishing a "shell" from the "fit-out" or "infill" apply to this type?

In a study I did in 1986, titled *Shell/Infill: A Technical Study of a New Strategy for 2x4 House-building*, I wrote in the introduction as follows:

"In a typical development of single-family detached houses, there is usually a fairly complex spectrum of variations that is commonly achieved by the application of current technology and organizational methods. Given the current state-of-the-art, we may not need to think of ways of achieving more variety but instead we may need to devise ways to organize the variety we expect more effectively.

In a typical development, we can see this spectrum of variety in several ways. For example, the same house type may be built, with variations in the front porch design; or the roof may vary, in roof covering and fascia detailing; or the window placement and sizes may vary in the same house type, according to the differences in interior space plans; and so on, in almost endless combinations.

If we go inside, we can find in the same house type a range of variations in interior layouts and systems. In one house, the living room will be larger than the others, or there will be a half-bath beside the family room in one house and in

another of the same type the half-bath will be by the front door. In one of the houses, the heating system maybe an electric heat pump with ducted air distribution, while in another of the same type, there may be a gas fired boiler and baseboard hydronic system for heating and window air conditioners.

In houses of the same type, we can find the kitchens in different locations, and different kitchen layouts in the same places, but with the same cabinets from the same manufacturer.

In the same residential development, we can also find different house types, but with the same heating and wiring systems, roofing, balcony trim details, and windows, and the same kitchen layouts with the same cabinets.

We can find in this development at another level, in different house types, exactly the same basic construction strategy, suppliers, and construction firms.

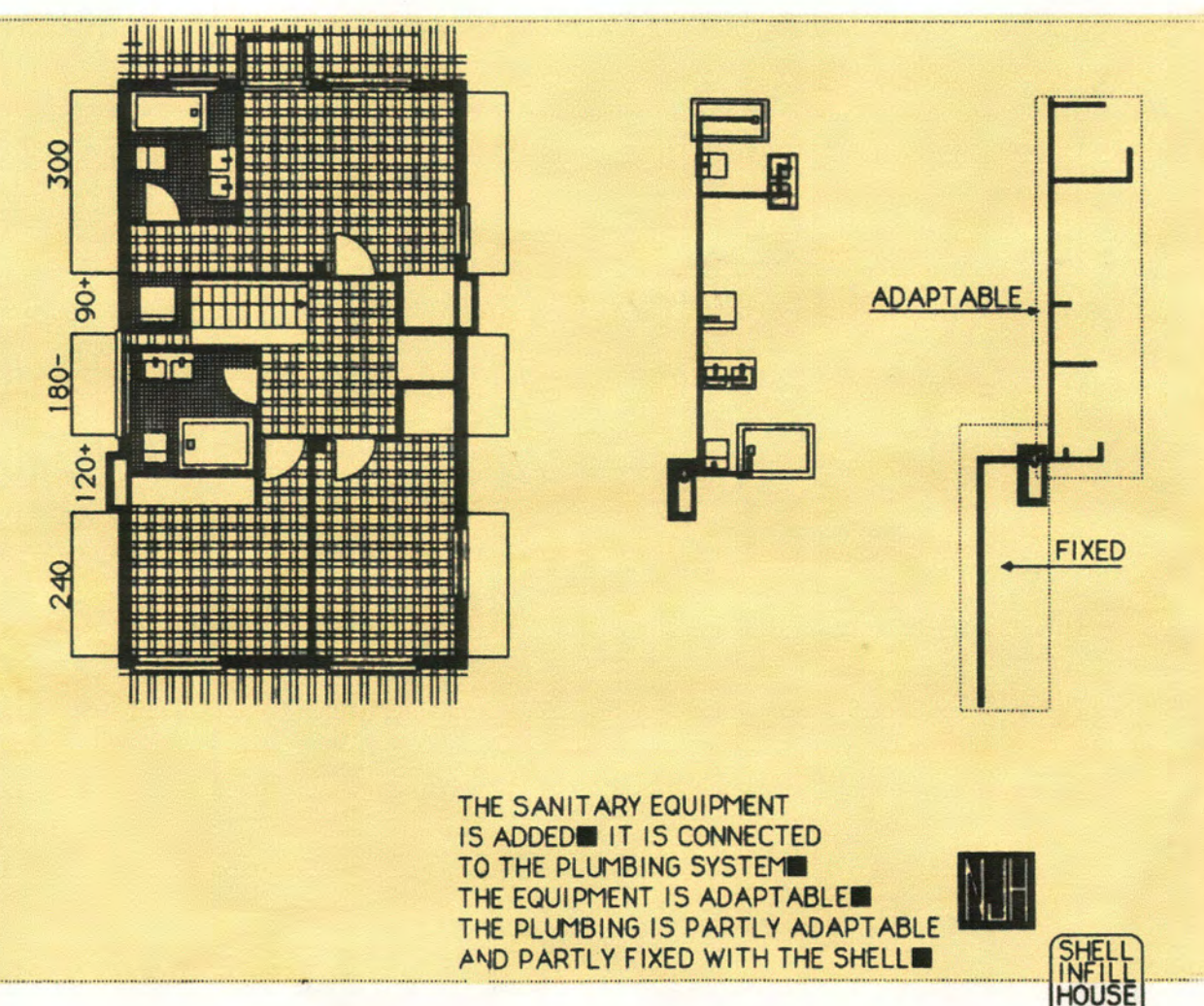
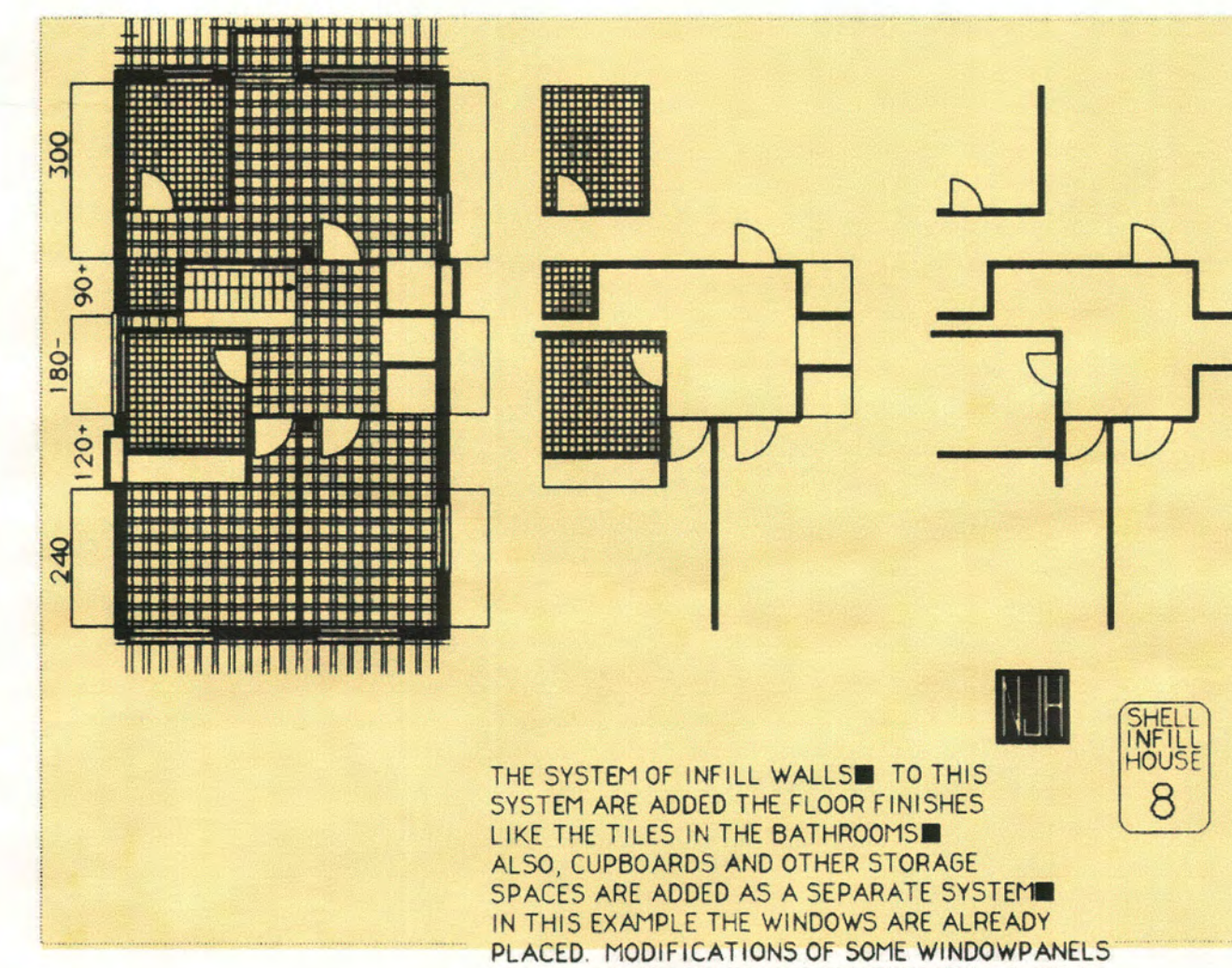
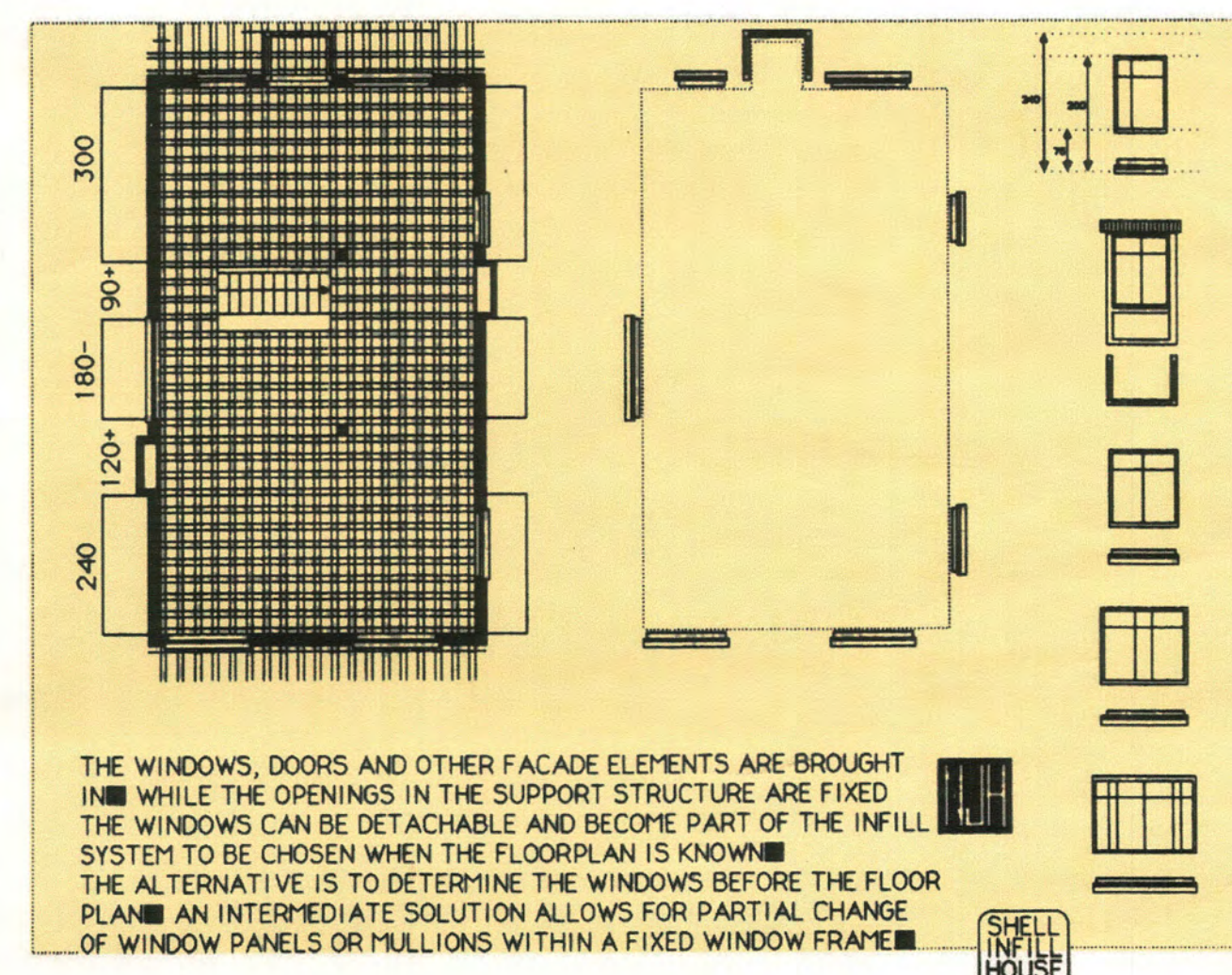
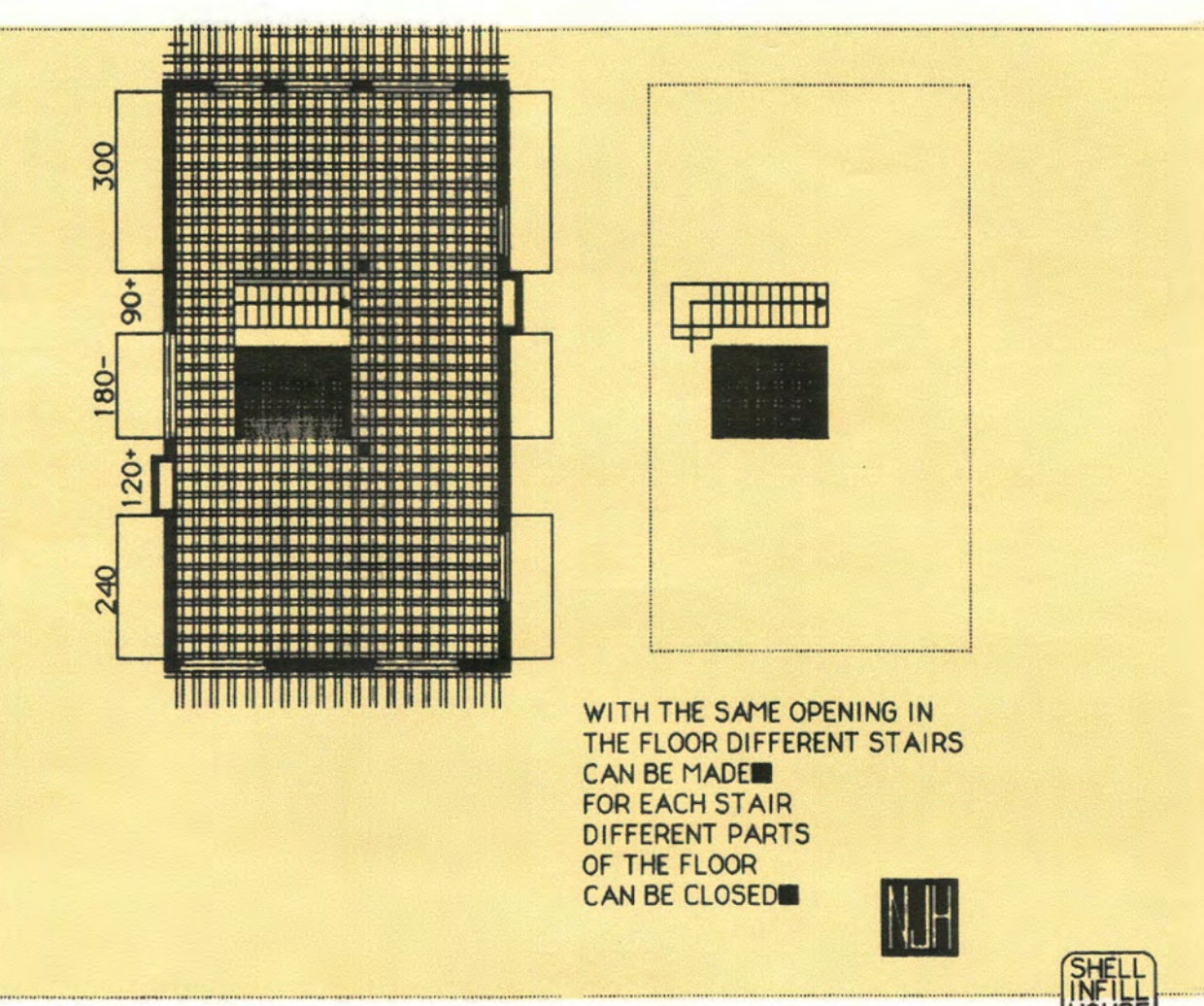
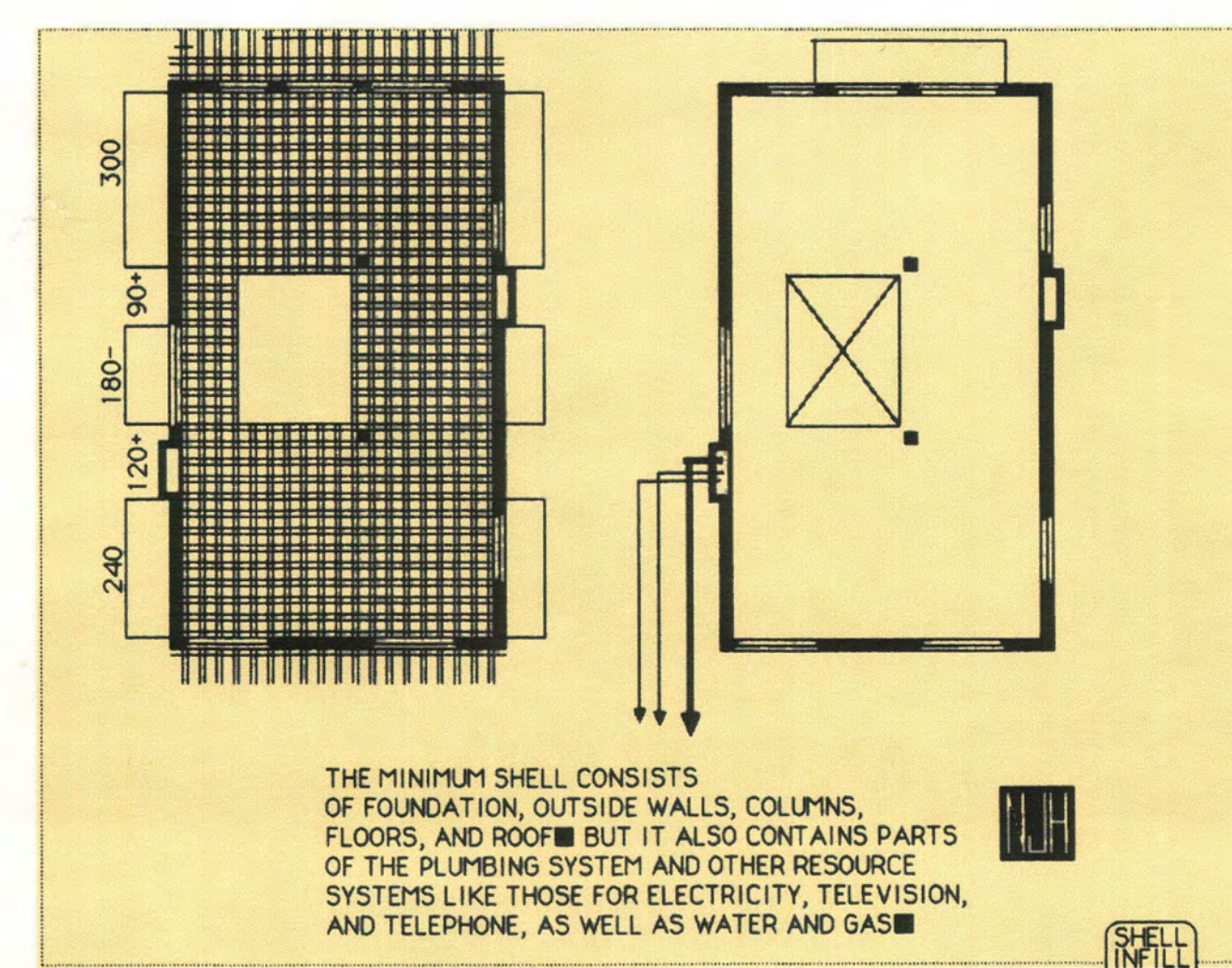
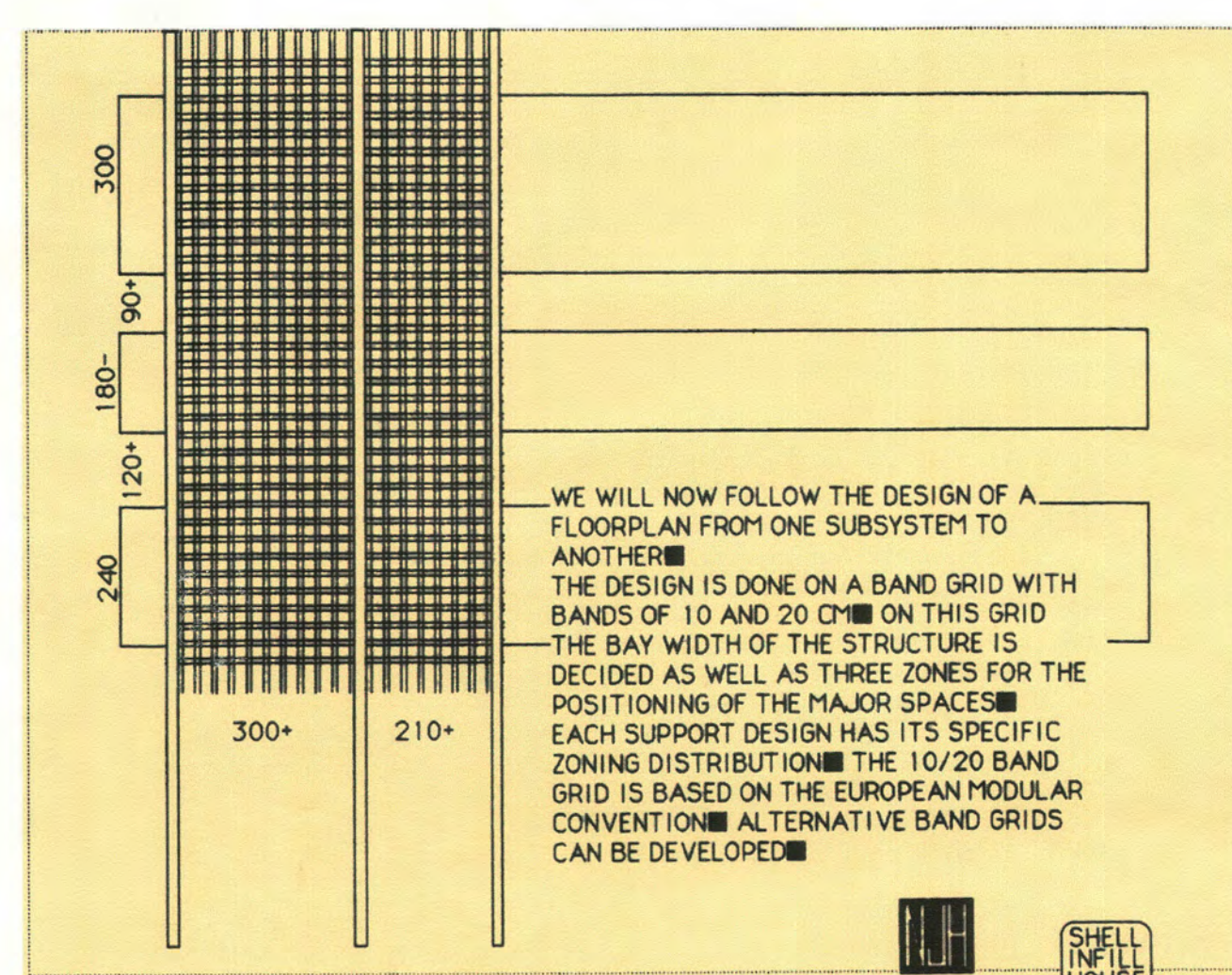
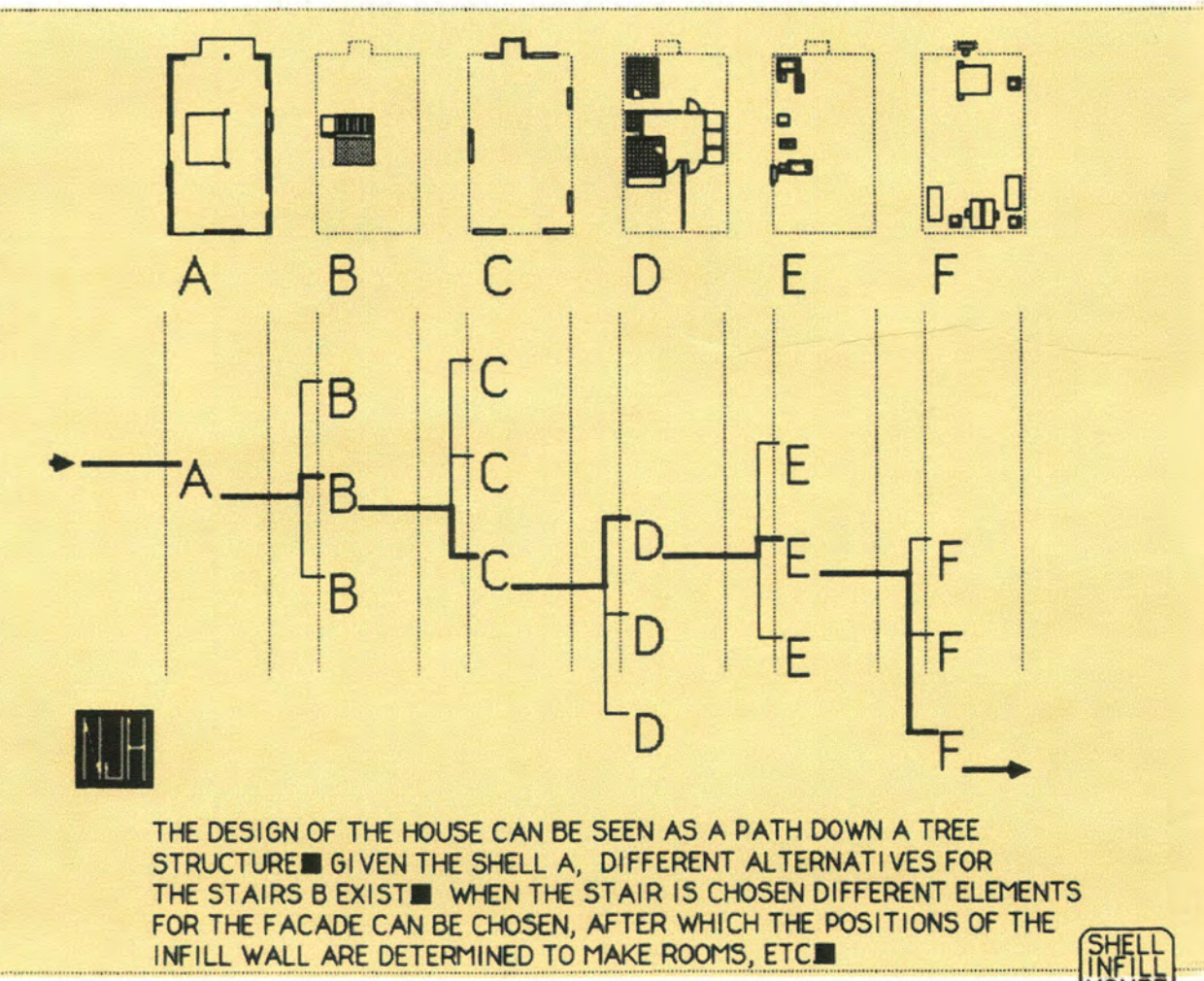
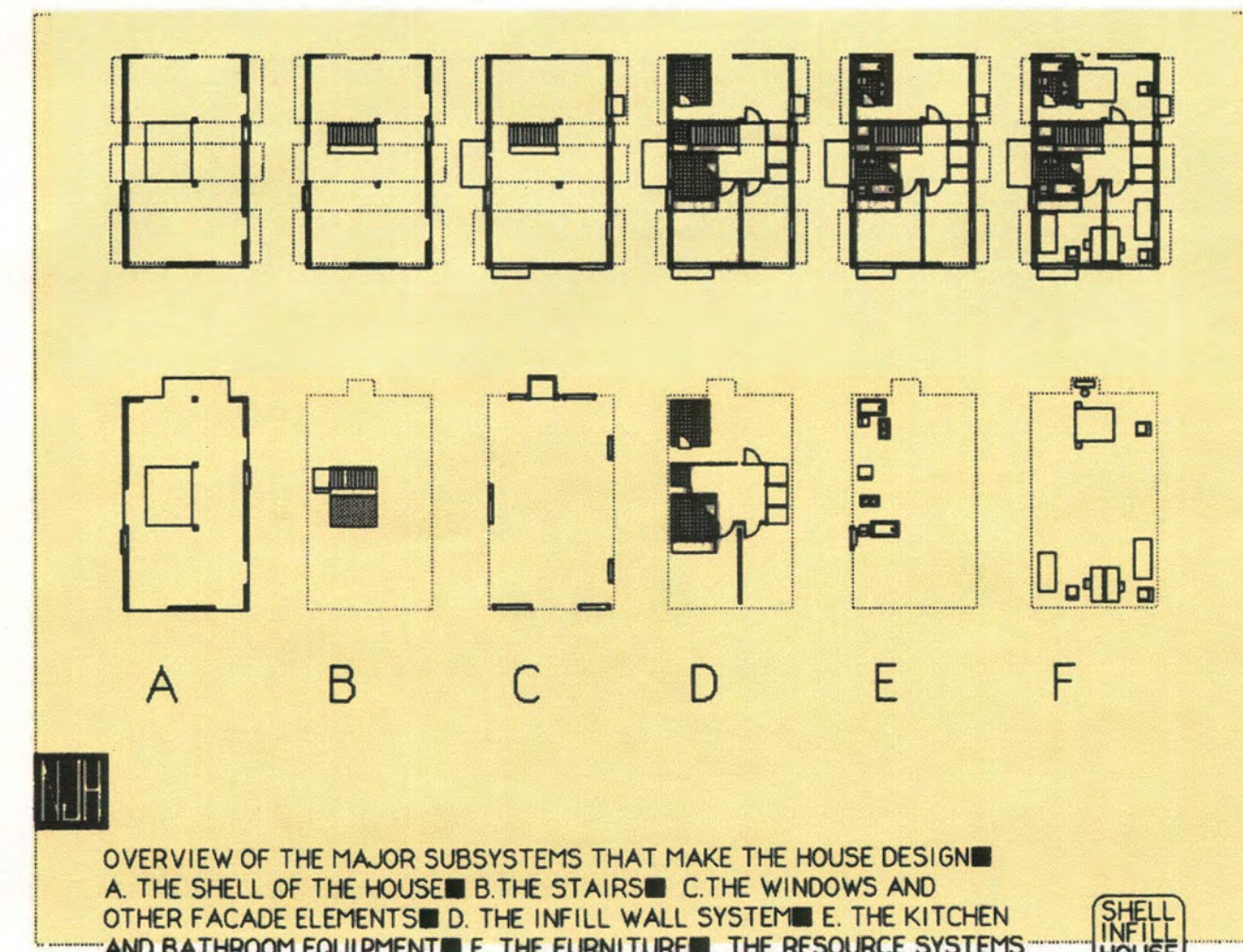
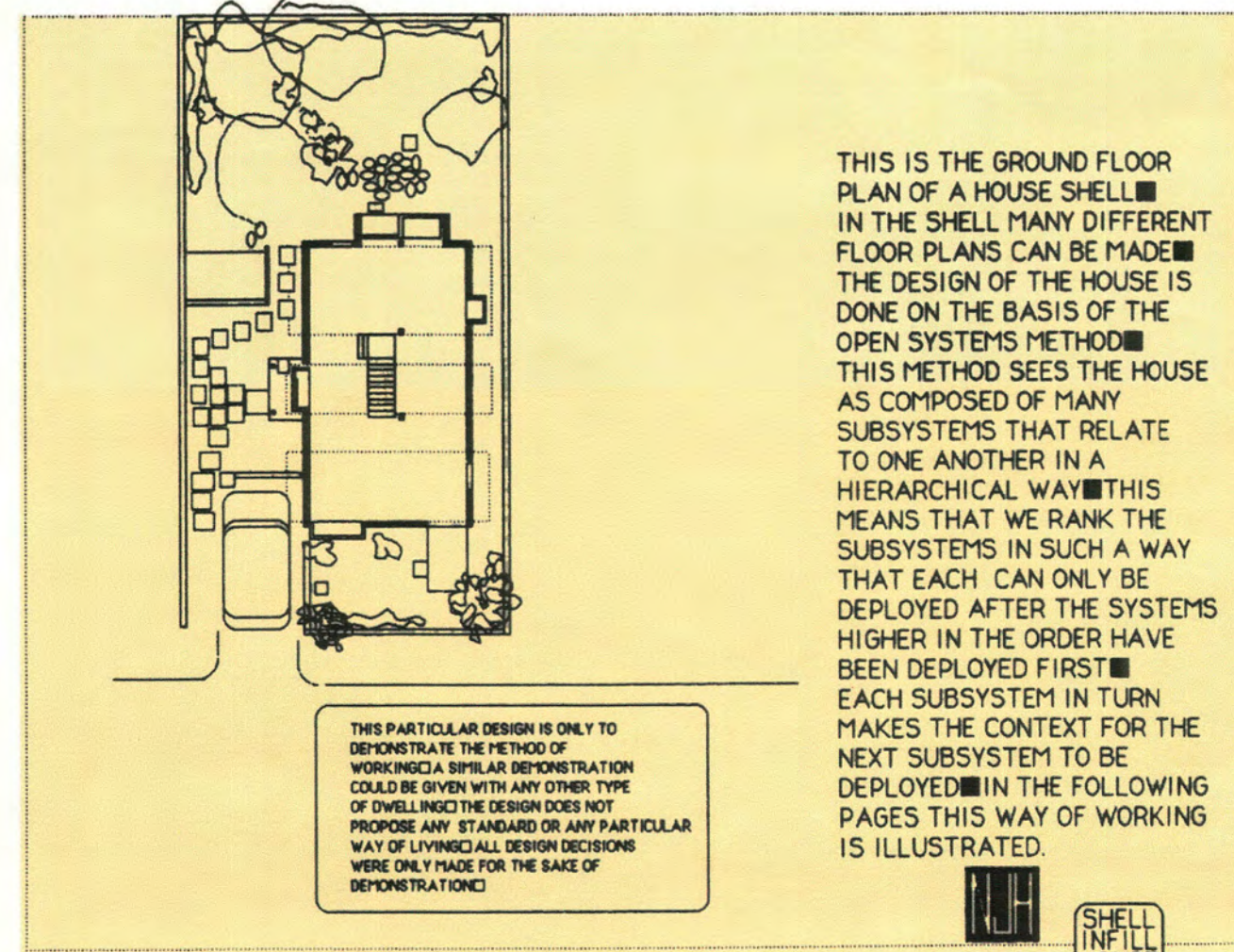
These are normal things. We would be surprised if in every house everything were either completely uniform or entirely different. It is also normal to return to the same site, years later, and find that some of the things that were the same are now different, as households take care to adjust their homes to their own and changing life patterns and expectations.

We will also find that, parallel to the process of differentiation, there remains a certain conformity, which comes about because the houses share a context, a site, a number of regulations, a building process and a repertoire of materials and methods, as well as any number of tacit conventions about how to live in a single family house in that place." (Stephen Kendall)

These notes serve as a background to the study displayed here. In his introduction to this SHELL/INFILL HOUSE study, John Habraken wrote: "In the drawings presented here, the particular design is only to demonstrate the method of working. A similar demonstration could be given with any other type of dwelling. The design does not propose any standard or any particular way of living. All design decisions were only made for the sake of demonstration."

SHELL INFILL HOUSE

A STUDY ON THE APPLICATION OF THE OPEN SYSTEMS APPROACH IN HOUSING DESIGN SUBMITTED TO MY COLLEAGUES AND FRIENDS IN JAPAN MAY/JUNE 1987
N. JOHN HABRAKEN



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