

38
86

THE DEVELOPMENT OF A LINEAR ENVIRONMENT

by
Pier Paoli

Thesis submitted to the Faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

MASTER OF ARCHITECTURE

APPROVED:

W. W. Brown, Chairman

O. C. Ferrari

G. Lehmann

November, 1987
Blacksburg, Virginia

ACKNOWLEDGEMENTS

I sincerely wish to acknowledge the following people for their contribution to this thesis: my mentors, Professors Brown, Lehmann, and Ferrari, for their close collaboration; Professor Schueller for his advice and criticism; Herbert for his interest in editing the text; and to all my close friends whom I've spent a most enjoyable part of my life with. Thanks for being supportive.

I wish to thank most especially Professor Lehmann, for his generous contribution of time and knowledge.

Above all, I wish to dedicate this book to my wife , my mother, and the rest of my family. They have all been my greatest supporters.

TABLE OF CONTENTS

TITLE	
ABSTRACT	
ACKNOWLEDGEMENTS	
TABLE OF CONTENTS	
INTRODUCTION5
- Assembling the Block7
THE CONCEPT8
- The Form9
- Relating Spaces to the Street	10
- Center, Path and Domain	11
- Light and Shade	12
RELATED PROJECTS.	14
- Visions and	15
- Realities	16
THE COMPONENTS.	18
- The Process ... The Rhythm	19
- The Structure	20
- The Module.	21
- Modular Arrangements	22
- Massing.	23
THE STRUCTURE	24
- Plans.	25
- Elevations	34
- Longitudinal Section	35
- Section Perspective.	36
- Perspectives: Beneath the Incline	37
Arcade Exterior	38
Arcade Interior	39
Along the Walkway	40
- Model Studies.	41
- Conclusion	43
APPENDICES	44
VITA	46

INTRODUCTION

This thesis is a study of the development of a linear urban environment formed through the arrangement of a repetitive structure. My aim is to propose a prototypical model in which the dwelling, workplace and related amenities can function satisfactorily together within the same structure.

A linear form was adopted due to its inherent ability to express direction, signify movement and growth, and adapt to various topographical conditions. Distinct linear spaces permit the dual function of circulation routes and human interaction. Studies of similar forms of multi-functional spaces such as piazzas and pedestrian streets indicate that there exists a strong relationship between the dwelling, workplace and the street.

Interest in the linear form gained popularity amongst Futurists in the late nineteenth century. The potential of the linear form was realized in Tony Garnier's *Cities Industriales* and Arturo Soria Y Mata's proposal to link linear districts by means of an elevated railway system. These theoretical studies served as a basis for related works such as Moshe Safdie's *Habitat 67* and Patrick Hodgkinson's *Brunswick Center*.

Similarly, the basis for this thesis evolved from prior ideologies. My intent is to create a prototypical form that could adapt to both urban and suburban situations. Therefore, the success of this scheme can be assessed by the way the prototype functions within a real situation.

Spaces generated within this design are arranged in a hierarchical order relating to their functions. Dwelling units are constructed in modular arrangements, terraced within an inclined structure. Stability for this structure is achieved by linking pairs of structural supports back to back with intermediate lateral supports that also function as circulation routes. Terracing of the modules permits maximum exposure of sun, air, and views, while creating large open living spaces within a private setting.

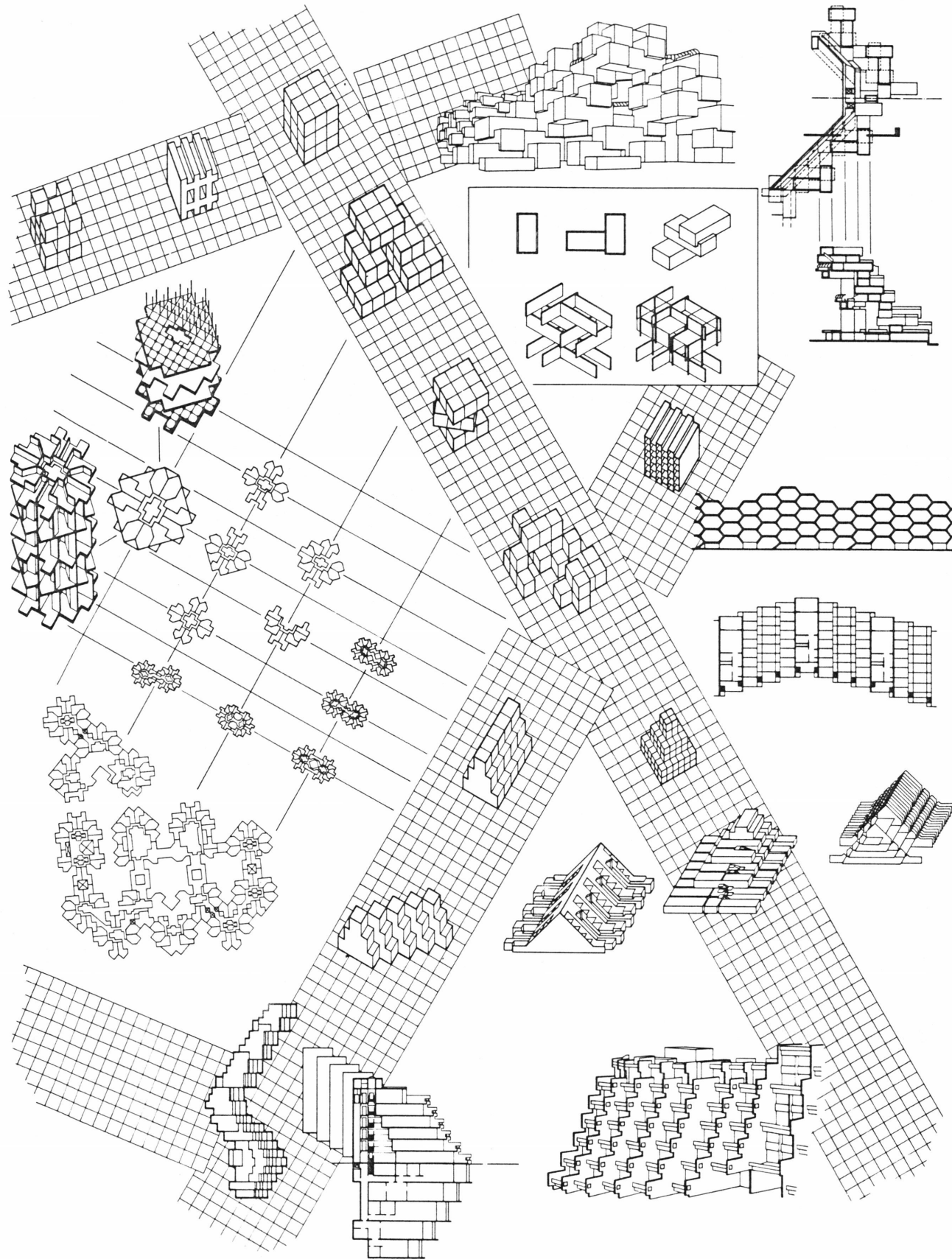
Groupings of structural supports form the block, which becomes part of the city. Spaces beneath the incline function as an arcade, providing urban amenities. The transition between these spaces occurs through a latticework of circulation routes. This "layering" permits growth or change of the sub-components without affecting the whole and the design establishes a hierarchy (dwelling-street-block-city) of spatial relationships.

The manner in which these spaces are used depends upon the needs and desires of the users. The quality of the space should express the values of its users. In order for the spaces to function satisfactorily, they must be fluid so that private spaces can flow into public spaces and vice versa. This is found in many Asiatic and European towns where the dwellings enclose a space and form the street. The architecture therefore responds to the spaces that are formed along its path. Balconies, stairs and views focus onto this space and develop a relationship between the dwelling and the street.

This permits the interior spaces to manifest outwardly and establish a sense of communal space.

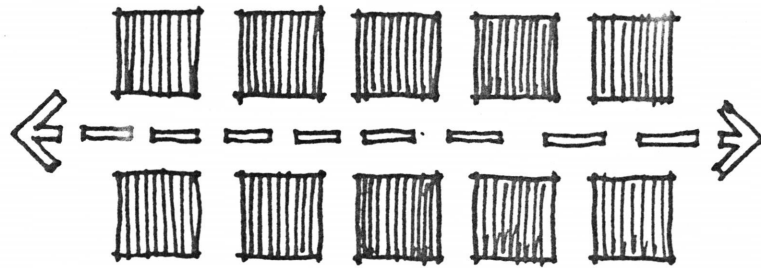
Light filters into the spaces beneath the incline from the voids between the clustered modules. This provides the warmth and liveliness that is a part of a "living street."

The nature of this environment is to provide the conveniences of an urban center. This proposal, therefore, stands as an example for future developments. Critics may be skeptical about this type of environment, but I am convinced it provides the best possible living conditions.



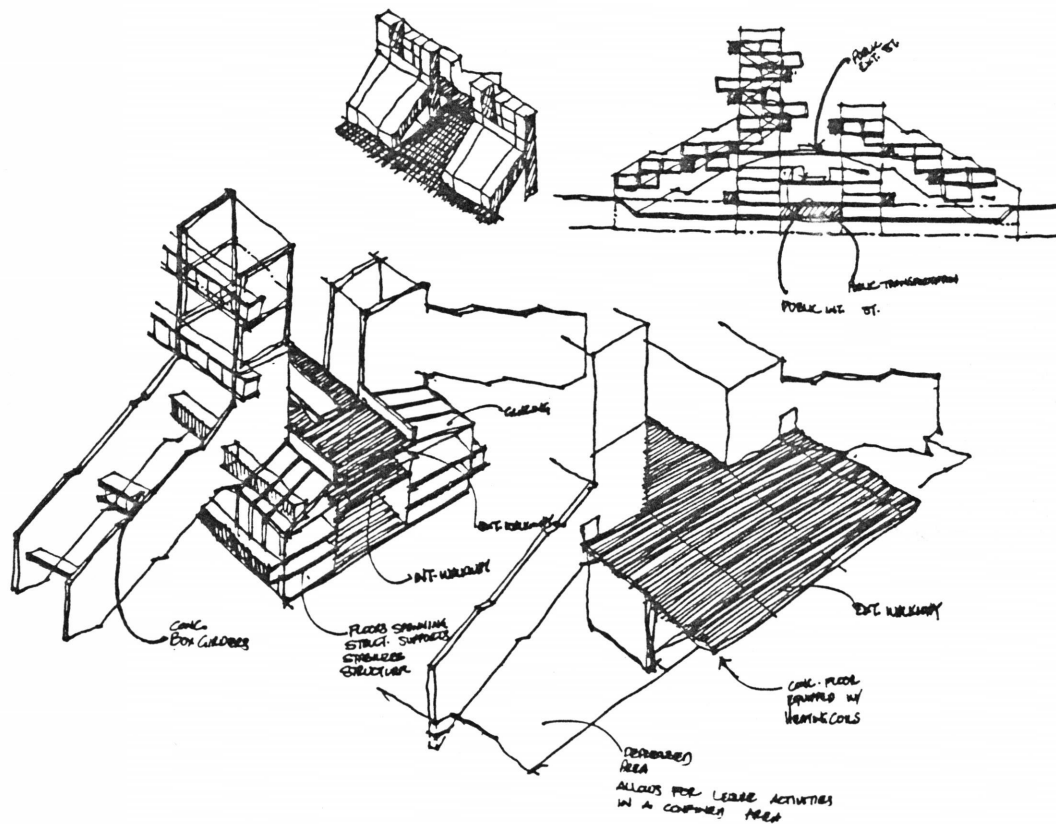
THE CONCEPT

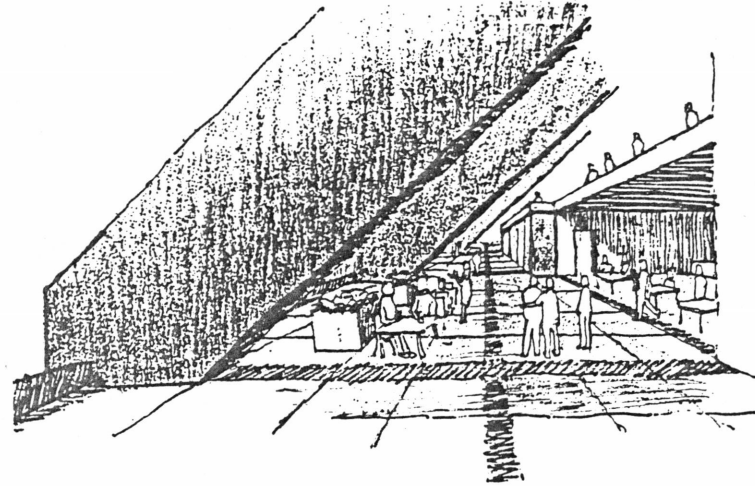
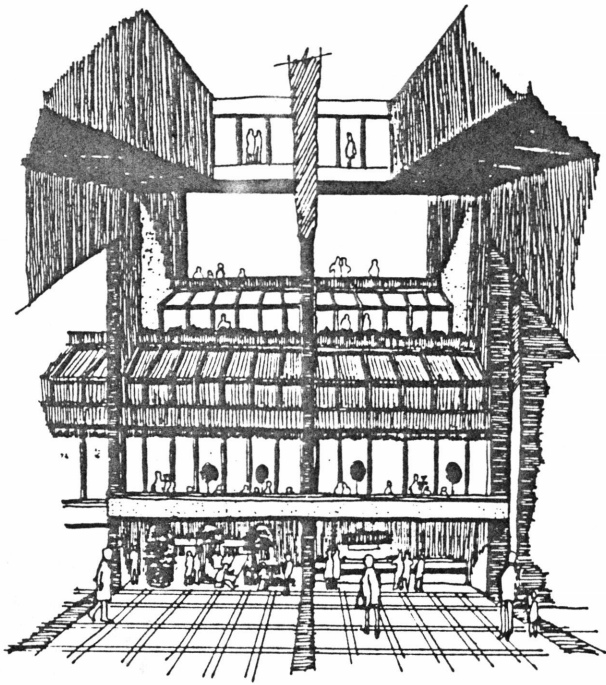
- MODULES LINKED & ORGANIZED ALONG ITS LENGTH



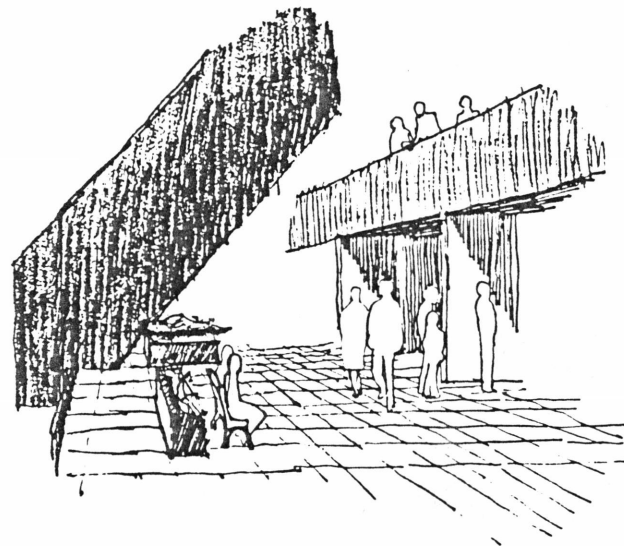
"The size and proportion of these elements are directly related to the structural tasks that they perform and can be, therefore, visual indicators of the size and scale of the spaces they help enclose."

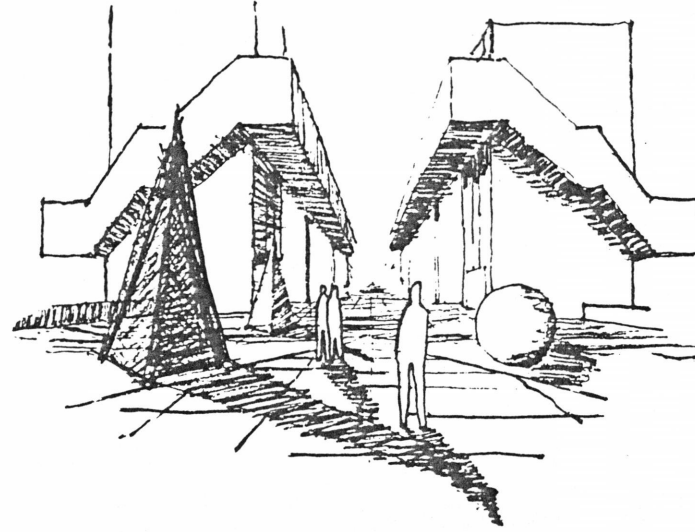
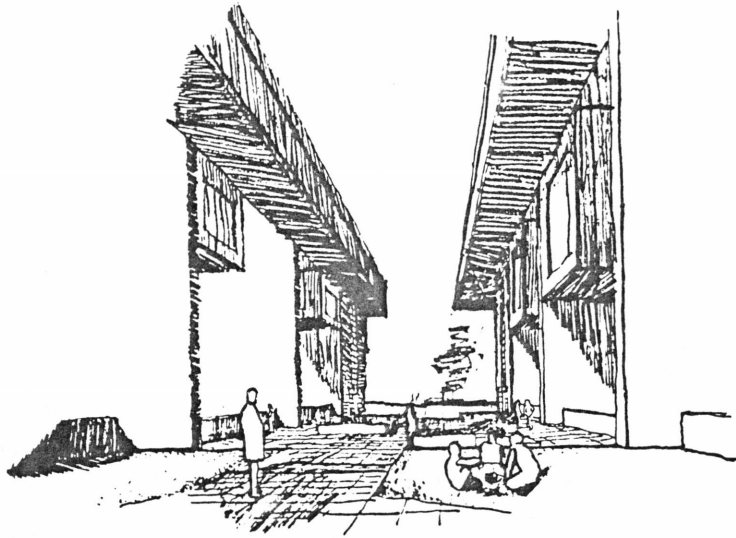
FRANCIS D. K. CHING





Popularity of the urban street is generated through the diverse activities that occur along its path. This space becomes much more enjoyable when the pedestrian and the automobile are separated. Pedestrian streets are attractive because of the human interaction and pace of movement. In many ways the street becomes a platform of events for the participants and on-lookers.





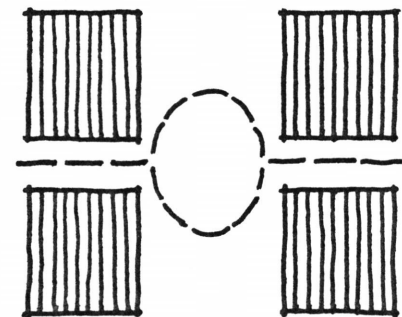
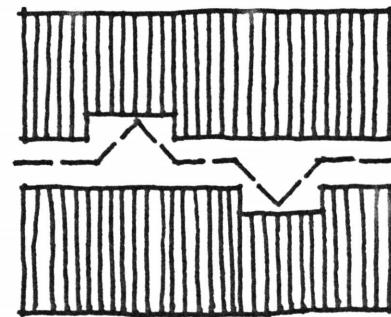
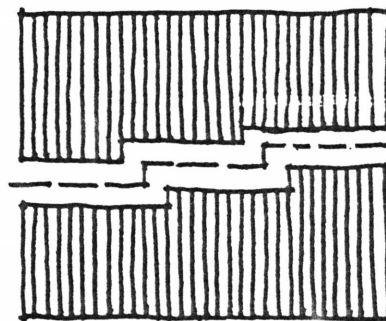
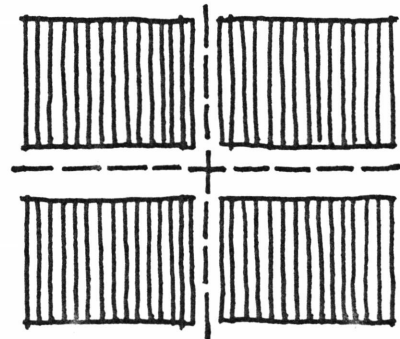
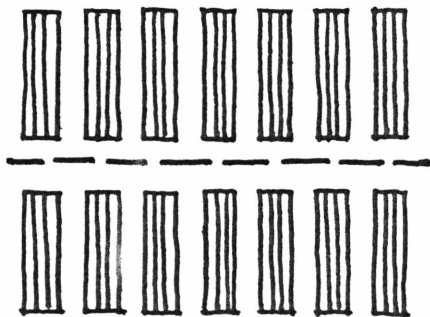
A boundary is created through repetitive planes. The strength of the boundary is dependent upon the degree of the enclosure.

Volume and flow of movement is indicated through a hierarchy of circulation routes.

Leisurely pace along the path--movement through this space is offset by the changes in direction and levels.

Pauses along the path offer a relief from the movement and permit a variety of activities to occur.

Space becomes a connector between objects creating the potential for gatherings and meetings to occur.
--expectation of event



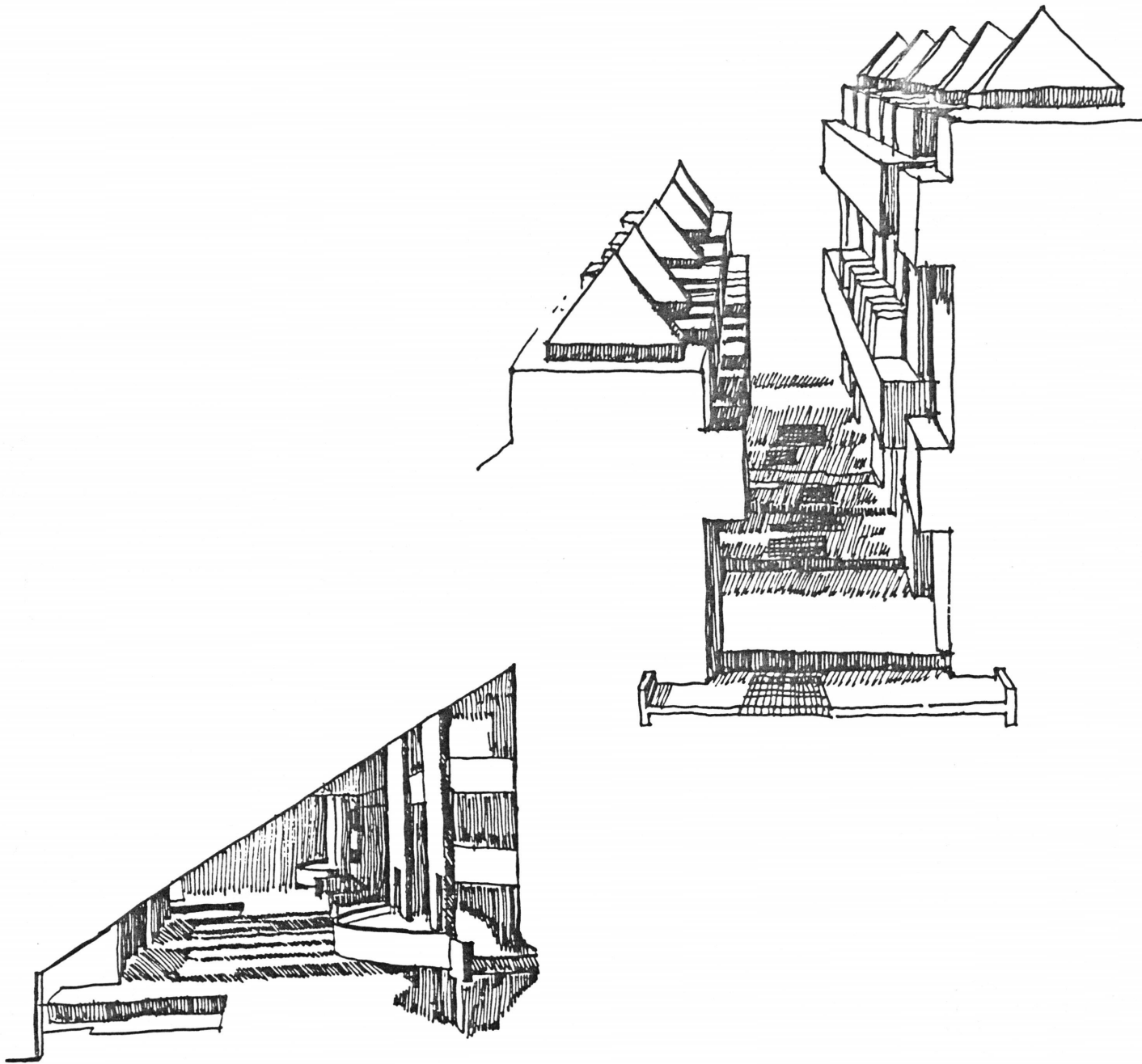
"Architecture is the masterly, correct and magnificent play of masses brought together in light. Our eyes are made to see forms in light; light and shade reveal these forms ..."

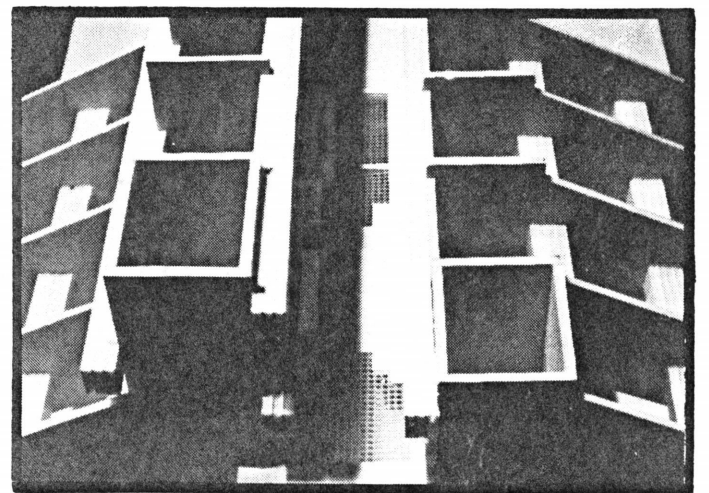
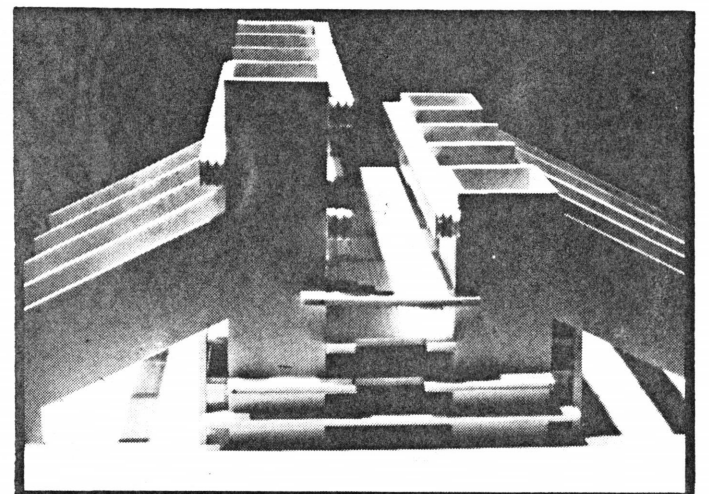
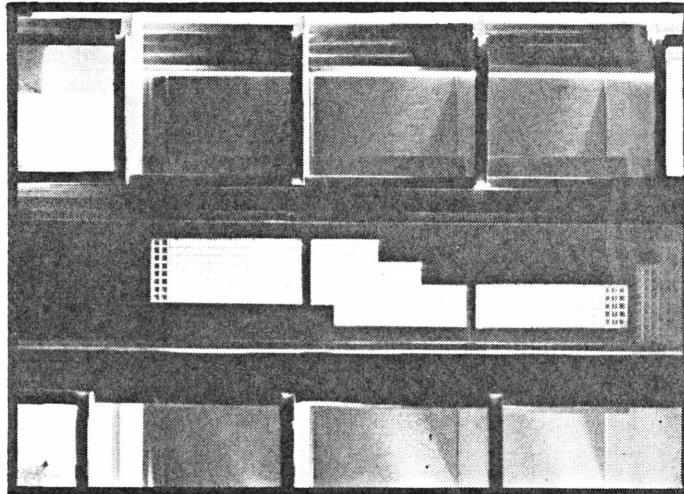
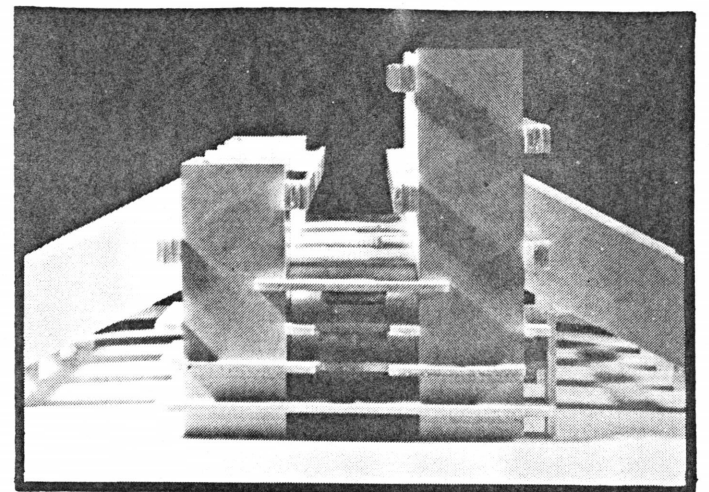
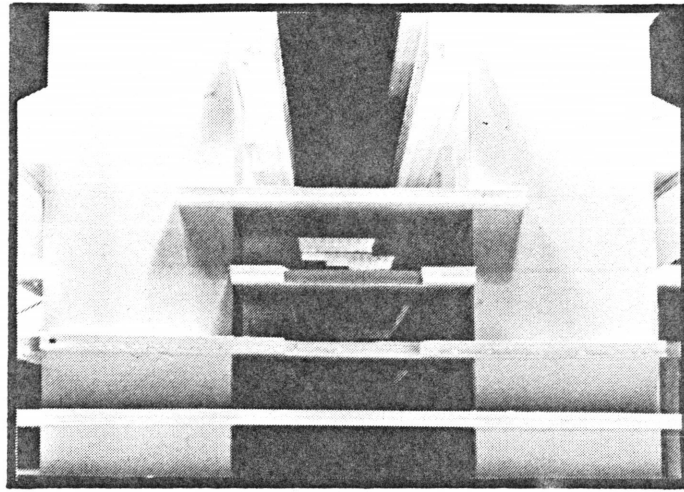
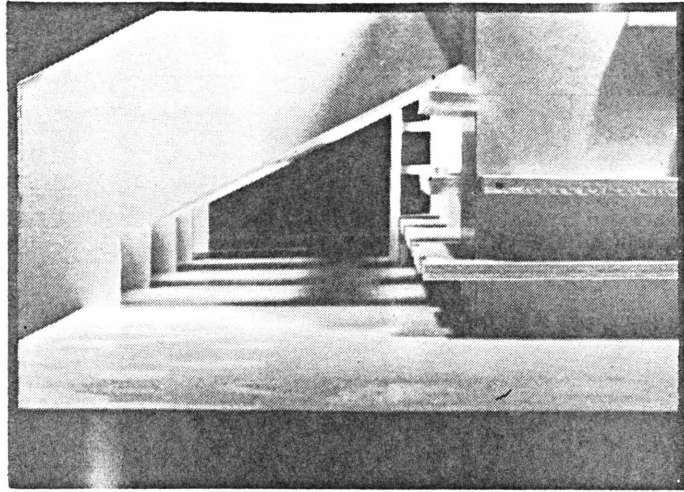
LE CORBUSIER

Terracing provides adequate light to the modules along the perimeter of the incline and onto the elevated pedestrian street. However, the light that filters down onto the spaces beneath the incline is limited.

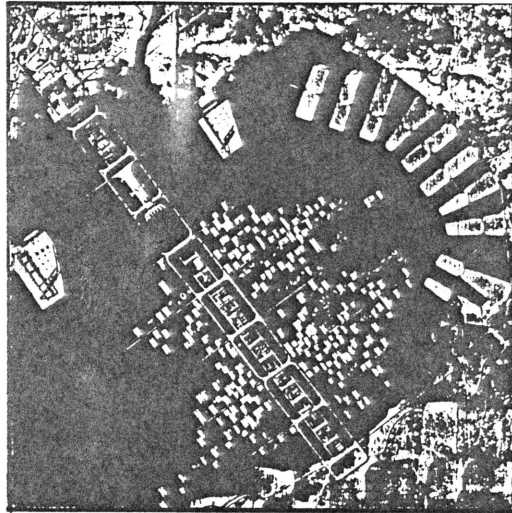
Direct sunlight is not a critical factor. However, the quantity and quality of light is important. In order to increase the ambient light levels, light coloured surfaces and glazing to reflect the light are used to illuminate the space.

Spaces within the arcade incorporate both natural and artificial lighting. Natural light is provided through the glass block walkway that creates the path along the pedestrian street. At night, the path becomes lit by the spaces below.



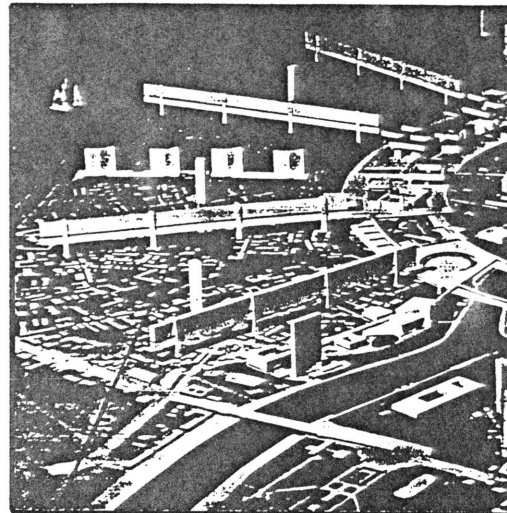


RELATED PROJECTS



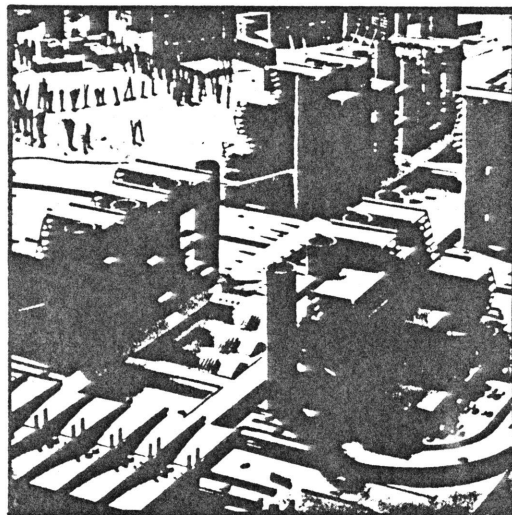
TOKYO BAY, 1960

Kenzo Tange
Arata Isozaki



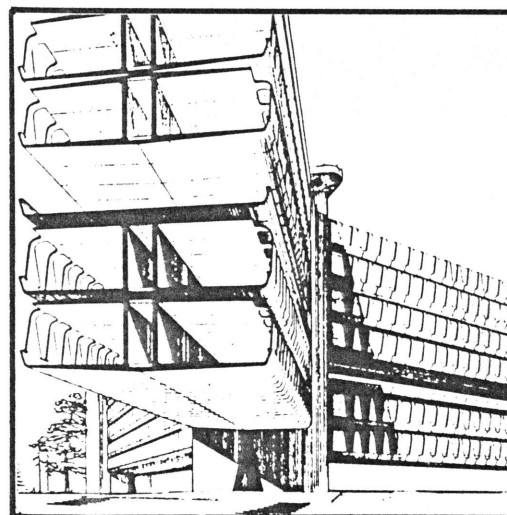
REDEVELOPMENT OF MOSCOW
CITY CENTRE, 1966

V. Kalinline, Y. Ivanov
P. Kovaliov, V. Magiudov
V. Tarassevitch



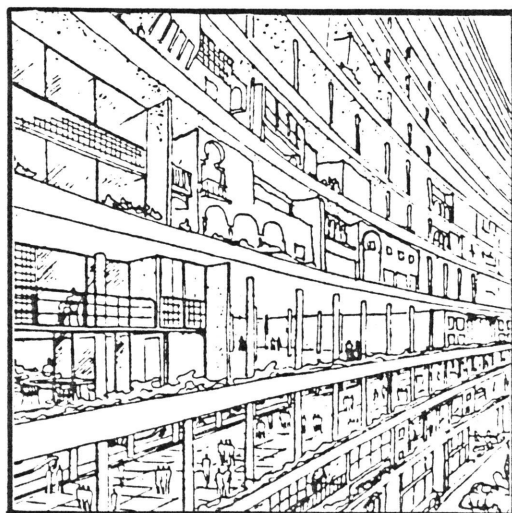
SKOPJE CITY CENTRE, 1965

Kenzo Tange



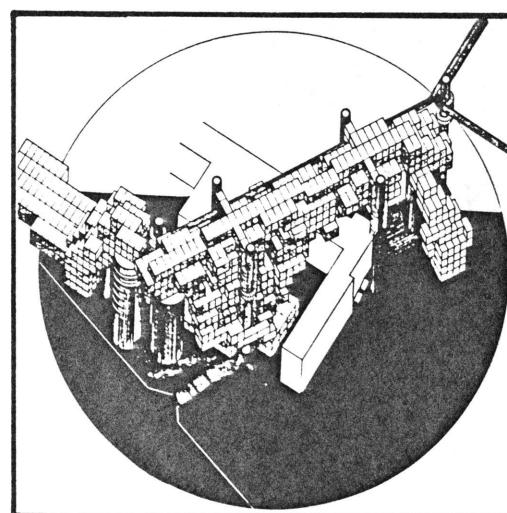
GIRDER BUILDING, 1966

Fabrizio Carola
Ettore Minervini
Luciano Boscotrecase



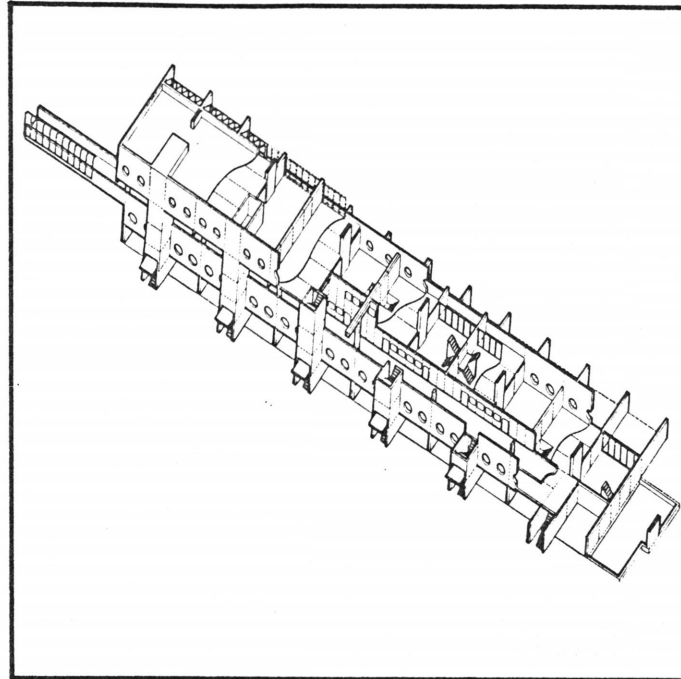
FORT L'EMPEREUR PROJECT
FOR ALGIERS, 1931

Le Corbusier



SPATIAL STRUCTURE OF RIGID
INTERLOCKING CELLS

Georg Kohlmaier
Barna von Sartory
Stefan Polonyi

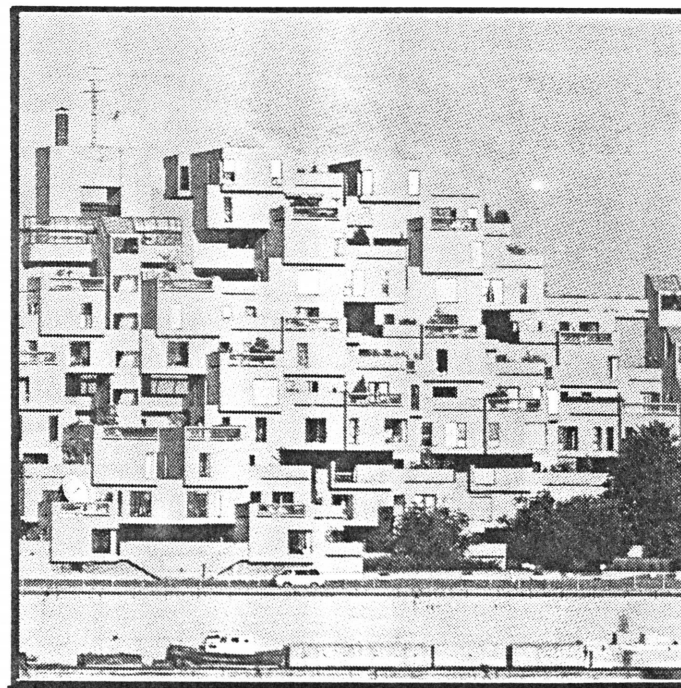


TOWN CENTER HOUSING
 JAMES STERLING (1968)
 RUNCORN, ENGLAND

This proposal was initially conceived as an alternative to the suburban sprawl.

The development was planned as a linear housing form creating cul-de-sacs. All traffic feeds along a main artery that connects the town centre and highway.

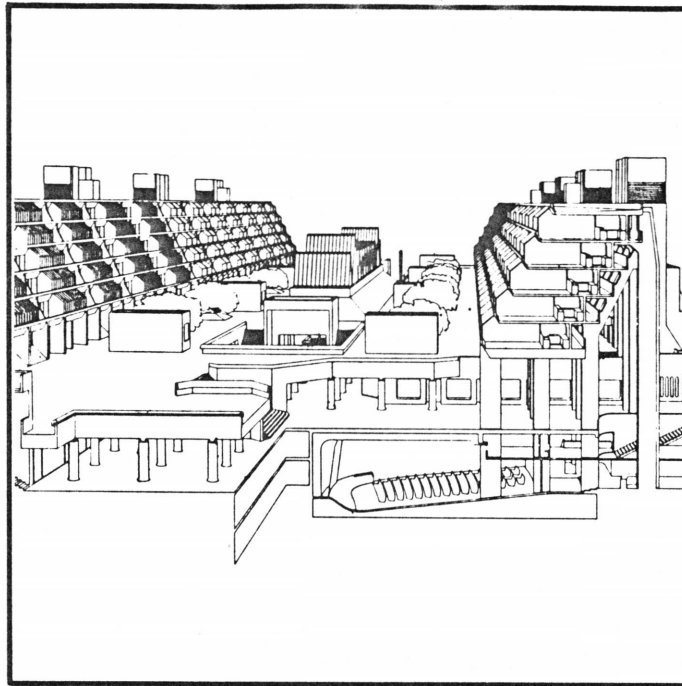
Elevated walkways are formed by setting back the units to create a path. Open corners of the cul-de-sac serve as commercial/retail spaces. Terraced blocks are formed through the repetition of a five-storey unit comprised of two lower duplex units topped by a single unit. These units are made of prefabricated concrete load-bearing walls and floors. Diagonally ribbed precast concrete panels are used as infill.



HABITAT
 MOSHE SAFDIES (1969)
 MONTREAL, CANADA

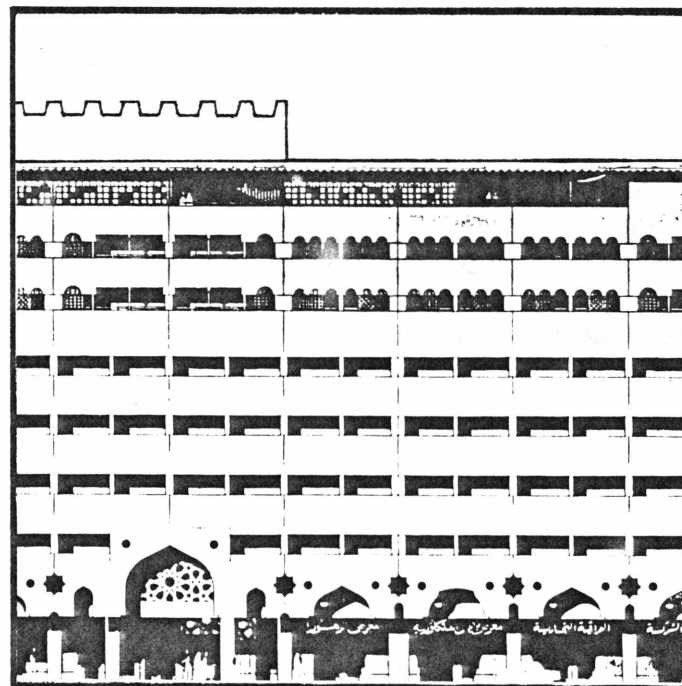
This scheme was designed as a prototypical model for middle-income city dwellers in a medium-density development. The modules offer privacy, identity and open spaces of a single family suburban house.

This structure is composed of three dimensional loadbearing units connected by a "post-tensioning" system. Units are terraced between pairs of box girders, creating a continuous zig-zag pattern. Despite high construction costs, access and servicing problems, Habitat is an example of successful multi-storey terraced housing.



BRUNSWICK CENTRE
 PATRICK HODGKINSON (1968-72)
 BLOOMSBURY, LONDON

This example provides maximum amenities without recourse to tall buildings. Stepped units flank an open public terrace beneath which commercial and professional offices, a cinema and parking are located. Criticism of this project has been directed at the void beneath the terraced units. However, this space provides access to the units and its repetitive structural form creates a monumental exterior that overpowers its surroundings. Nonetheless, this structure represents a period within the modern Urban planning and has historical value, if nothing else.



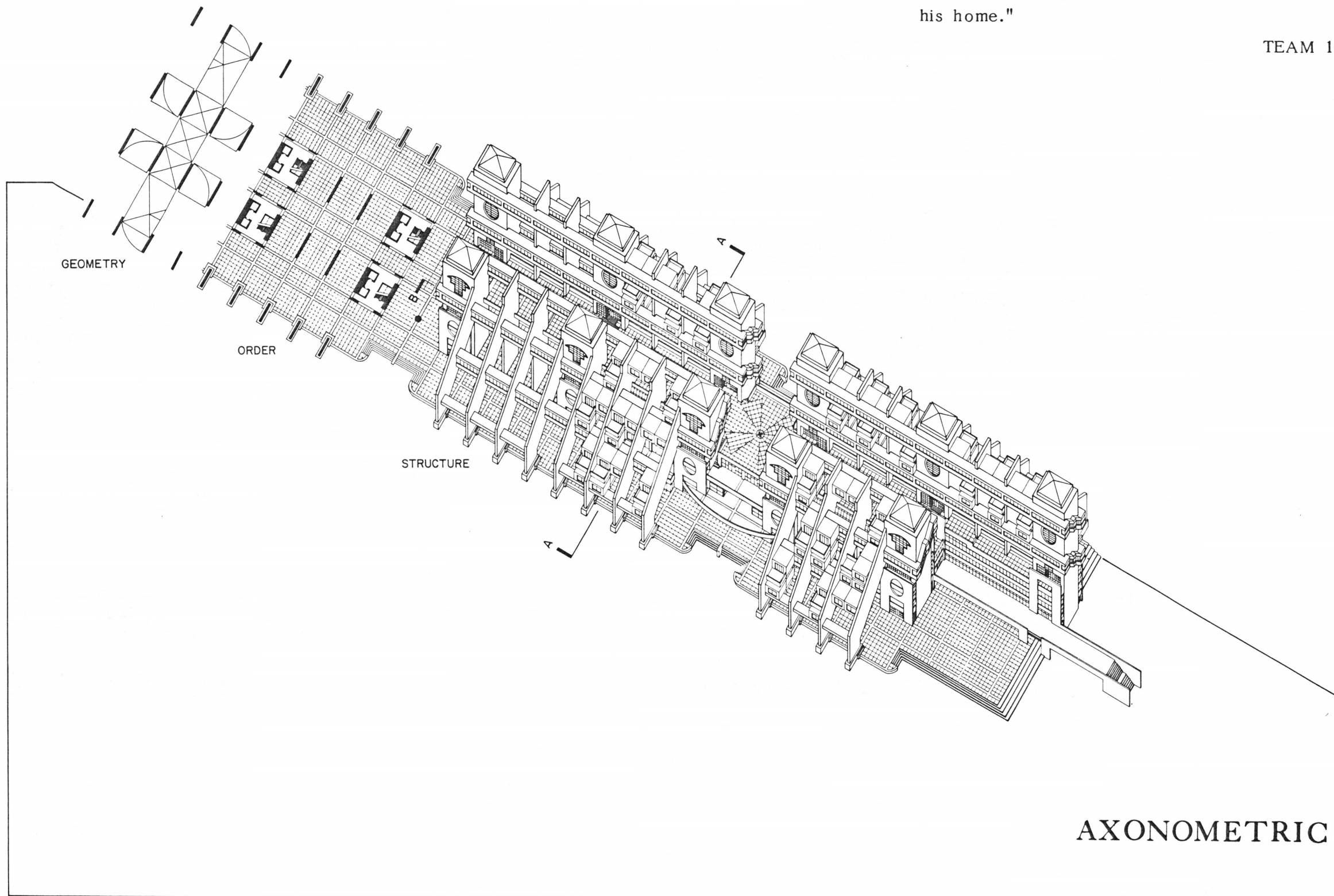
KHULAFI STREET DEVELOPMENT
 VENTURI, RAUCH, SCOTTBROWN (1982.)
 BAGHDAD, IRAQ

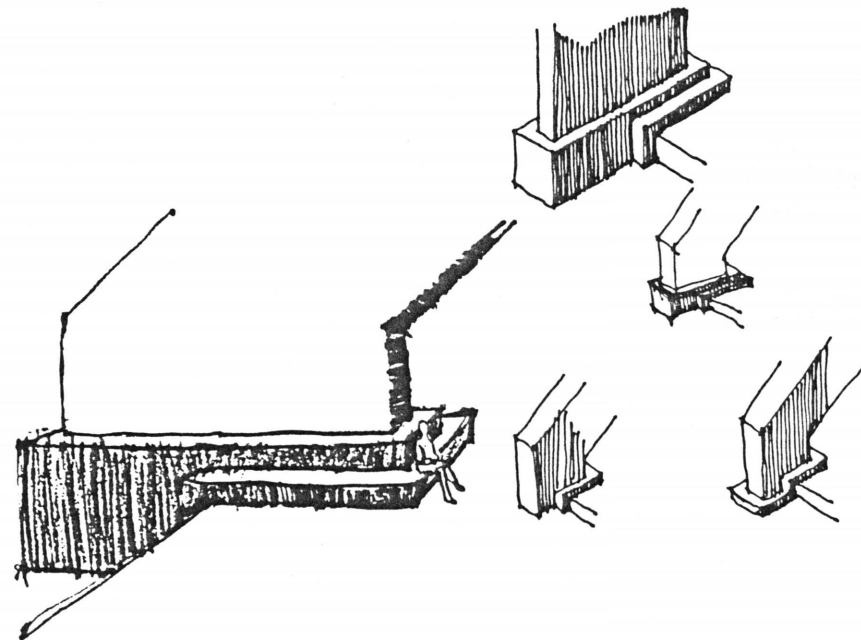
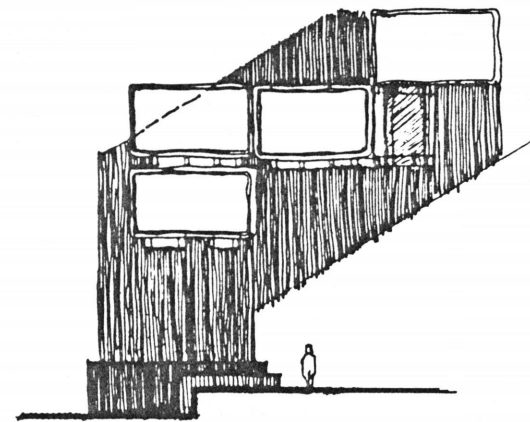
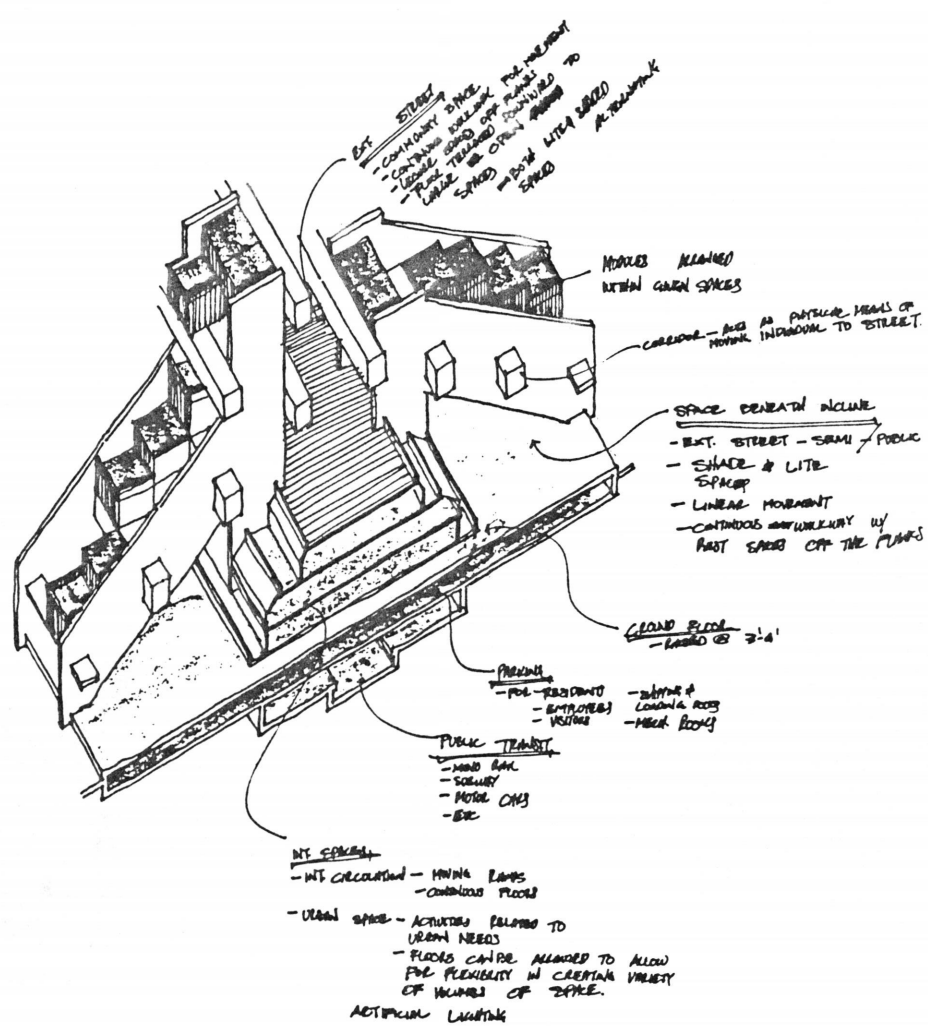
A nine-storey mixed use building with a shopping arcade on the bottom two floors, four office floors in the middle and three apartment floors at the top. The cast-in-place concrete structure is shaded by a continuous precast concrete screen wall with interstices for light and views along the main facades. The design gives urban quality to the high rise slab and the "brisesoleil" functions as both a decorative and structural element.

THE COMPONENTS

"It is impossible for each man to construct his house for himself. It is for the architect to make it possible for the man to make his house his home."

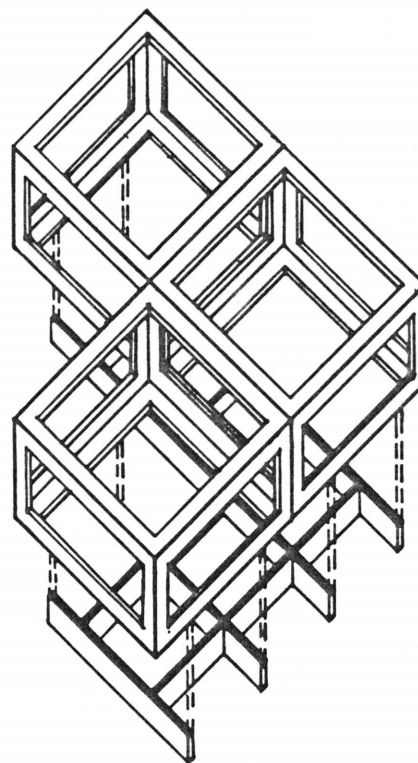
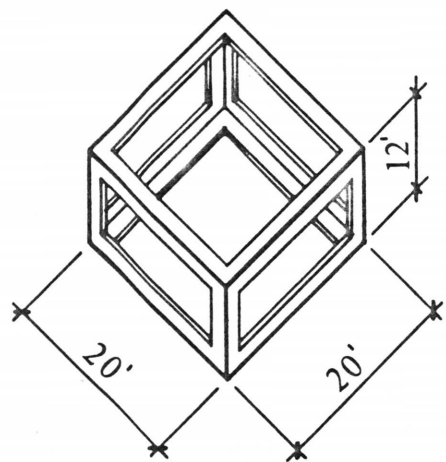
TEAM 10





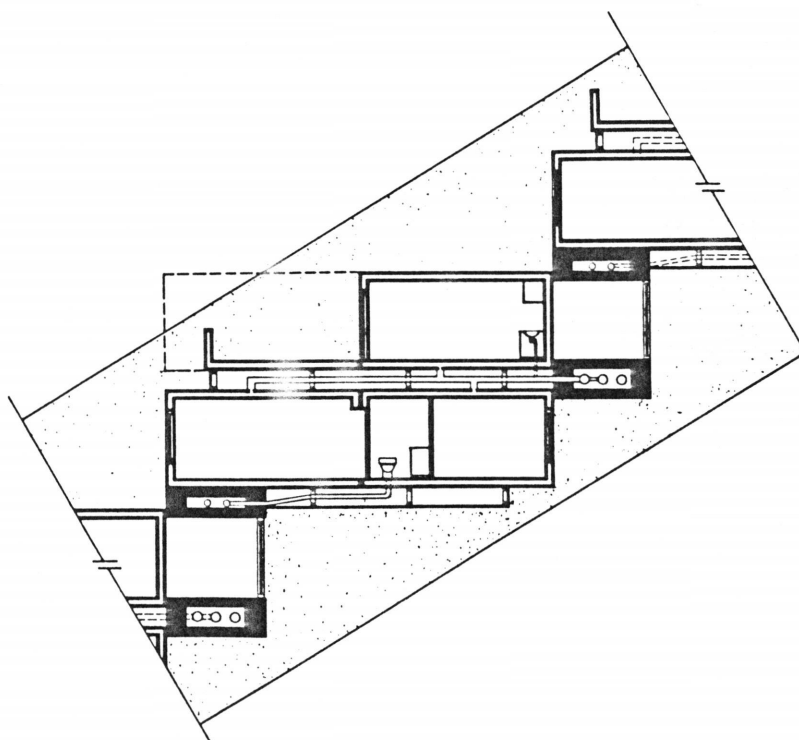
Designed as a prototypical model for medium density needs, this proposal combines the advantages of a high-rise building with the privacy of low-rise and terraced housing. The inclined structures are built of reinforced concrete that supports "prefab" modules within the slope. These units are assembled in situ and are secured to reinforced concrete girders which span the incline structure. Girders function primarily as corridors and carry the services within the void. Structurally, the girders and modules combine to stabilize the structure against longitudinal structural collapse.

Intermediate lateral supports flank pairs of structures along their widths to provide stability. Additional support is provided by the elevator and stair towers. These towers also function as arterial routes for services that branch off to the box girders and supply the units. The repetition of this pattern forms the block which forms the city.

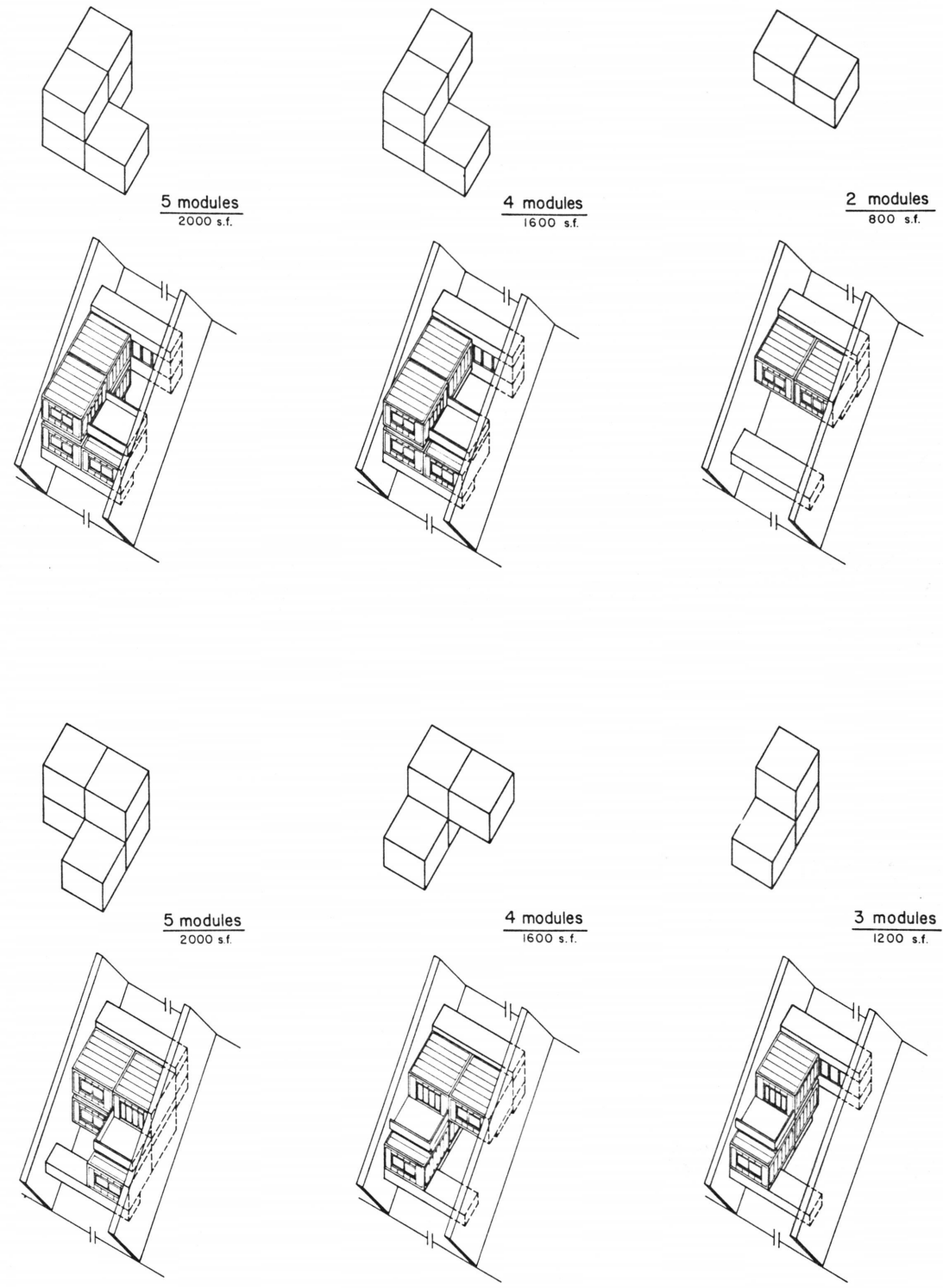


Modules are constructed of a 20'x20'x12' steel frame structure with intermediate supports. These are fastened together linearly to create a space frame structure. Stacking the modules requires a steel girder to join the two levels together. This girder is fastened to the side of the incline to provide a bearing ledge. The main support for the modules within the incline is provided by reinforced concrete box girders. The upper module is fastened to the face of the girder and the lower end is supported on top of a lower concrete girder. Additional rigidity is provided from the insulated metal panels that clad the structure.

Services to the all modules are provided within the void of the box girders and branch out into the steel girders supporting the modules.



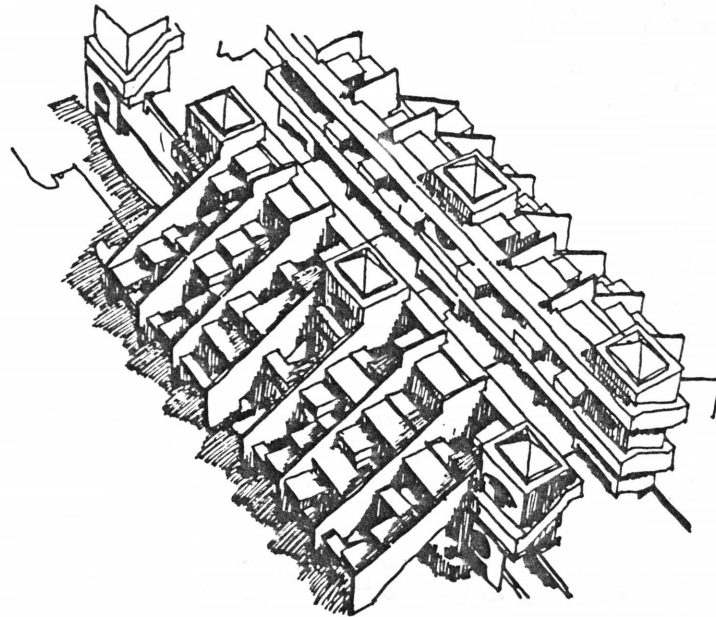
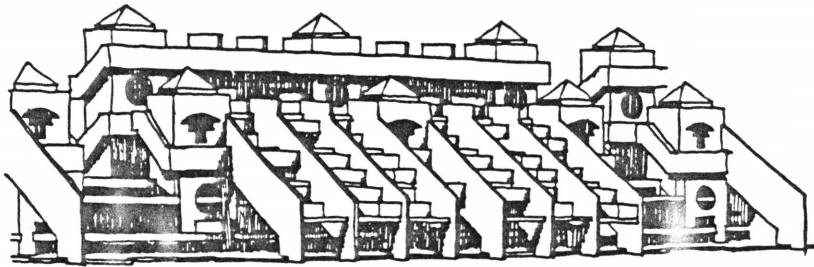
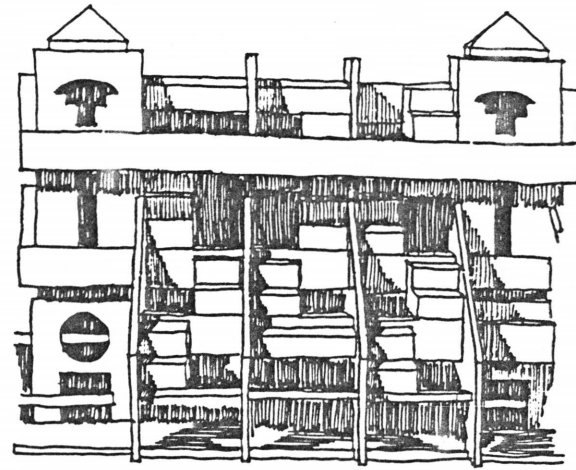
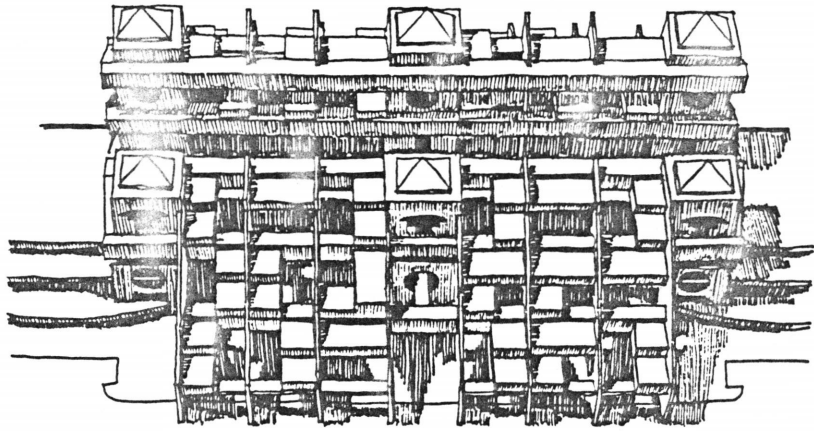
MODULAR ARRANGEMENTS



Terracing creates large roof areas that form part of the dwelling, by extending the interior spaces outward. Terraces permit close interaction between the public and private spaces. Yet some privacy is provided through the inclined structures that flank the dwelling and the terrace itself.

Variations in modular arrangements allow the resident individual creativity in arranging his own space. Groupings, however, are limited to the amount of enclosure within the incline. In order to provide the incline, modular arrangements do not exceed five in number.

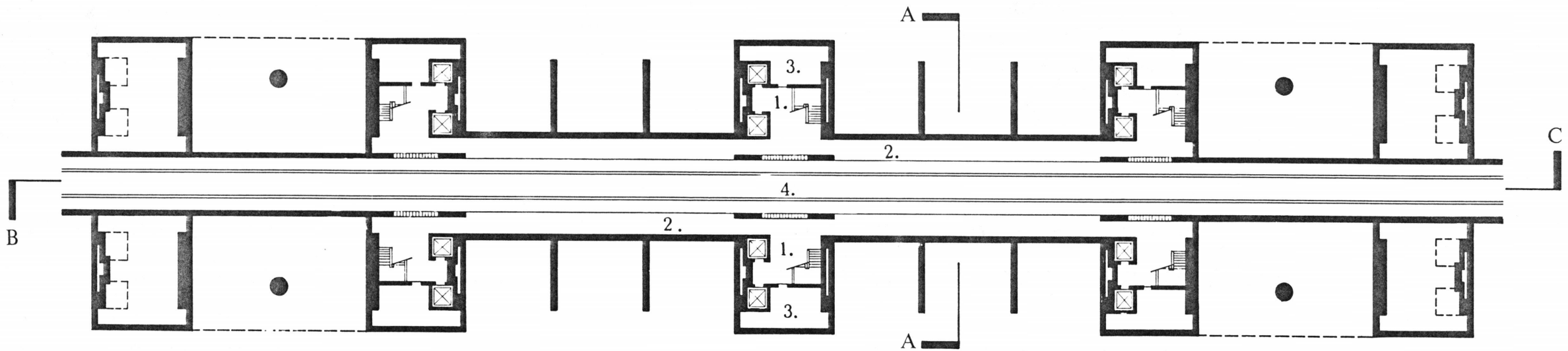
Separating modules in space expresses identity and creates its own quality of living. This form of expression is a means to create a sense of identity and diversity to the block.



THE STRUCTURE

LEGEND

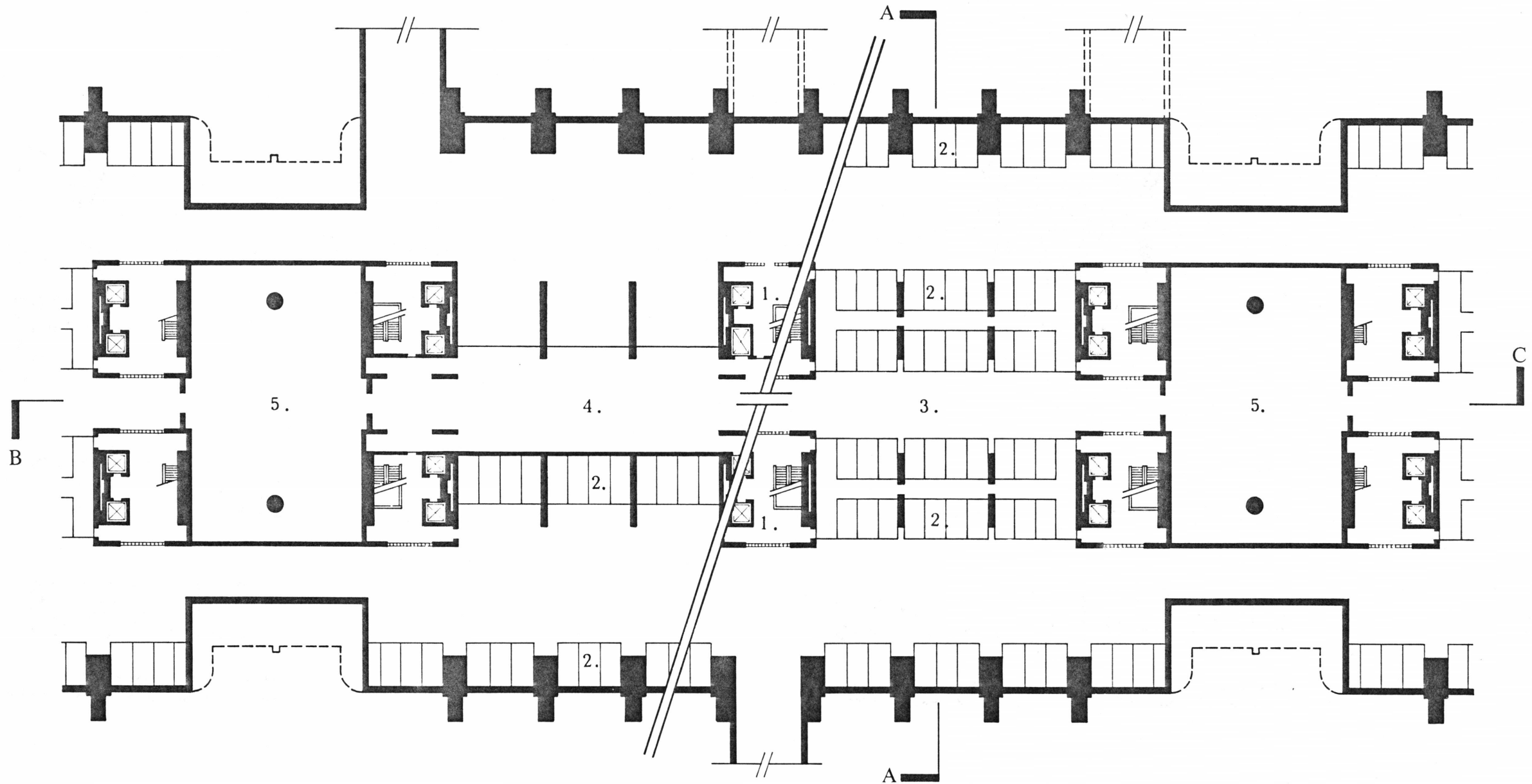
- 1. stairs / elevators
- 2. platform
- 3. service room
- 4. transit track



TRANSIT LEVEL

LEGEND

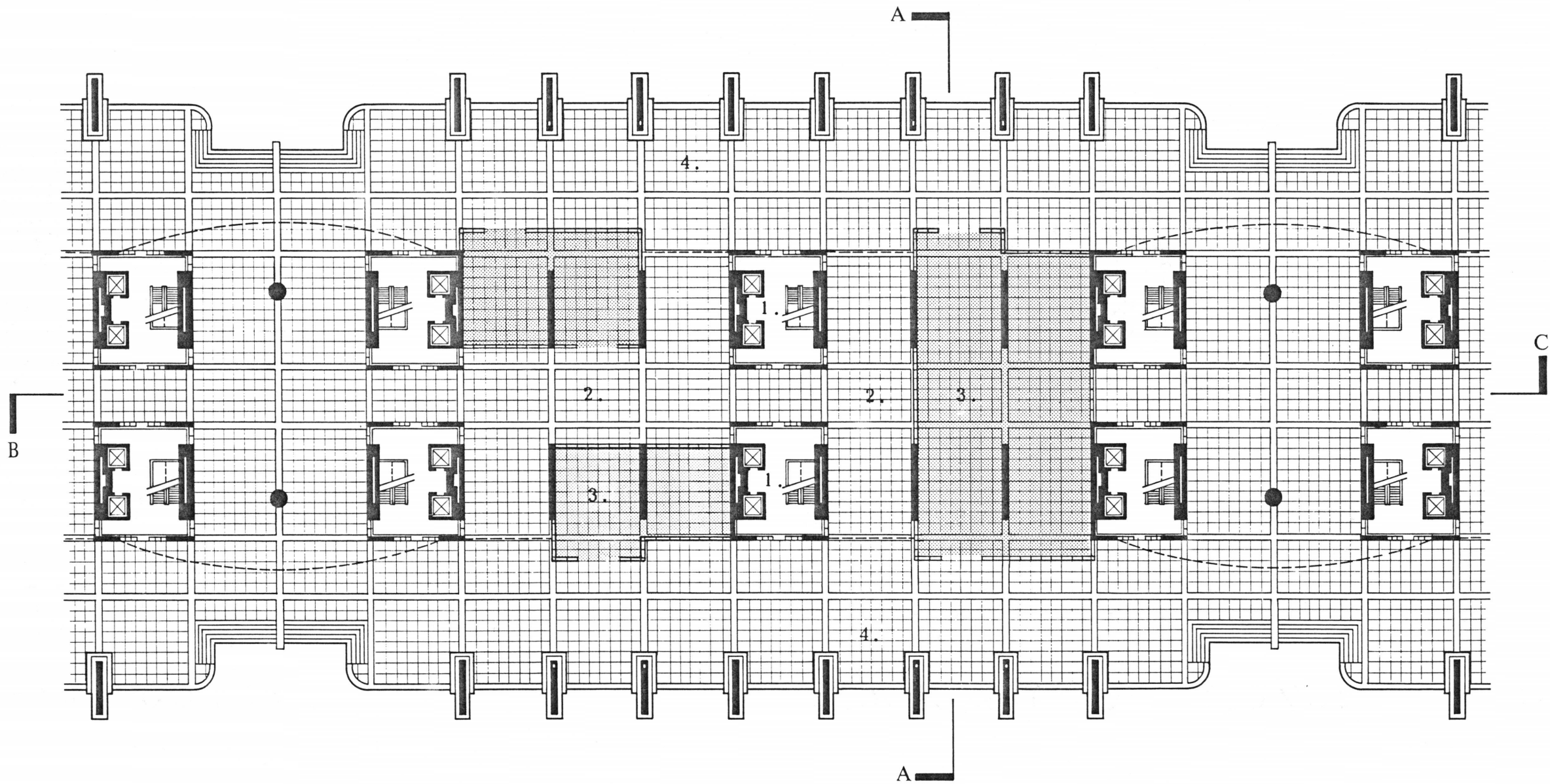
- 1. stairs / elevators
- 2. parking
- 3. walkway
- 4. loading
- 5. service room



LOADING/PARKING LEVEL

LEGEND

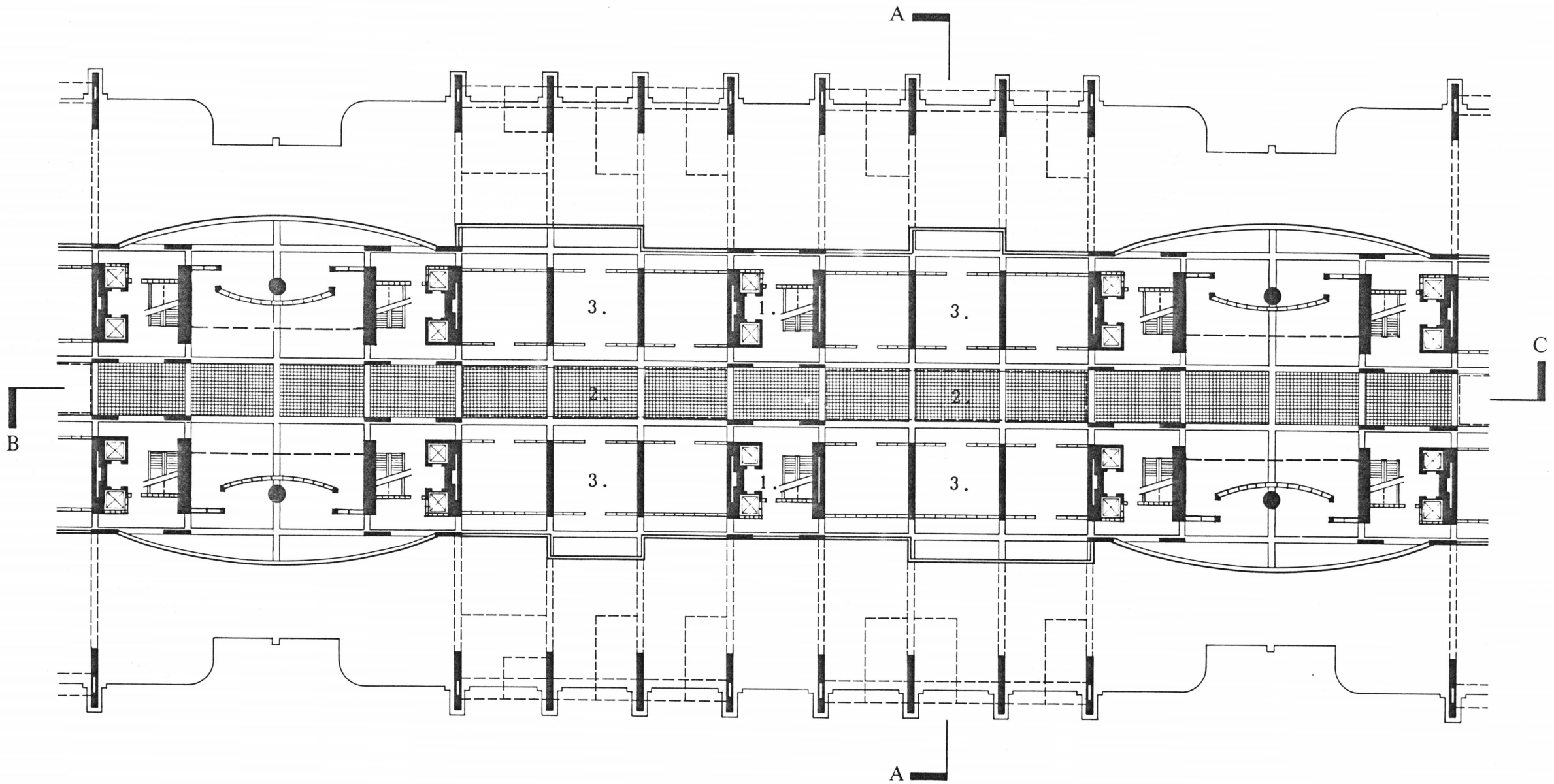
- 1. stairs / elevators
- 2. arcade
- 3. shops
- 4. walkway



GROUND LEVEL

LEGEND

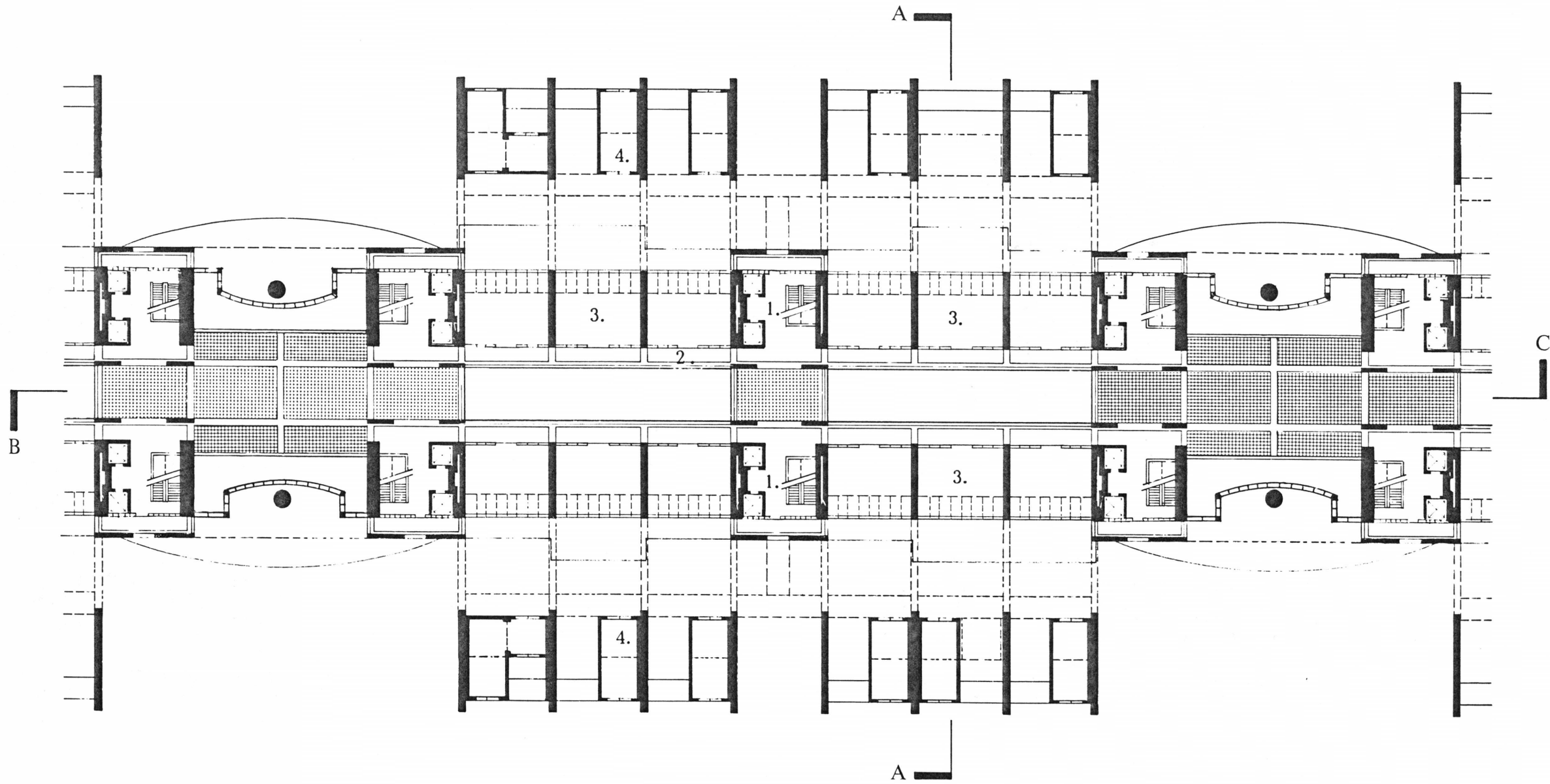
- 1. stairs / elevators
- 2. walkway
- 3. shops



LEVEL 1

LEGEND

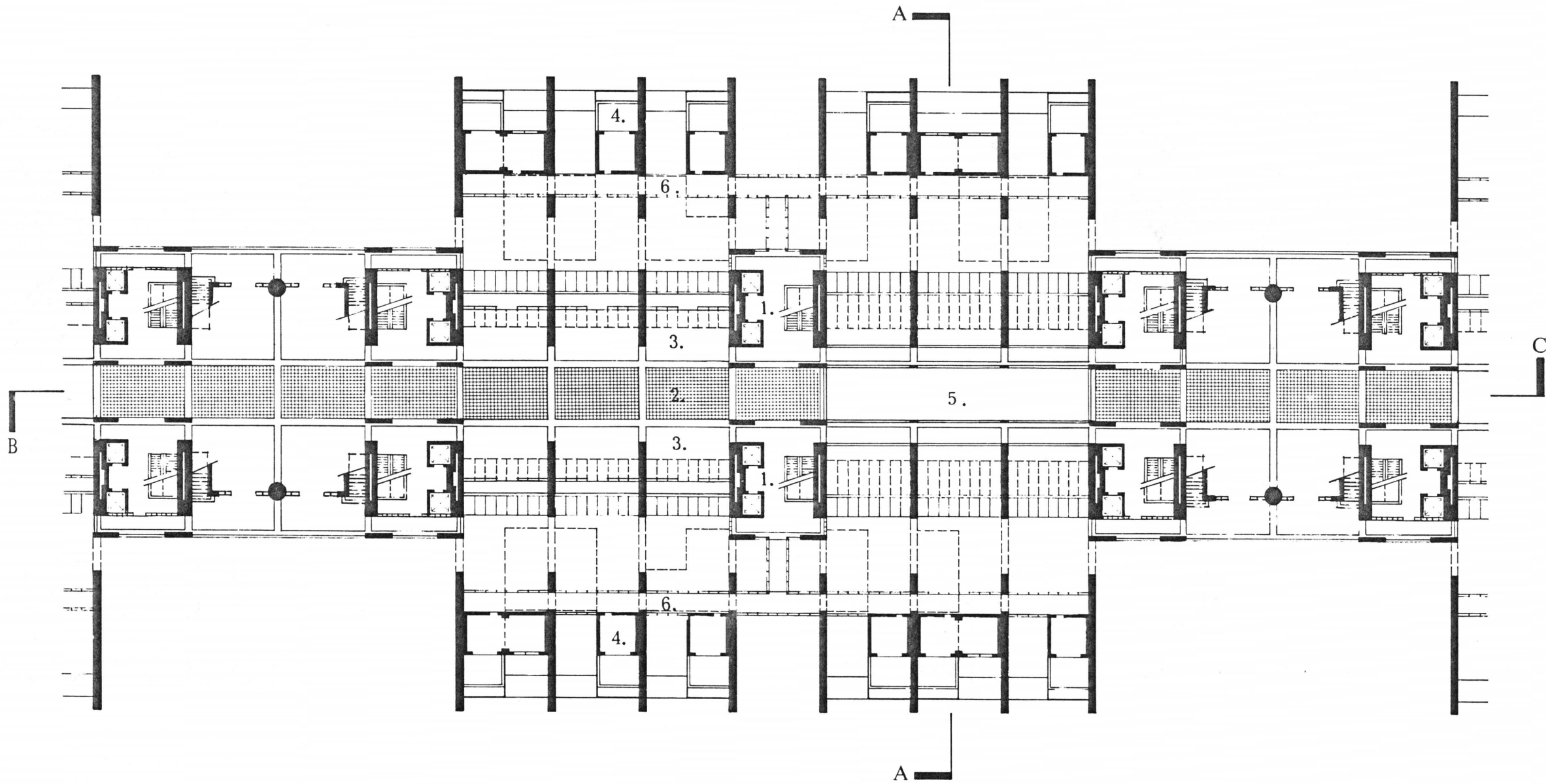
- 1. stairs / elevators
- 2. walkway
- 3. shops
- 4. dwelling



LEVEL 2

LEGEND

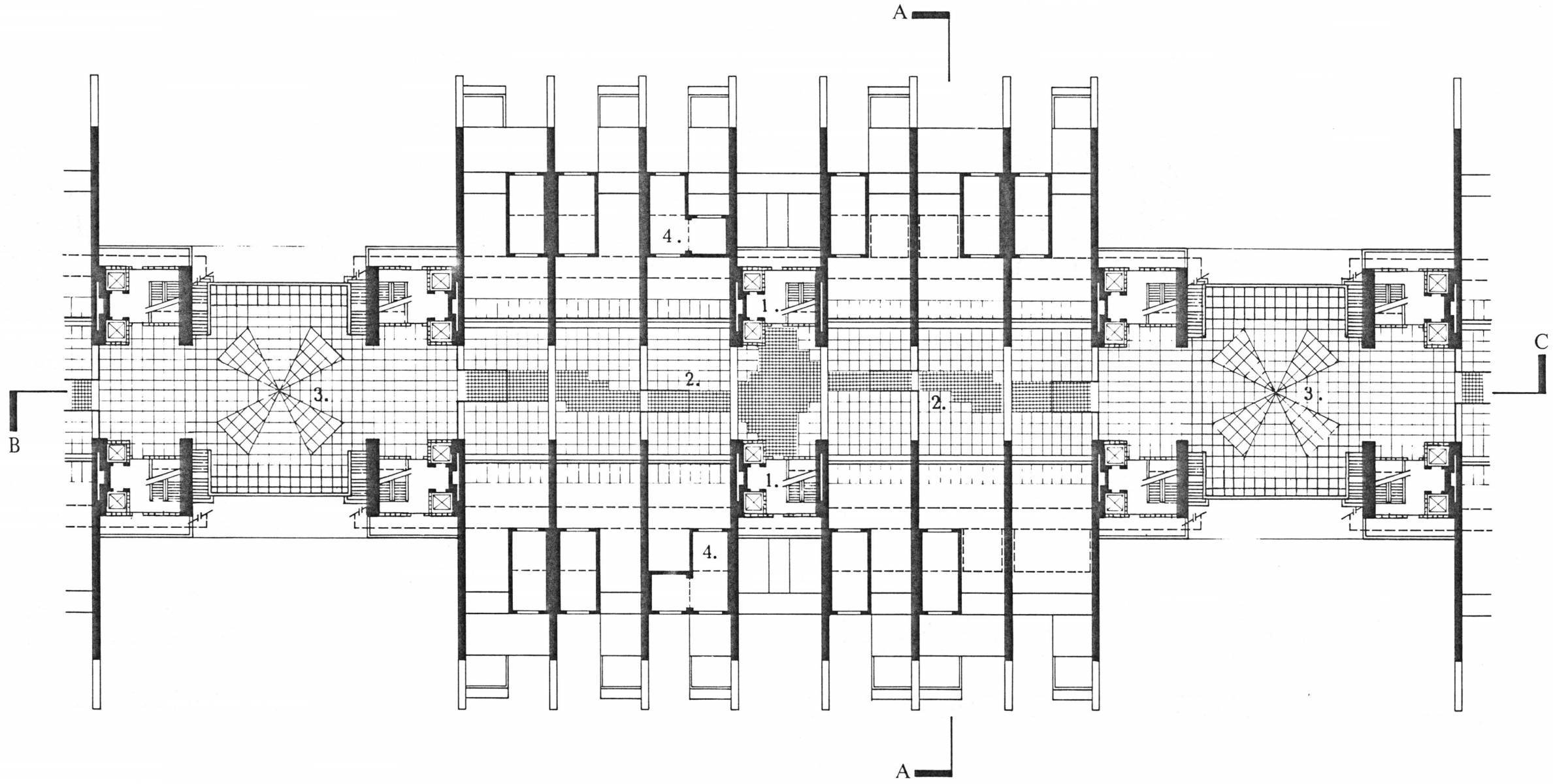
- 1. stairs / elevators
- 2. walkways
- 3. upper shops
- 4. dwelling
- 5. open to below
- 6. corridor



LEVEL 3

LEGEND

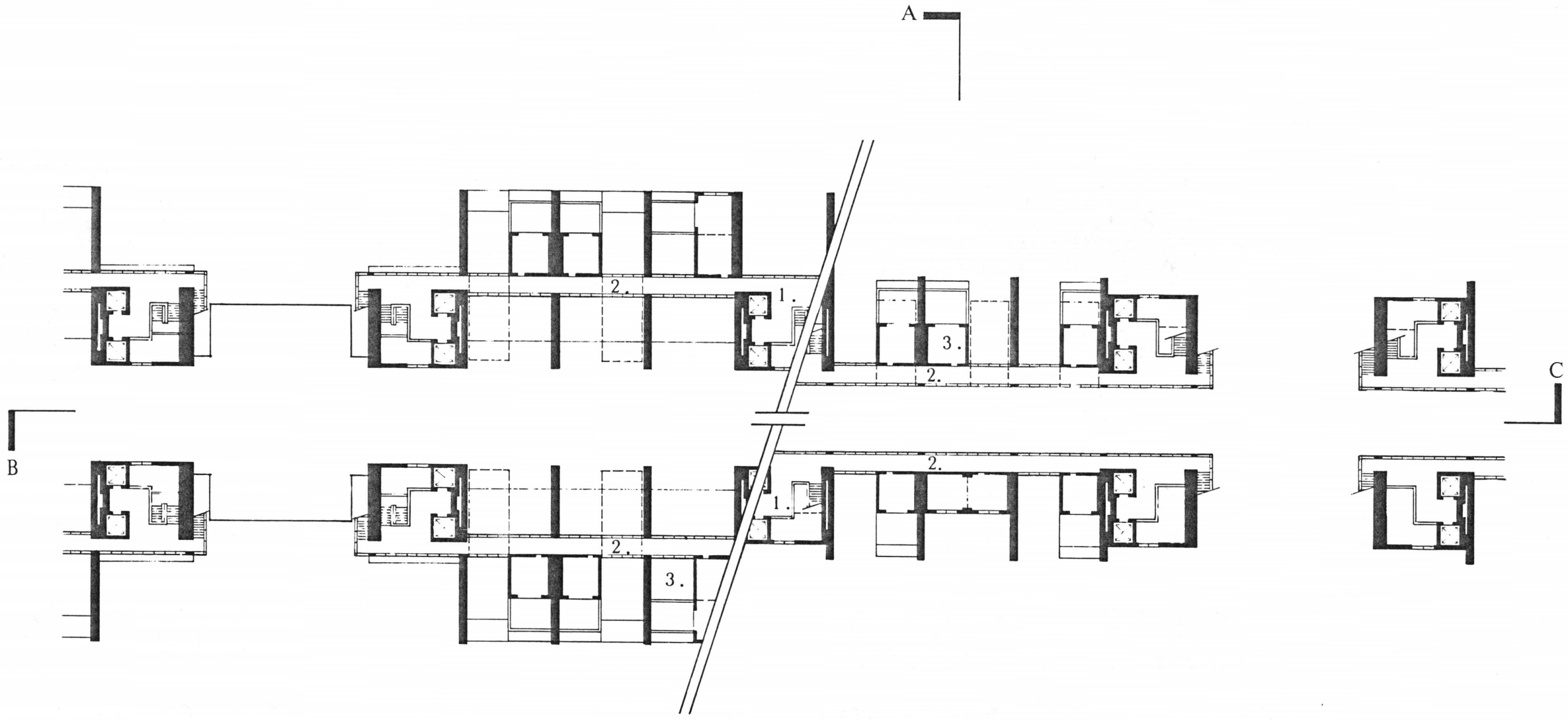
- 1. stairs / elevators
- 2. walkway
- 3. plaza
- 4. dwelling



LEVEL 4

LEGEND

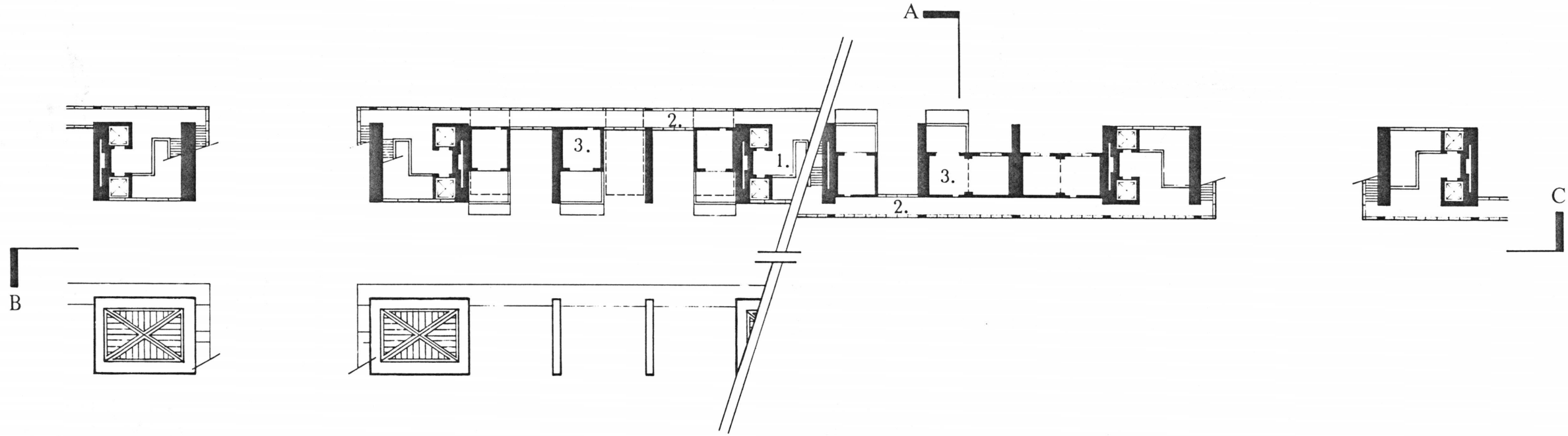
- 1. stairs / elevators
- 2. corridor
- 3. dwelling



LEVEL 5/7

LEGEND

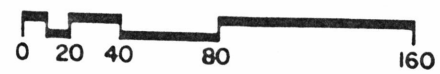
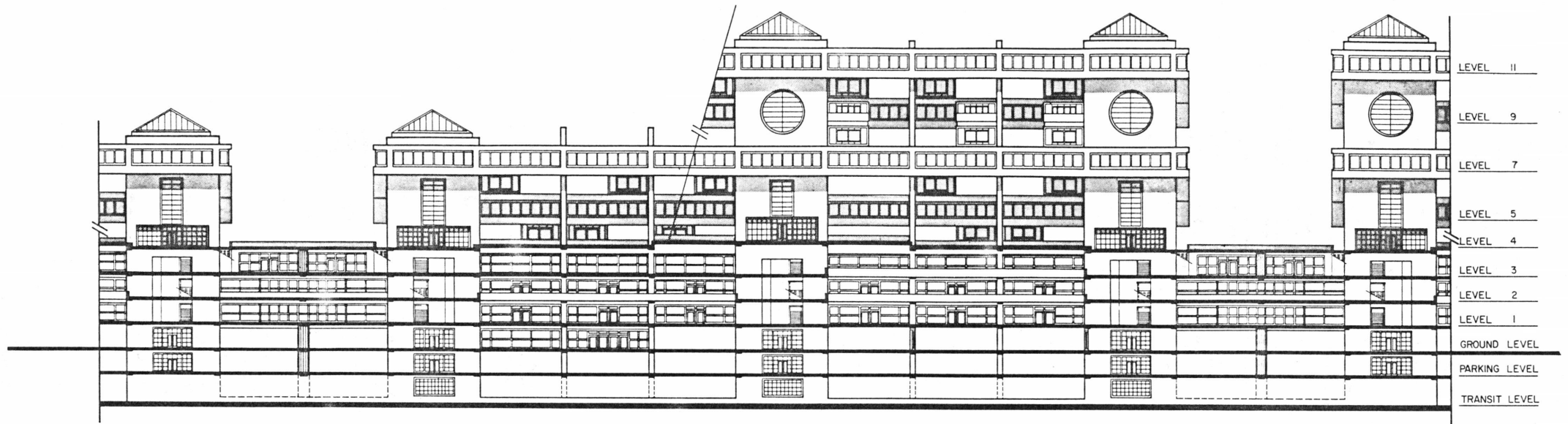
- 1. stairs / elevators
- 2. corridor
- 3. dwelling



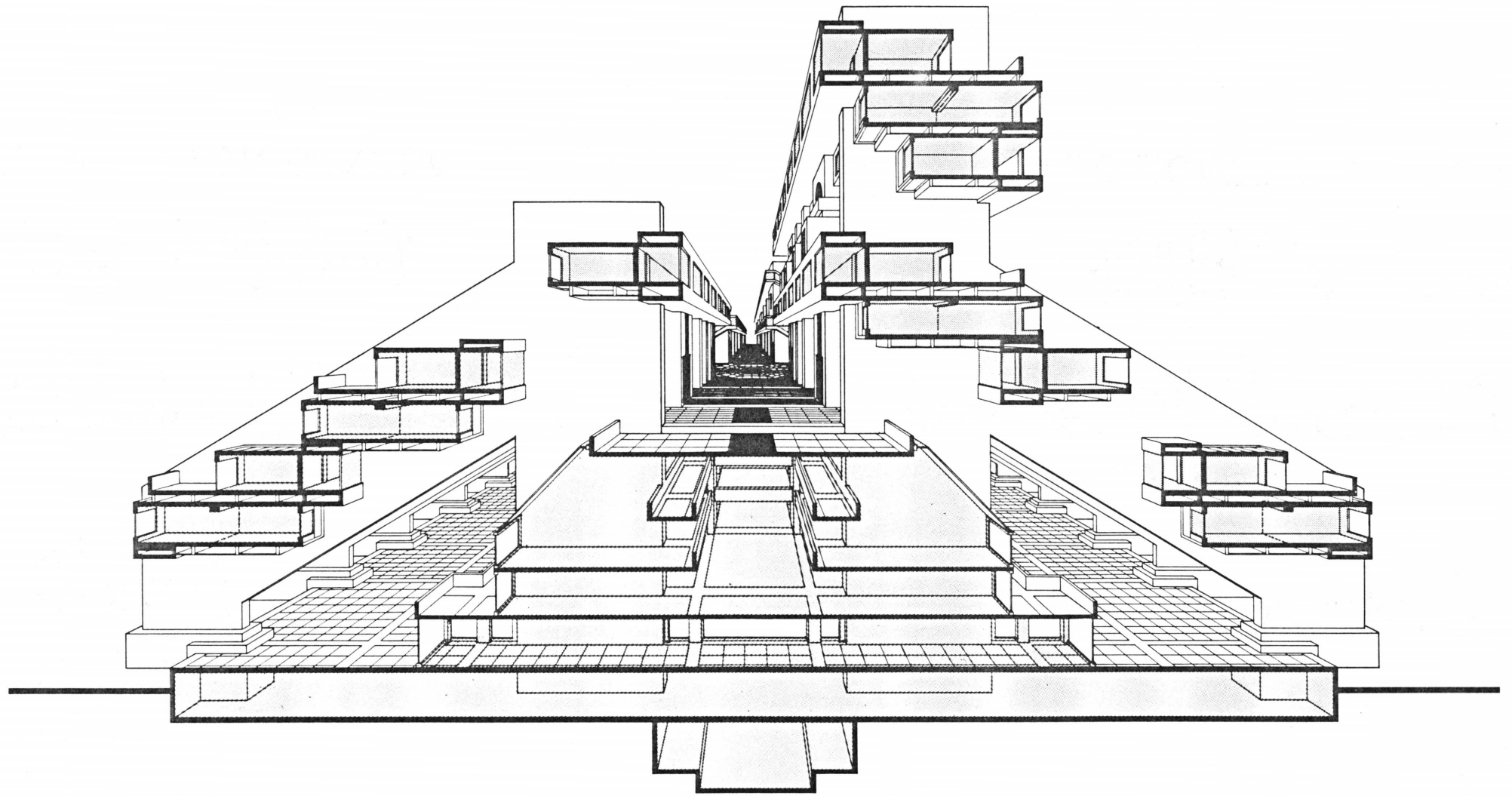
LEVEL 9/11



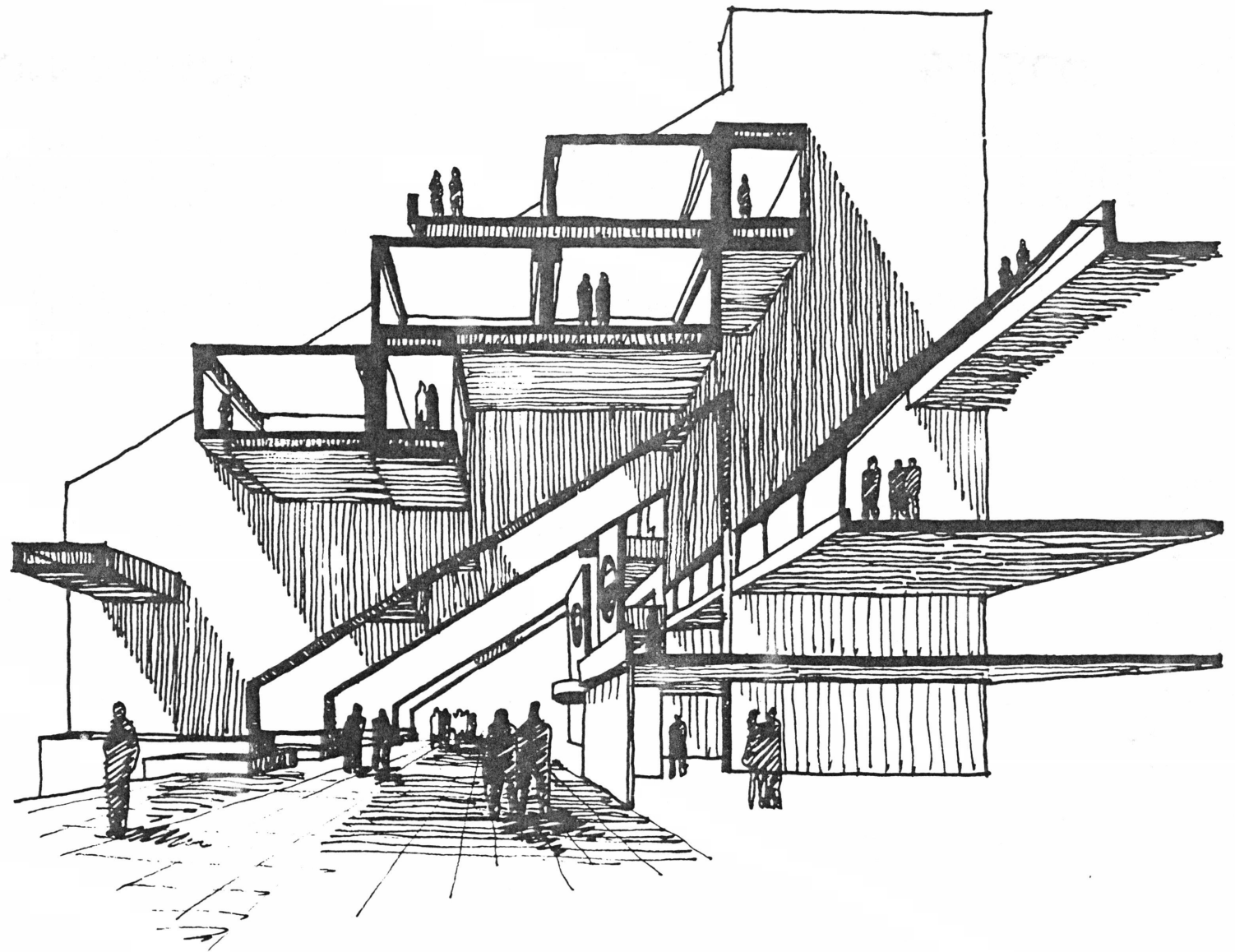
ELEVATIONS



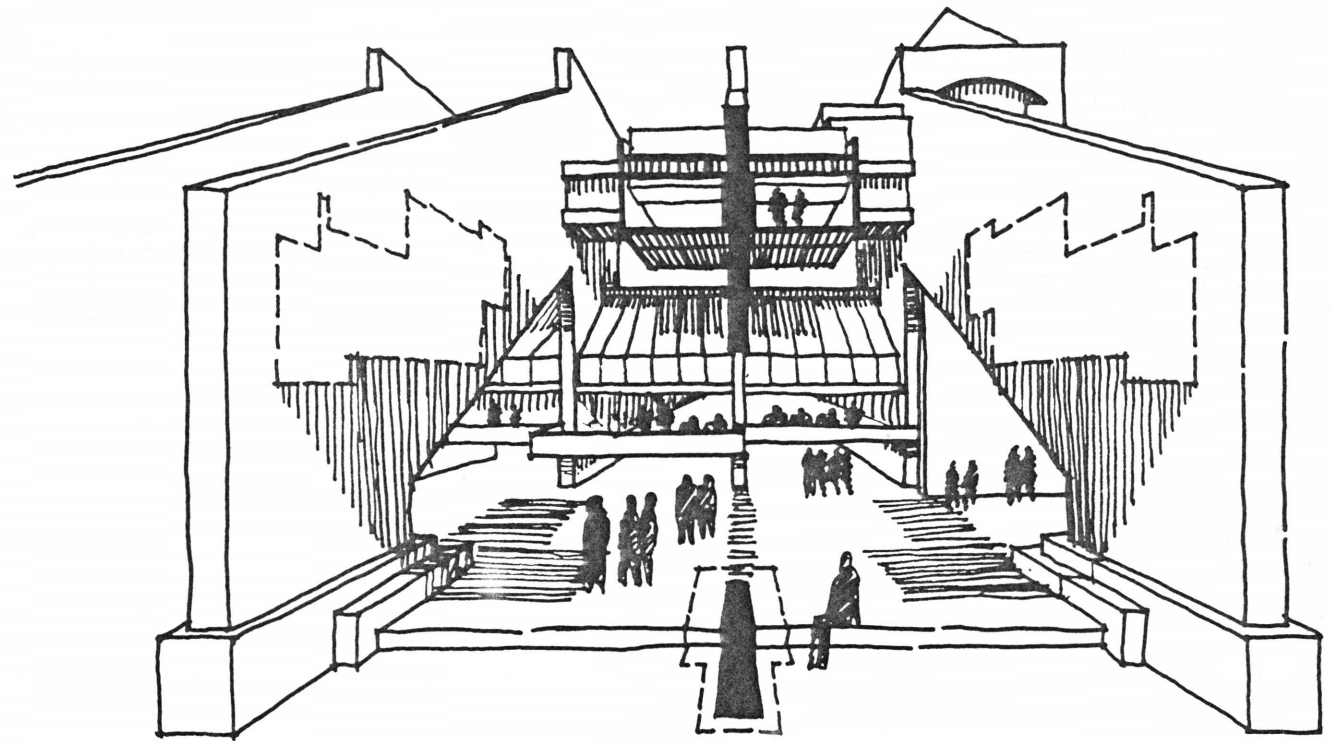
LONGITUDINAL SECTION



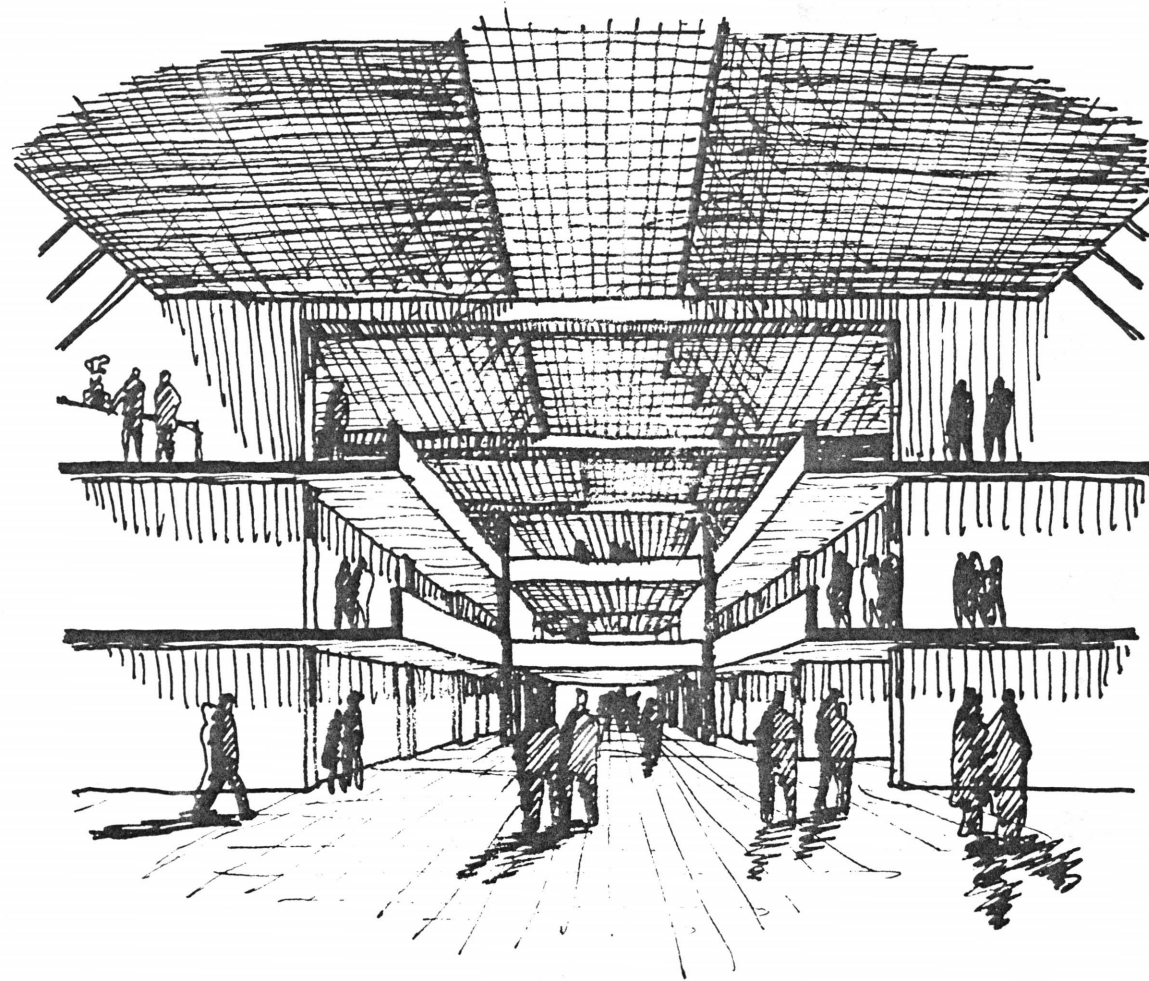
SECTION PERSPECTIVE



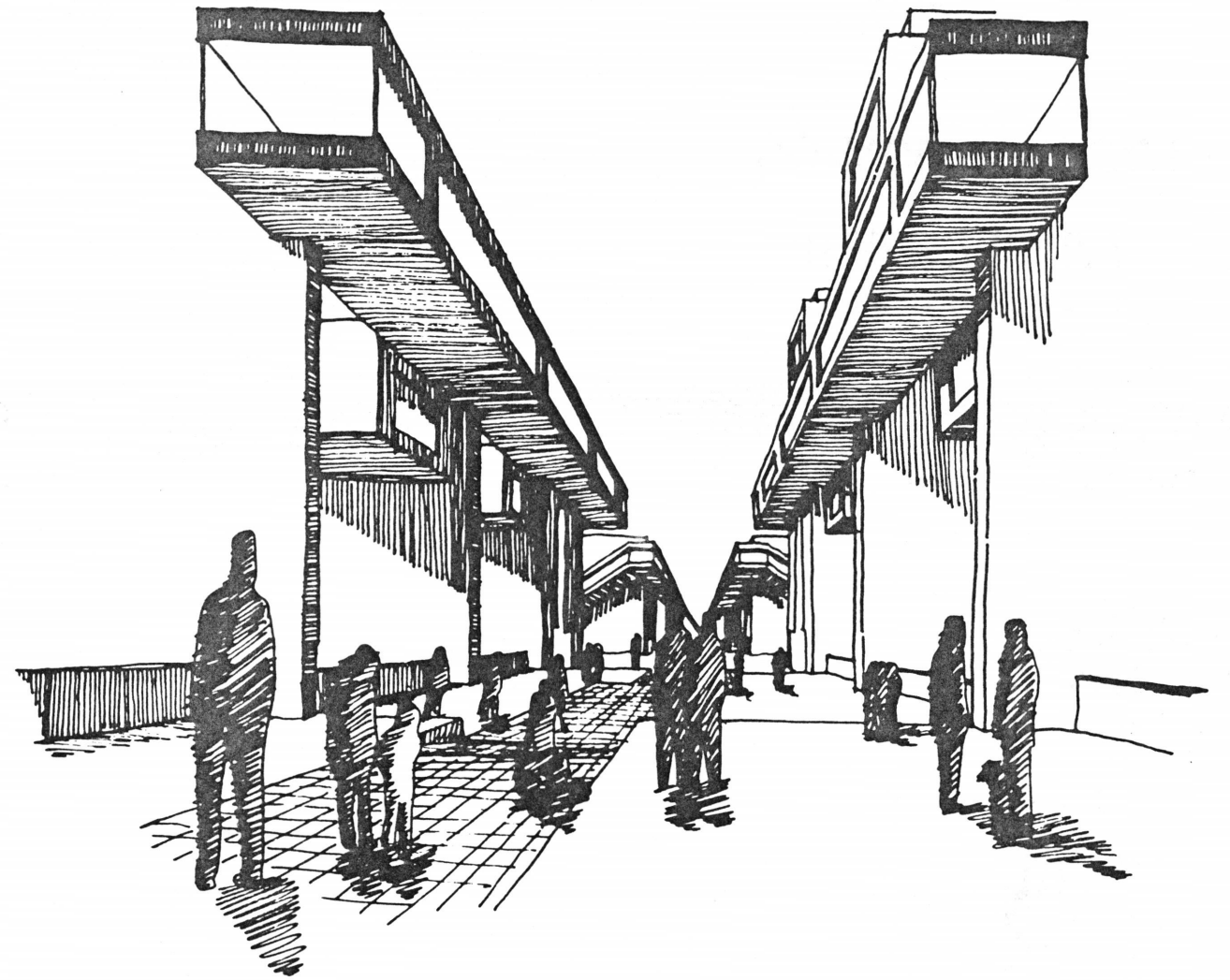
PERSPECTIVE : BENEATH THE INCLINE



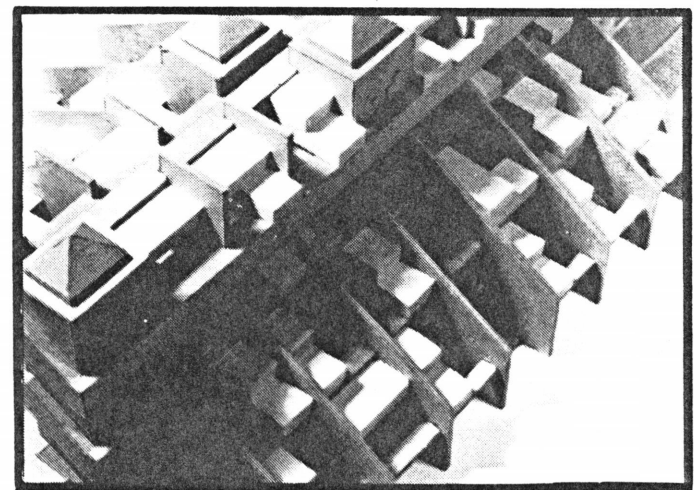
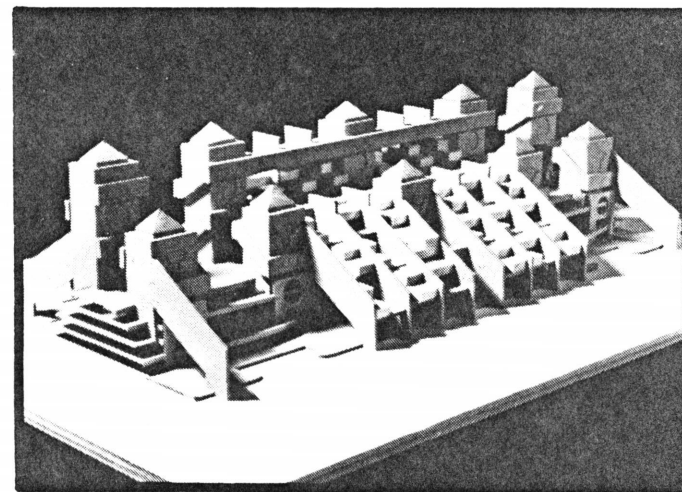
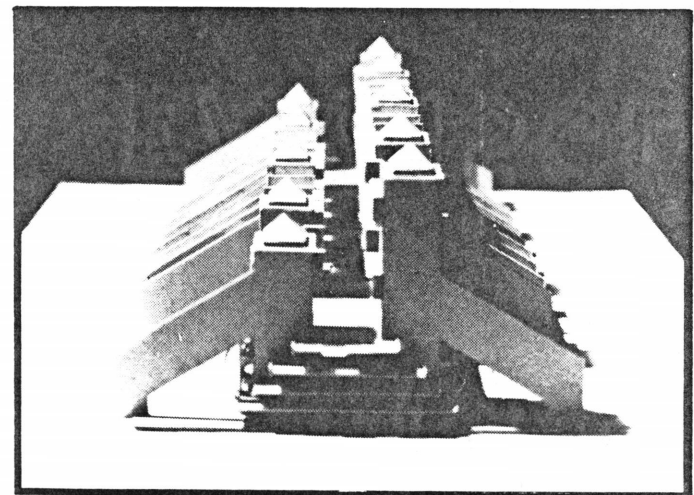
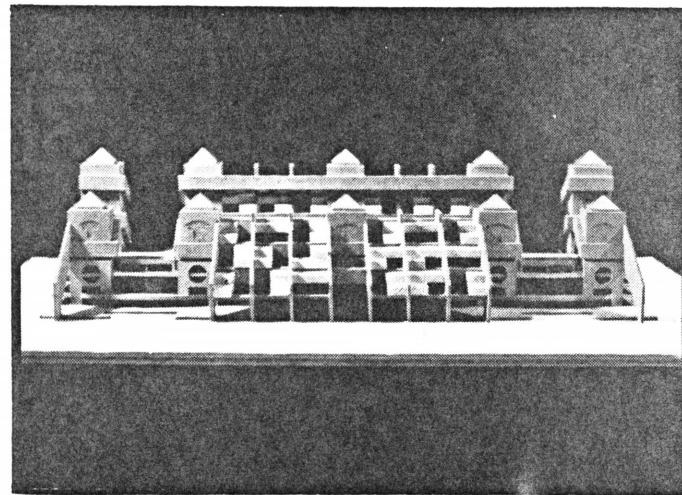
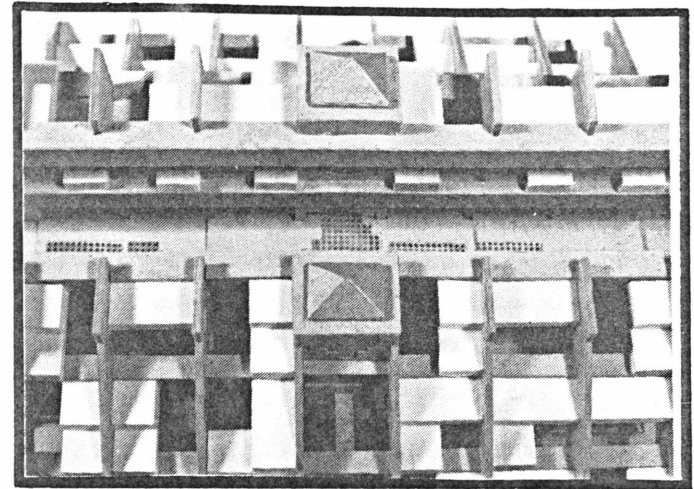
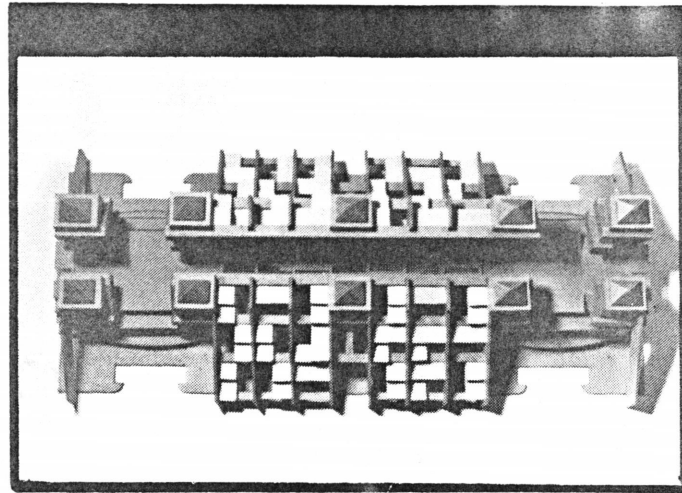
PERSPECTIVE : ARCADE EXTERIOR

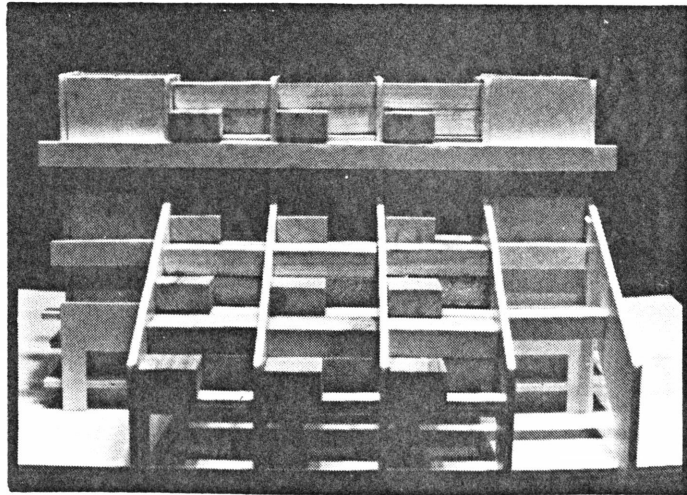
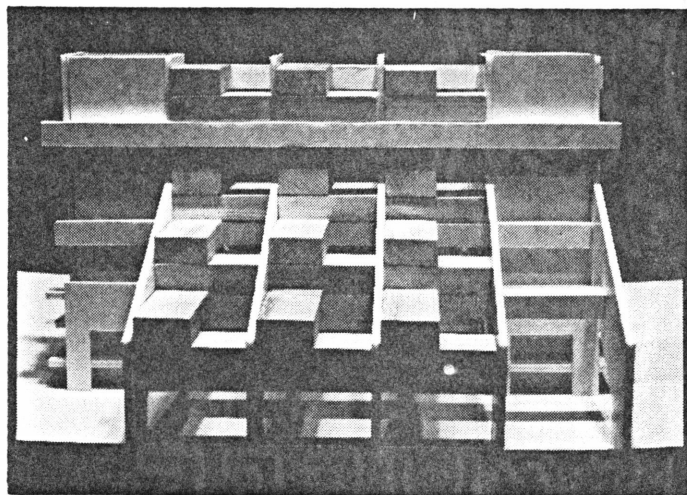
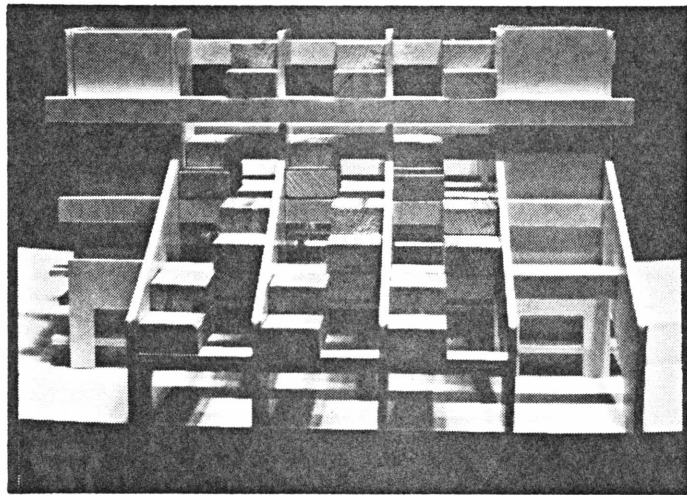
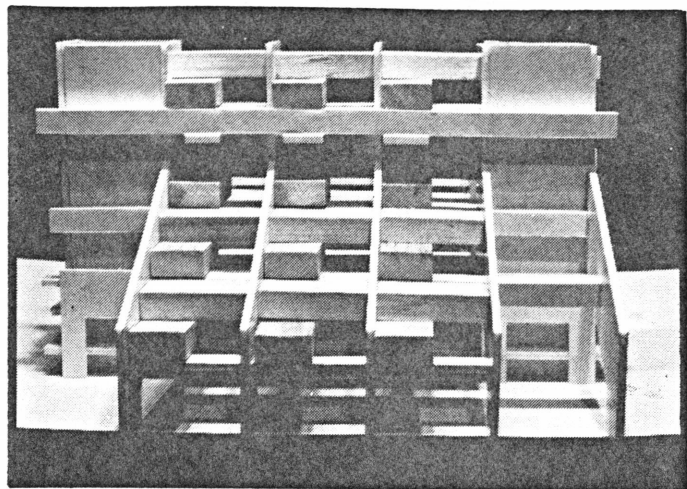
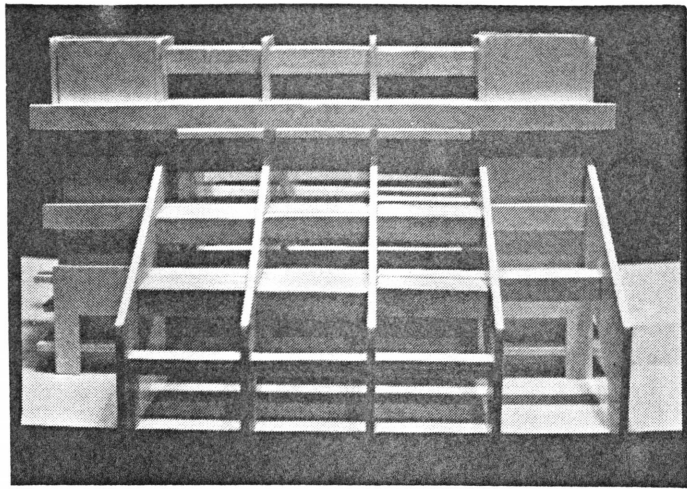
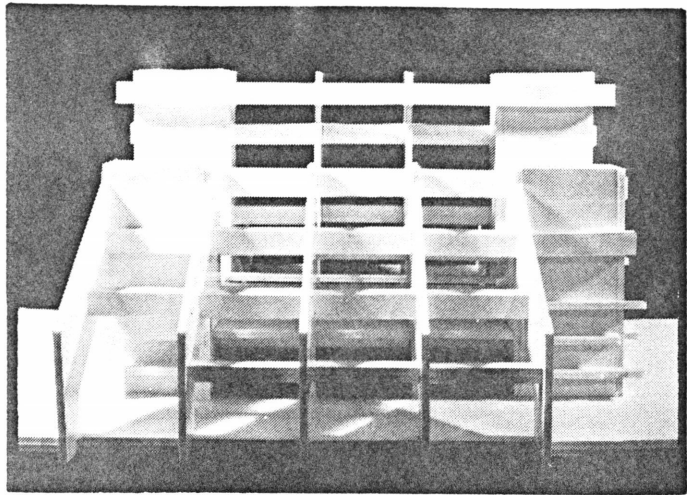


PERSPECTIVE : ARCADE INTERIOR



PERSPECTIVE : ALONG THE WALKWAY





This thesis does not conclude the study of this project. It begins the research.

Recognizing the possibilities inherent in this environment, I have endeavored to explore spatial relationships within the different levels of human interaction.

The future application of this proposal represents one direction towards the variety and diversity in multi-family developments.

This study has been a sojourn into the design process of my approach towards architecture. It has afforded me the opportunity to broaden my horizons on the subject of multi-family living in a linear environment. But, most of all, I have come to understand that architecture is a never ending process of study with no absolute end.

APPENDICES

- The Architectural Review, Architectural Press Ltd., London, England, Oct. 1985.
- Architectural Record, McGraw-Hill, New York, N.Y., Dec. 1973, Sept. 1979.
- Bacon, Edmund N. Design of Cities, The Viking Press, New York, N.Y., 1967.
- Banham, Reyner. Megastructures--Urban Futures of the Recent Past, Harper & Row, New York, N.Y., 1972.
- Ching, Francis D. K. Architecture: Form, Space & Order, Van Nostrand Reinhold Co., New York, N.Y., 1979.
- Le Corbusier (C. E. Jeanneret-Gris). The City of Tomorrow, MIT Press, Cambridge, Mass., 1971.
- Dahinden, Justus. Urban Structures for the Future, Praeger, New York, N.Y., 1972.
- Giedion, & Sigfried. Space, Time and Architecture, the Growth of a New Tradition, Harvard University Press, Cambridge, Mass., 1980.
- Luchinger, Arnulf. Structuralism in Architecture & Urban Planning,
- Maxwell, Robert. New British Architecture, Prager Publishers, New York, N.Y., 1972.
- Progressive Architecture, Reinhold Publishing, Cleveland, Ohio, Dec. 1984.
- Rossi, Aldo. The Architecture of the City, MIT Press, Cambridge, Mass., 1982.
- Safdie, Moshe. For Everyone a Garden, MIT Press, Cambridge, Mass., 1974.
- Smithson, Alison. Team 10 Primer, MIT Press, Cambridge, Mass., 1968.
- Soleri, Paolo. Arcology: The City in the Image of Man, MIT Press, Cambridge, Mass., 1969.

VITA

**The vita has been removed from
the scanned document**