

ALTERNATIVE DESIGN SOLUTION TO PUBLIC HOUSING

Ciudad Losada, Venezuela

by

Meyer Cohen

B. Arch., Pontificia Universidad Javeriana, Bogota, Colombia
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Submitted to the Department of Architecture on May 19, 1978, in partial fulfillment of the requirements for the degree of Master of Architecture in Advanced Studies.

ABSTRACT

This thesis involves a proposal and a design for a public housing development in the new town, CIUDAD LOSADA, in the vicinity of Caracas, capital city of Venezuela. Provision of low-income housing for the new immigrants and the unskilled laborers attracted by the development of the new town is the focal point of this study.

The understanding of the indicators that affect the design of dwelling units, the construction systems, and the urban layouts used for low-income housing programs in Venezuela is attempted.

Some of the indicators are: cost of services, utilities and land, availability of resources, environmental considerations, and the social and the cultural structure.

The organization of the material is twofold. First, a housing proposal is based on incremental development of two to five story structures. Within the housing proposal, the system, the process, and the construction materials are analyzed. The second section deals with an urban proposal for 25,000 inhabitants, for the sector UNIDAD 4-20 in the CIUDAD LOSADA development. The main priorities of such a proposal are efficient land subdivision and circulation systems.

Thesis Supervisor: Waclaw Piotr Zalewski

Title: Professor of Structures

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PREFACE

This study involves a proposal and a design for a public housing development in the new town, Ciudad Losada, located in the region of the valley of Tuy, in the vicinity of Caracas, capital city of Venezuela.

The study focuses on the provision of housing for the new immigrants and the unskilled laborers attracted to the new town, becoming its low-income population. It includes:

A housing proposal based on incremental development of 2 or 5 story structures. It also includes the system, the process and the materials of construction.

An urban proposal for 25,000 inhabitants, for the sector UNIDAD 4-20 in the Ciudad Losada development.

This study is an attempt to understand the indicators that affect the design of dwelling units, the construction systems and the urban layouts used for low-income housing programs in Venezuela. Such indicators are:

- a. Cost of services and utilities and cost of land.
- b. Availability of resources: labor, materials and mechanization.
- c. Environmental considerations: climate, topography and location.
- d. Social and cultural structure.

The information for this study was derived from:

- Field research carried out in Caracas and Ciudad Losada, Venezuela (December 1977 to January 1978)
- Maps and aerial photographs from INAVI (National Institute of Housing Venezuela).
- The Urbanization Primer developed by Professor Horacio Caminos and Professor Reinhard Gothert.
- Work by students on the Urban Settlement Design Program, MIT.
- Studies on construction system analysis carried out in the Building Systems Program, MIT, under the guidance of Professor Eduardo Catalano (January 1976 to May 1977).

INTRODUCTION



In spite of the extraordinary natural resources of the country and its actual economic growth, the uncontrolled urbanization and the housing shortage are most visible in Caracas. Great numbers of squatter settlements cover most of the surrounding mountains.

Sources of Illustrations

Banco Obrero, Accion de Renovacion Urbana para la Unidad No. 20 "El Valle-Los Jardines", Caracas 1965-1970.

INTRODUCTION

The rapid growth of most urban centers in Latin America, that has been defined as an uncontrolled process of urbanization, is caused by an accelerated population growth and a rapidly increasing rural to urban migration movement.

Contrary to the process suffered by today's most developed countries, the urbanization process of Latin American cities cannot be assimilated with industrial development. In many cases, it only means an extraordinary rural poverty. Consequently, people are moving from the country side into the urban areas faster than they can be accommodated, and the cities are suffering a severe shortage of housing and utilities. Until now, the strategies for solving this shortage of shelter have not been able to either supply the necessary quantity of dwellings to reach the very low-income groups, or to satisfy the environmental and social needs of the people that are being provided with housing.

In spite of the extraordinary natural resources of the country and its actual economic growth based on the oil market, and maybe even aggravated by it, Venezuela presents today the same phenomena of uncontrolled urbanization as the other countries of Latin America.

Until not long ago, a large part of the industrial and commercial activities of the country were concentrated in Caracas (Venezuela's capital city). This concentration of resources has deepened the differences between the rural and the urban areas. Thus, the main cause for the rapid urbanization is migration. This migration is not only from other areas of the country, but also from other neighboring countries. The migrant population is usually uneducated and unskilled.

A. Location

CARACAS

Caracas, the capital of Venezuela, is located in a valley that sits between two chains of the Cordillera de la Costa, close to the Caribbean coastline. The valley has 11218 Ha. of totally developed flat land, 22.471 Ha. of land with less than 40% slope and 38.697 Ha. with more than 40% slope. It has a tropical climate, with an annual average temperature of 24.8°C that varies

very little through the year.

B. Demography

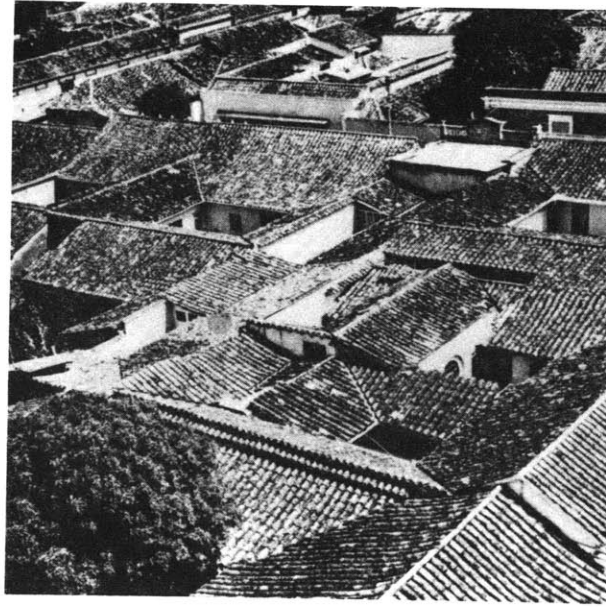
By 1950, the population of Caracas only amounted to 495,064 inhabitants. With what has been called the Urban Explosion Period, from 1950 to 1961, the population doubled, being close to 800,000 people by 1961. In the next 10 years, the population doubled again; by 1971, there were close to 2,000,000 inhabitants in Caracas. By 1974, 2,392,176 people lived in the city, and the estimated figure for the year 1990 has been 5,100,000 inhabitants with a growth rate per annum of 4.44% (Oficina Metropolitana de Planeacion Urbana). Venezuela is one of the less densely populated countries in Latin America; nevertheless, 23% of its 11,000,000 inhabitants are concentrated in Caracas.

The uncontrolled urbanization and the housing shortage of Caracas are very visible because of the extraordinary number of squatter settlements that exist, which cover most of the mountains around the valley and the land along main streets and highways. In 1971, 900,000 people lived in 3,000 Ha. in Ranchos (shanties), in other words, 40% of the population of Caracas, living in 26% of its total area of 11,500 Ha., were living in squatter conditions.

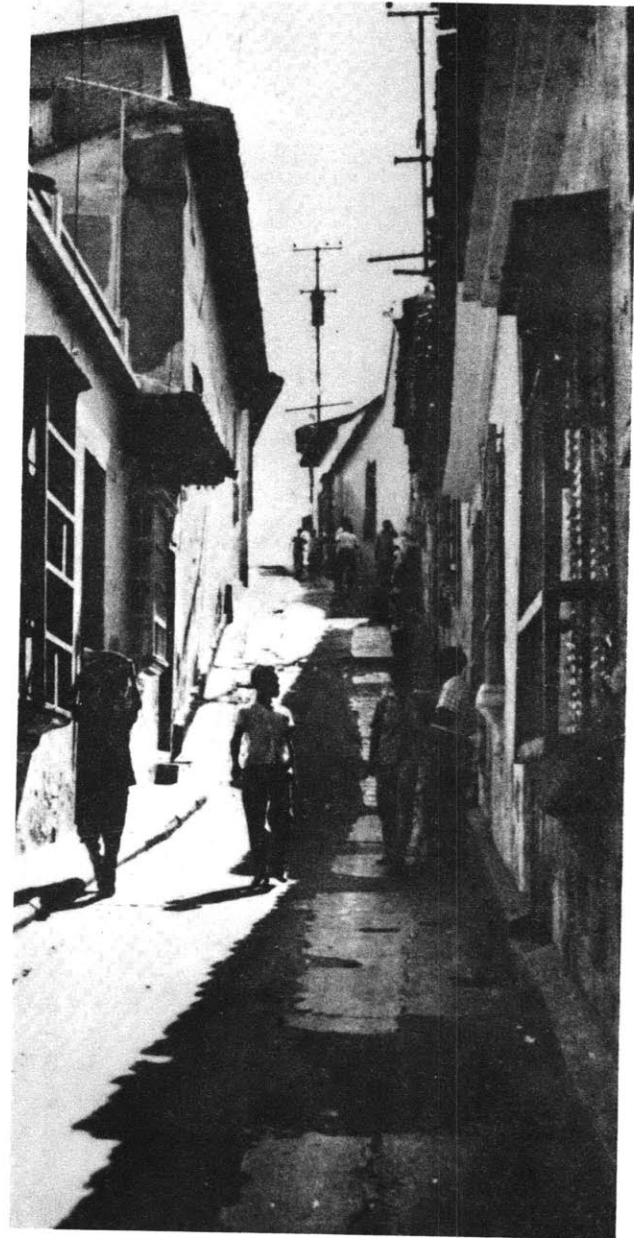
The government responses to the housing shortage have been affected mainly by the scarcity of feasibly buildable land. The cause for such lack of land is the rugged topographic conditions of the valley, making extremely expensive and scarce the limited available flat land, and very difficult the provision of infrastructure to the sloped areas. Great demand and consequent speculation plus the skyrocketing inflation rates affect the construction and the housing costs. The government solutions to housing (public housing programs) have been unable to reach the most needed levels of the population, due to the causes just described. This population is then left on its own to produce their shelter, turning to squatter settlements and shanty conditions. Meanwhile, the public housing, called *VIVIENDA DE INTERES SOCIAL* (Social Housing) is providing dwelling units to the middle income population that only amounts to 27% of the total population of Caracas (incomes over \$5,200 dollars a year), while 40% of the population earns less than \$2,666 dollars a year (MERCAVI 70).

TRADITIONAL HOUSING

As it is for all of Latin America, the traditional house in Venezuela is a single or multi-family colonial row house, with interior patios. The interior space of the house is divided in ample rooms of multi-functional use. The



Traditional Colonial House
(top left) Aerial view shows the typical
court
(bottom left) These two pictures show the
and right) typical colonial street and
its human scale

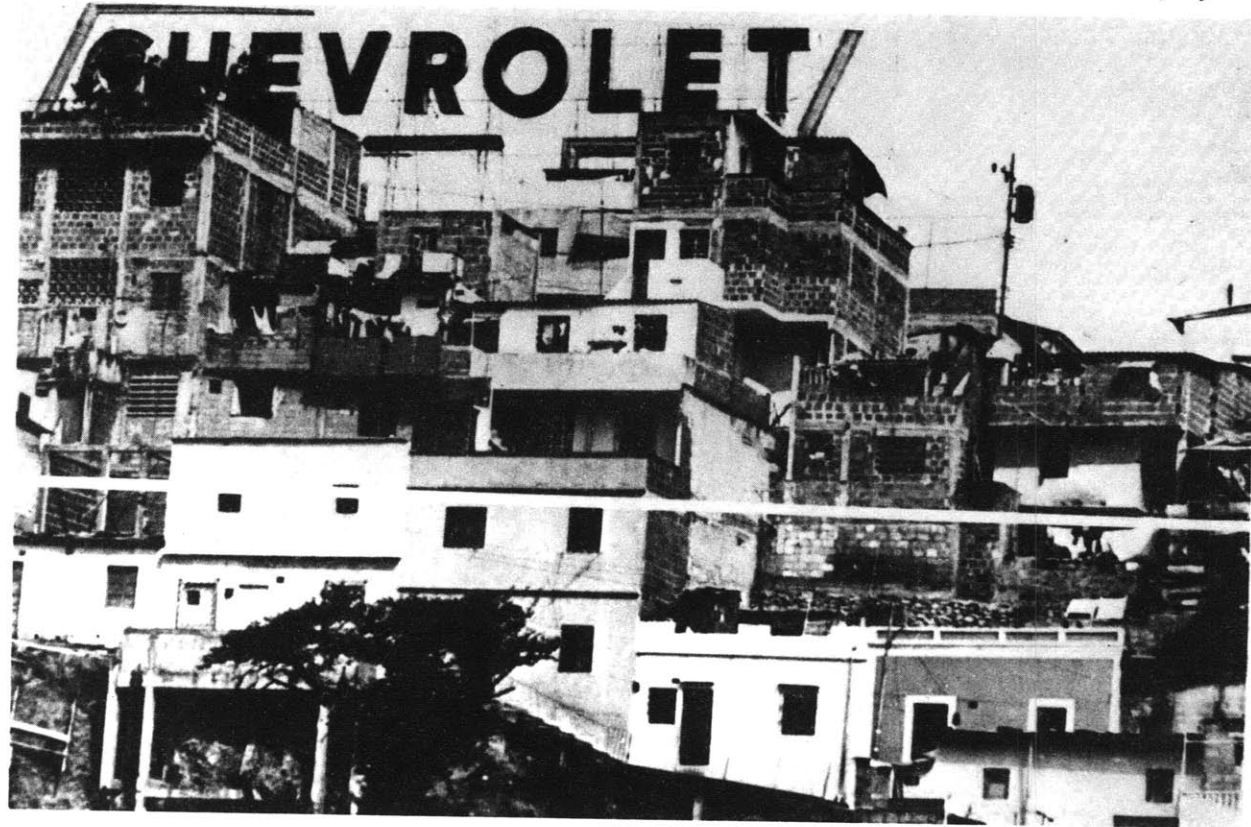


Sources of Illustrations

(top left) Graziano Gasperini, La Arquitectura Colonial en Venezuela. Ediciones Armitano, Caracas 1965.

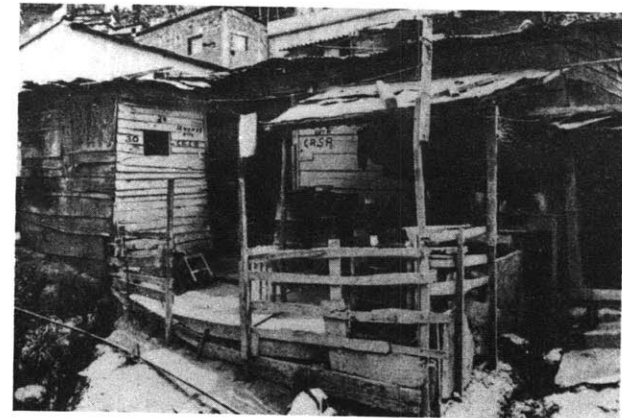
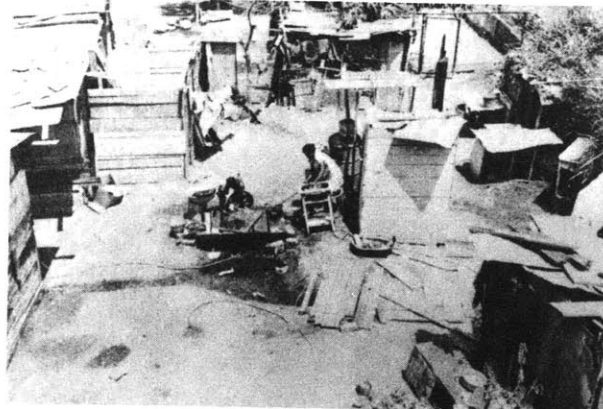
(bottom left) Ibid.

(bottom right) Ibid.



Popular Housing

- (top) Consolidated squatters. Some structures have been developed up to 5 stories high
- (bottom left and right) Shacks or Ranchos made of non-permanent materials are slowly transformed in consolidated dwellings



Sources of Information

- (top) Negrón, Marcos, America Latina
Naissance de "L'Autre Ville" a
Caracas, Architecture d'Aujourd'hui,
1974, Vol. 173.
- (bottom right) Ibid.
- (bottom left) Ibid.



Traditional Housing

(top) Here the industrial area of Caracas is shown where the traditional colonial house has been subdivided into several independent units, most of which are used as tenements.

(bottom left) These photographs show the typical corner store

(bottom right) Additional room has been added to the houses in response to family or economic needs.

Sources of Illustrations

(top) Negrón, Marcos, *Amérique Latine Naissance de "L'Autre Ville" à Caracas, Architecture d'Aujourd'hui*, 1974, Vol. 173.

(bottom right) Ibid.

(bottom left) Ibid.



INTRODUCTION (13)

aggregation of these houses, built very close to the streets, allows all types of small retail spaces to happen at the ground level. This type of urban pattern then creates a close network of activities and uses in the streets that make them vivid and dynamic.

POPULAR HOUSING

The solution that the marginal sectors of the population, unable to be reached by the existing public or private mechanisms, have given to their housing need is that of illegally built houses. They are mostly developed in an incremental self-help basis, due to the unstable income of this group, which varies from month to month.

The owner-occupant and his family supply much of the unskilled labor, contracting out to neighborhood roofers, plumbers, carpenters, etc., the more technical parts of the work. The house then becomes a dynamic entity that is adapted to the available resources and the changing necessities of its inhabitants. This type of housing has certain characteristics that are somehow similar to the traditional model. It is also built in groups or rows located very close one to the other, of up to 5 stories in height, and of medium to high density. The closeness of the structures creates an urban pattern that is very easy to negotiate by foot and where great accessibility to spontaneous small shops and community facilities exists.

PUBLIC HOUSING

The kinds of public housing solutions that have been implemented in Venezuela, and especially in Caracas, corresponds to neither the traditional nor the popular types of housing. They are more a result of the forced implantation of foreign, American and European models of development. The most common forms that public housing for low-income people have taken in Caracas are the high-rise type and the detached single family house type, none of which has been able to reach the income bracket to which it was originally directed.

HIGH RISE DEVELOPMENTS

The high-rise model has its origins in the U.S.A. where it started to be implemented in the 20th Century as a solution to housing for the middle class. Even if, in appearance, it might seem that it is an appropriate approach to low-income housing for Caracas because it provides higher densities, taking advantage of the scarce available land, it actually represents higher initial investment and even higher maintenance costs. Because of the complexity of high-rise structures, the total construction process, as well as the provision of services, becomes a responsibility of the public sector. The required



High rise public housing
(top) Undefined land/lot boundaries result in wasteful utilization of land. In some cases, the whole project has been fenced only to prevent vandalism.

(bottom) This is a general view of the high rise model. Extremely small dwelling unit areas are in contradiction with the large unused, unmaintained open areas.



services for this type of development are much more sophisticated and more expensive than the ones needed for low-rise developments (water pumps, elevators, mechanical equipment, etc.). All this means that a large initial investment by the public sector is necessary. Again, the sophistication of the service systems, and the concentration of density in one single structure can be translated into higher maintenance and managerial costs, all of which are also the responsibility of the public sector.

This type of development, as it has been implemented, involves large amounts of vacant land surrounding the free standing structures. This vacant space is supposedly designated as open recreational areas. Because of its lack of definition, it becomes wasted land that no one maintains or cleans, unsafe and vulnerable to vandalism. People would, if possible, take over these pieces of land for their own use. For example, in the "23 de Enero," a high-rise development built in the 50's in Caracas, the vacant land around the buildings has been taken over by squatters who have settled there.

The high-rise model involves long distances through vacant space between buildings. It completely negates the street and the street activities. It uses the street only as a boundary and access point, destroying the network of activities that existed in the traditional type of housing. Without the street activity, the possibilities for casual or occasional employment for the low-income groups is abolished (street vendors, newspaper sellers, etc.).

The same reasons can be given to say that the high-rise model is mostly vehicular-oriented, and that pedestrian circulation is almost completely avoided. Even the community facilities that are provided, such as commercial centers and supermarkets, are reflections of the American suburban vehicular culture. It even negates the fact that most low-income people get their supplies on a daily basis and that a small corner store is much more useful for their convenience than a large supermarket 20 blocks away.

In the popular model of housing, the size of the dwelling unit and its location has a direct relation to the economic capacity of its inhabitants, creating a great number of dwelling sizes and types. In the high-rise model, the dwelling types are few and fixed in terms of amount of space. This condition does not allow for growth or range of investment by their users. Furthermore, the selection of the areas provided is set in the minimum standards established by the public sector. This minimizing of the space can

create serious harmful conditions to the individual and the family life.

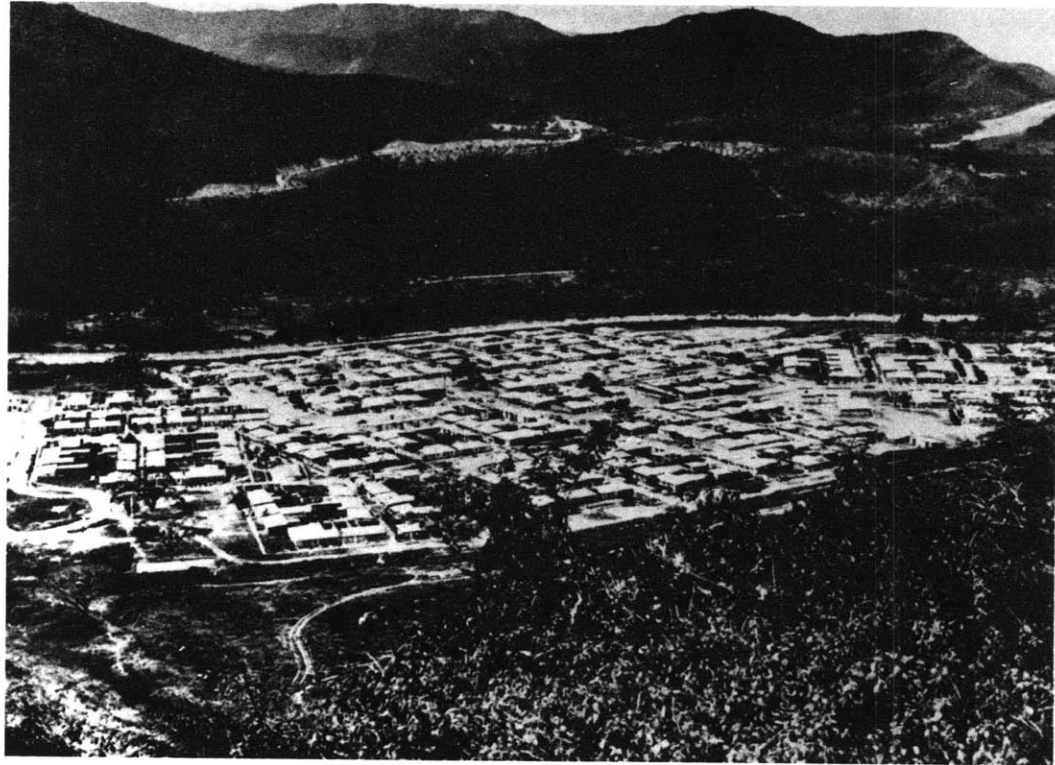
DETACHED HOUSING DEVELOPMENTS

The single detached house, called "Quinta" in Venezuela, is a product of the economy/culture of the automobile, foreign to the traditional and popular housing models. In the rapidly growing urban centers of Venezuela, economic, social and political systems of industrialized economics have been implanted. The urban sprawl, caused by the development of detached housing units on the periphery of the city cores, is one of them. The urban sprawl is a phenomenon that affects the urban center dominated by the automobile. It deteriorates the quality of life in many ways; social relations are weakened, community life vanishes, transportation becomes a waste of time, energy and money, due to the long distances that are necessary to travel daily, and it especially makes every member of the family completely dependent on the car to go to work, to go shopping, to go to school, to go anyplace for recreation, etc. These dependencies and their consequences cannot be afforded by the people of the low and the very low-income groups. As a consequence, detached suburban housing, no matter how well planned, is not adequate for the majority of the population.

Besides this, urban sprawl tends to impose hardship on those without ready access to cars. With lower densities, fewer and fewer locations are accessible on foot or by transit. Consequently, it also tends to limit the opportunities of the poor to get employment located far away, and accessible only by car.

Efficient utilization, distribution and subdivision of the land are essential parameters in any social, political and economic system. Nevertheless, land is wasted in an unprecedented way in the urban sprawl. This waste can be detected through the following characteristics:

- The settlements are placed out of the service or the existing infrastructure, utilities and transportation networks. The direct consequence is the immediate expansion of these networks to zones scarcely populated at a very high expense.
- The natural environment is systematically destroyed by uncontrolled developments; especially rich and necessary agricultural land.



Detached
Housing
Development

Detached row houses built by the I.N.A.V.I. This model has been proposed for Ciudad Losada.

Sources of Illustrations

(top) Instituto Nacional de la Vivienda.
La Política Habitacional del
Gobierno Nacional. Venezuela 1975.

(bottom) Revista Sociedad Venezolana de
Arquitectos. 19 Caracas 1965:
Dos Ciudades.



- Finally, the maximum expression of the urban sprawl is the overabundance of unnecessary public streets.

The consequences in terms of cost for both the public and the private sector are monstrous. It is not only the initial cost of construction of such routes, but also maintenance and operational costs. More areas need to be paved, cleaned, illuminated, controlled, etc., besides the cost of other services, such as police protection, mail distribution, transportation, garbage collection, etc., which is also increased. This cost goes directly or indirectly to the people that live in such developments. This cost represents either an extreme burden on the individual or an inefficient provision of services, as in the case of the development of Caricuao in Caracas, where a population of 300,000 people has only two traffic policemen and constant problems with their water supply (Universal, Special Supplement March 78).

As it has been said before, the urban model has implications in all other aspects of the community development. The land utilization and the public circulation have a critical decisive influence over the installation and maintenance costs of the infrastructure network (water supply, electricity, drainage) as well as the cost of services, such as public transportation, garbage collection, mail delivery, telephone lines, street lighting, police protection, etc.

An economic urban model is necessary in spite of the social group that is being supplied with housing, the desired housing types, the exercised political and administrative methods or the available financing systems.

Negligence on the implementation of efficient design norms and careless utilization of urban land have produced severe economic effects that are already being felt at the city level and are especially critical on the high-rise and single family unit developments.

The need for an efficient urban model is especially true when it is being designed for a low-income community. The valid or mistaken decisions that are made at this level would constitute a burden or a value for the residents of the development and the city as a whole.



City Center Streets In the city center of Caracas, due to great street activity, opportunities for part time jobs or sub-employment are numerous. This type of economic activity is the primary source of the low-income groups.

Sources of Illustrations

(top) Revista Sociedad Venezolana de Arquitectos. 19 Caracas 1965: Dos Ciudades.

(bottom) Ibid.



PROPOSAL

The proposed urban model and housing system try to return to the values that have been lost in the developments that are actually being implemented, restoring the street life and offering dwelling units that can be adapted to a diverse income population (low and moderate-low incomes). Such solutions are based on incremental development of the housing in accordance with the economic needs and possibilities and the growth of the family.

The proposed "clusters" are each one of 20 to 50 families grouped around a shared space. This space is completely separated from the public areas, making it safe and identifiable by its inhabitants. At the same time, it promotes the creation of a community feeling. In this way, it is easier for the residents, once they become aware of their needs, to get organized and have communal agreements to satisfy these needs (for example, creation of cooperatives among residents to obtain financing, or cheaper building materials or goods, or communal efforts to upgrade the semiprivate property, taking its maintenance responsibility from the public sector.

Which is the criteria to decide density and adequate building type for housing? Low density requires more extensive areas for a given population, and as it has been shown, it results in higher costs of land and infrastructure per person. On the other hand, very high densities not only overload the services but also create negative social conditions. While it is possible to determine limits of density on the basis of infrastructure and land cost and service, it is difficult to determine them on the basis of social conditions. There is not enough experience or available data, only tentative methods, such as case studies or personal observations, which have been used to this effect.

Low population densities, in the range of 50 to 100 persons per hectare, can be found₂ in the high-income suburbs where each dwelling sits in a lot of up to 800 m². This model is expensive in terms of land and infrastructure, but because of the proportion between people and land, social conflicts are not created. High densities, in the range of 200 to 350 persons per hectare, can be found in the government-financed high-rise developments in the Metropolitan area of Caracas, and they are occupied by a middle-income population. In this project, the proportion between people and land has been reduced to an extreme where not only living conditions are inhuman, but also



High rise public housing
(top) Squatters take advantage of
wasted land around the high-rise
projects to settle
(bottom) Due to the cost of land, this
type of development is being
built all over the metropolitan
area of Caracas



Sources of Illustrations

(top) Revista Sociedad Venezolana de
Arquitectos. 19 Caracas 1965:
Das Ciudades.

(bottom) Meyer Cohen, 1978

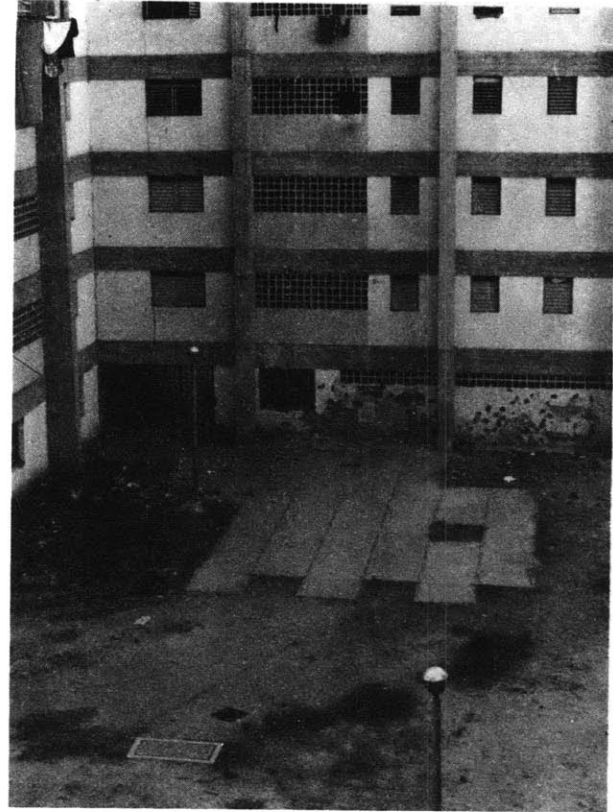
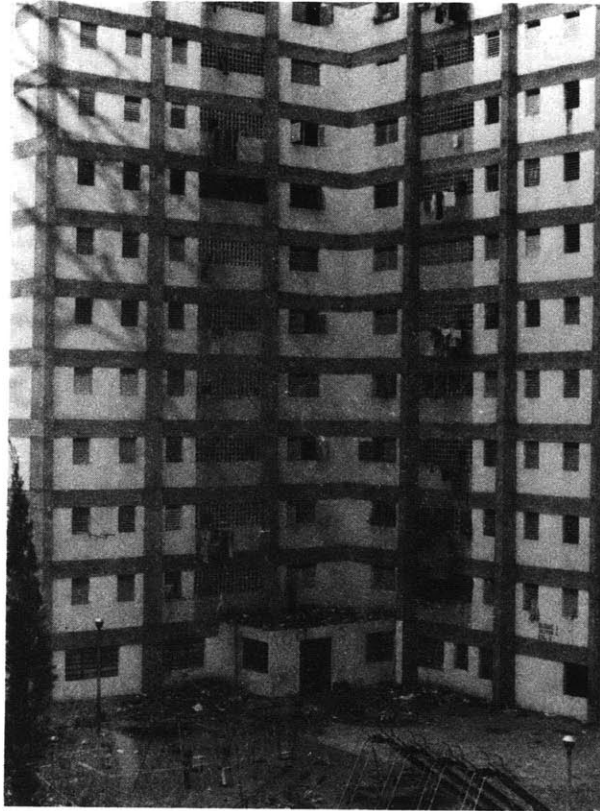
High rise public housing

(top left) Lack of definition of the open areas make them vulnerable to vandalism and poor maintenance. Garbage is thrown from windows into the "playground."

(top right) Vandalized and abandoned wasted areas.

(bottom left) Overdesigned sidewalk, in areas of very little pedestrian circulation, are not maintained, becoming an economic burden for the project

(bottom right) Unplanned coordination between transportation agencies and housing authorities have results like this one. Abandoned and unutilized bus stops.



Sources of Illustrations

(top) Meyer Cohen, 1978.

(bottom) Meyer Cohen, 1978.



The introduction of foreign construction models has produced this type of contrast in Caracas.

(top) Parque Central development and traditional neighboring surroundings

(bottom right) Macro-projects like the Helicoide were started under the dictatorship of Perez Jimenez were never finished and now are occupied by squatters

Sources of Illustrations

(top) Negron, Marcos, Amerique Latine
Naissance de "L'Autre Ville" a
Caracas, Architecture d'Aujourd'hui,
1974, Vol. 173.

(bottom) Ibid.



strained conditions are created, where continuous conflicts, vandalism and consequent abandonment are common.

On the other hand, a much more responsive model is the one of squatter development of "Ranchos". These settlements of low and very low income have densities that are in the range of 200 to 400 persons per hectare, but this density is constantly changing in a progressive way. The community is always in a growing process, while floors are being added to the existing dwellings in order to supplement the family income by renting the additional space.

This fluctuating density is a very important consideration to have in mind for the design of settlements for low and very low income population.

The following chart shows how changes or density affect the design of urban settlements in relation to cost, social and health conditions, technical implications, and dwelling unit design.

INFLUENCES ON DENSITY

HEALTH

Water Supply

	EFFECT OF REDUCING DENSITY	EFFECT OF INCREASING DENSITY
1. <i>Community source</i>		
(a) Natural—springs, wells, rivers, etc.	Greater carrying distance	Danger of source drying up and pollution
(b) Piped water to stand-pipes, sale kiosks, etc.	Increased cost of reticulation and—if convenient carrying distances are to be maintained—provision of water points	Lower costs; the more readily available, the greater the consumption
2. <i>Individual source</i>		
(a) Natural—wells, boreholes, etc.	Greater protection from pollution	Greater risk of pollution
(b) Piped water to individual plots	Increased cost of reticulation; greater capacity of the ground to absorb waste water	Lower cost of reticulation; increased risk of saturation of the ground by waste water; disposal system may be needed unless consumption controlled, e.g. by metering

Sanitation and Waste Disposal

1. <i>Individual sanitation systems</i> Disposing effluent into ground—pit and bored-hole latrines; aqua privies and septic tanks	Depending on subsoil conditions, greater capacity of the ground to absorb effluent; less risk of nuisance from ill-kept units; less risk of pollution to natural water sources	Increased risk of saturation of the ground and pollution of natural water sources; and danger from damage to building foundations; greater care necessary to maintain units, but easier to inspect
2. <i>Community sanitation systems</i>		
(a) Bucket system	More costly to run but less risk of nuisance and danger to health	Cheaper to run but greater risk of nuisance and danger to health; not suitable for high buildings
(b) Water-borne system	Increased costs	Lower costs
3. <i>Waste disposal</i>	Disposal of waste on plots is possible at very low densities; public collection becomes necessary as densities increase but lower densities mean higher operating costs	Lower cost of operating public collection; at very high densities, disposal in high buildings, and general congestion, makes collection more costly

Light, Sunshine Air and Quiet

1. <i>Daylight</i>	Less risk of sky obstruction by nearby buildings; important in higher latitudes and where sky mostly overcast	Greater risk of sky obstruction by nearby buildings; but use of high buildings and low plot coverage, mixed development (i.e. buildings of different heights), and especially open plan arrangements, may considerably reduce this risk; less important in lower latitudes where skies are bright and protection from glare welcome
2. <i>Sunshine</i>	Less liability to shading by nearby buildings; important in higher latitudes where summer is short and sunshine welcome	Increased possibility of shading by nearby buildings; important in lower latitudes where shelter from the sun is desirable
3. <i>Air</i>	Enables breeze to circulate more freely; beneficial in warm and particularly humid climates where the air is often still	Neighbouring buildings may help to give protection against wind; beneficial in climates where cold or very hot winds prevail
4. <i>Quiet</i>	Less risk of discomfort from noise; but reduction in density effected by decrease in height of building alone may have little effect on external noise levels at lower storeys	Increased risk of discomfort from noise; particularly in warm, humid climates where buildings usually open to catch breeze; but increase in height of buildings may give relief from external street level noises to upper storeys

		EFFECT OF REDUCING DENSITY	EFFECT OF INCREASING DENSITY
LIVING SPACE WITHIN DWELLING		Depends largely on the means of the household but also on social habits and personal preferences, and on climate and shortage of accommodation	Tends to increase as, all other things being equal, it is cheaper to provide
			Tends to decrease as, especially in high buildings, it is more costly to provide
SOCIAL Private Open Space		Depends on availability and cost of land; habits and preferences of the occupants; also on climate, soil, etc.	
	<i>Space for recreation, garden and outdoor living</i>	Permits sleeping out and outdoor living generally in warm climates; and consequently lower indoor space standards; beneficial for gardening except where climate and soil conditions are difficult; limit reached when space becomes too large to be well kept, or is used for non-domestic purposes or illegal building	Less easy to provide; may be necessary to provide more costly space indoors on roof or balconies; and more public open space as compensation
	<i>Space for laundry, storage and other domestic activities</i>	Permits outdoor space for laundry and clothes drying; for storage of dustbins and other domestic appurtenances	Less easy to provide except by costly space indoors; or by providing communal laundries, drying areas, stores for prams, cycles, etc.; where families own cars, there is tendency to keep them on the public way
Privacy		Importance largely derives from religious, social and cultural traditions. Design and construction of buildings, and the layout and planting of their surroundings may influence degree of privacy	
	<i>Overhearing and unwanted noise</i>	Beneficial; especially in warm humid climates and at night in hot dry climates, where openness required	Disadvantageous; for full privacy in warm climate, air-conditioning may be needed at high densities
Protection		Close communion with neighbours; street lighting, police services; and easy access	More difficult and costly to provide
			Cheaper to provide and more effective; but at very high densities, ability to be lost in a crowd may make protection more difficult and costly
Community Facilities		Local shopping centres; markets; schools; public open space; etc.	At very low densities, difficult to provide economically without causing people to travel inconvenient distances
			Easier to provide more conveniently and cheaper, except at very high densities when it may be costly and difficult to provide adequate space

INTRODUCTION (27)

	EFFECT OF REDUCING DENSITY	EFFECT OF INCREASING DENSITY
TECHNICAL Shortage of Building Land	Greater use of land for housing purposes at the expense of other needs and users; scarcity reflected in higher costs	Frees more land for other uses; lower land costs; but if this results in high residential building there may not be any overall saving
Access	Tendency to wasteful use of land for vehicle roads and pedestrian access; costly to develop and maintain and demanding reduced access standards, e.g. unmetalled roads, narrow road widths and greater use of footpath access	Less costly to provide and maintain adequate roads and footpaths; use of multi-storey buildings results in savings in cost of external access, but entails additional building cost in providing vertical circulation, e.g. staircases and lifts
Ground Conditions	Subsoil conditions technically difficult for construction, e.g. rock outcrop, black cotton soil, etc.	Special foundations to buildings—particularly where multi-storey buildings are used—and drainage more economical to provide
ECONOMIC Land Cost	Related to physical shortage of land or to special suitability for other purposes	Increased costs tend to force housing development further out to less convenient but cheaper land
Distance from Home to Work and Transportation Costs	The siting of homes conveniently in relation to work places may be a factor of great importance in the economic life of households	Results in shorter distances to work, making journeys easier and cheaper; unless development is well planned, very high densities may produce congestion and make public transport more difficult to operate efficiently and cheaply, and travel by cycle or car difficult
Availability and cost of Essential Services	E.g. water, sewerage, drainage, lighting, power; roads and footpaths, public transport, etc. Detailed aspects are discussed separately under water supply; sanitation and waste disposal; access; ground conditions, etc.	As densities increase the cost of services generally tends to fall; but at certain levels, e.g. in high buildings, higher standards are needed, which may be more costly
Availability and Cost of Building Skills materials and Equipment	May permit less complicated building techniques; and, where it results from increase in space between buildings, less durable or fire-resistant materials; may reduce first cost and permit exploitation of traditional local building techniques; or use of self-help building	As densities increase, building techniques tend to become more complicated and costly, involving more durable and fire-resistant materials; up to a certain level, increases in density may result in savings in first cost due to economies in land use, services, space standards, and the adoption of multiple house types; however, a point is reached when higher densities involve even more complex and specialized building skills, design techniques and works organization, with consequent increase in first cost; at this level, greater rationalization of building processes, especially on large projects, may bring reductions in cost

Source

Stevens Peter H. M.
Densities in Housing Areas
London H. M. Stationery Office
1960

BASIC SERVICES

Empirically it has been proven that the behavior of the cost curve of the provision of service networks goes down when the density increases. Then the curve stabilizes in its lower part, to begin to increase again once the density drops below 1000 inhabitants per hectare (see chart).

This data is a product of adding costs of water supply, sewage, electricity and service streets to each lot, different projects done by Banco Alrero and private developers in Caracas. This added cost is then plotted in one curve that is in function of the population density.

The figure also shows that the curves of isolated services are very similar to the wave of total service costs.

The scale of behavior of the curve is as follows:

Density	Bs/P.C.
100	1200 (267.85 U.S.)
200	800 (187.57 U.S.)
400	300 (66.96 U.S.)
1000	100 (22.32 U.S.)
1900	500 (111.60 U.S.)

(1 U.S. dollar = 4.48 Bs.)

Estimates were done to lower construction costs on the basis of density adjustments in 37 cities with more than 20,000 inhabitants in Venezuela. These estimates show that by increasing the density from 400 to 700 inhabitants per hectare in Caracas, the construction costs would be reduced by 58%, and that in other cities in the interior, by increasing the density from 140 to 400 inhabitants per hectare, the costs would be reduced by 65%.

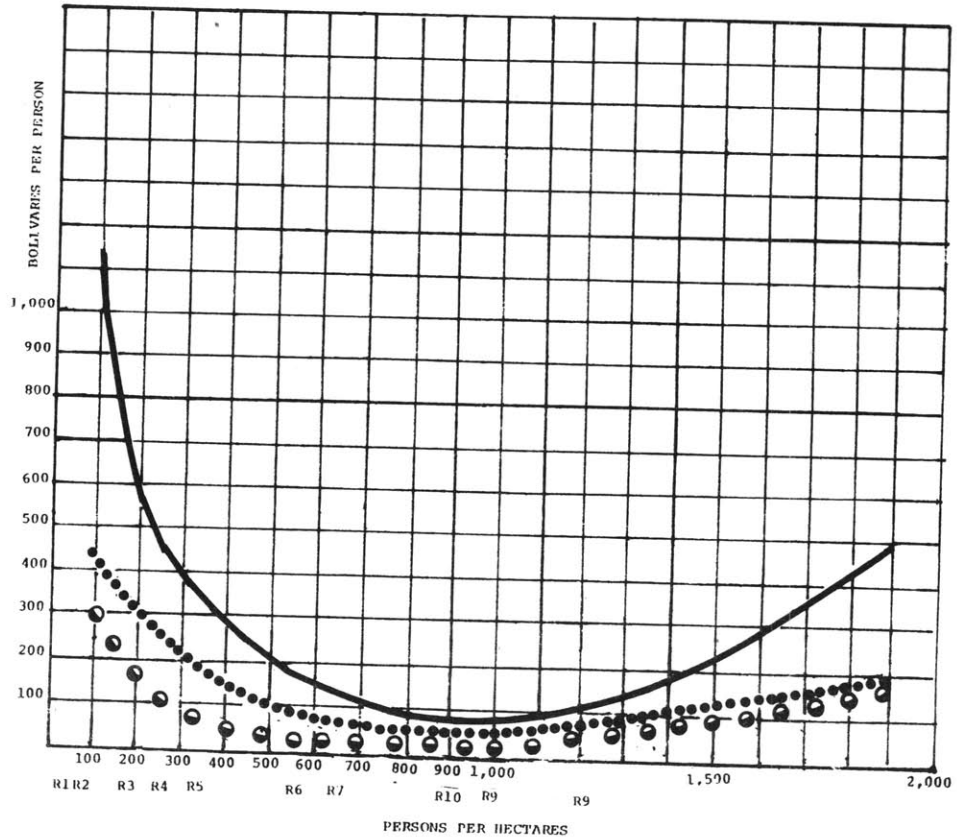
VERTICAL: COST PER PERSON

Bolivares per person
1 U.S. dollar = 4.48 Venezuelan Bolivares (1,971)

HORIZONTAL: PERSONS PER HECTARES

SERVICES

- ● ● ● ● ELECTRICITY
- ○ ○ ○ ○ WATER AND SEWAGE DISPOSAL
- CIRCULATION
- TOTAL
- R NUMBER OF STORIES

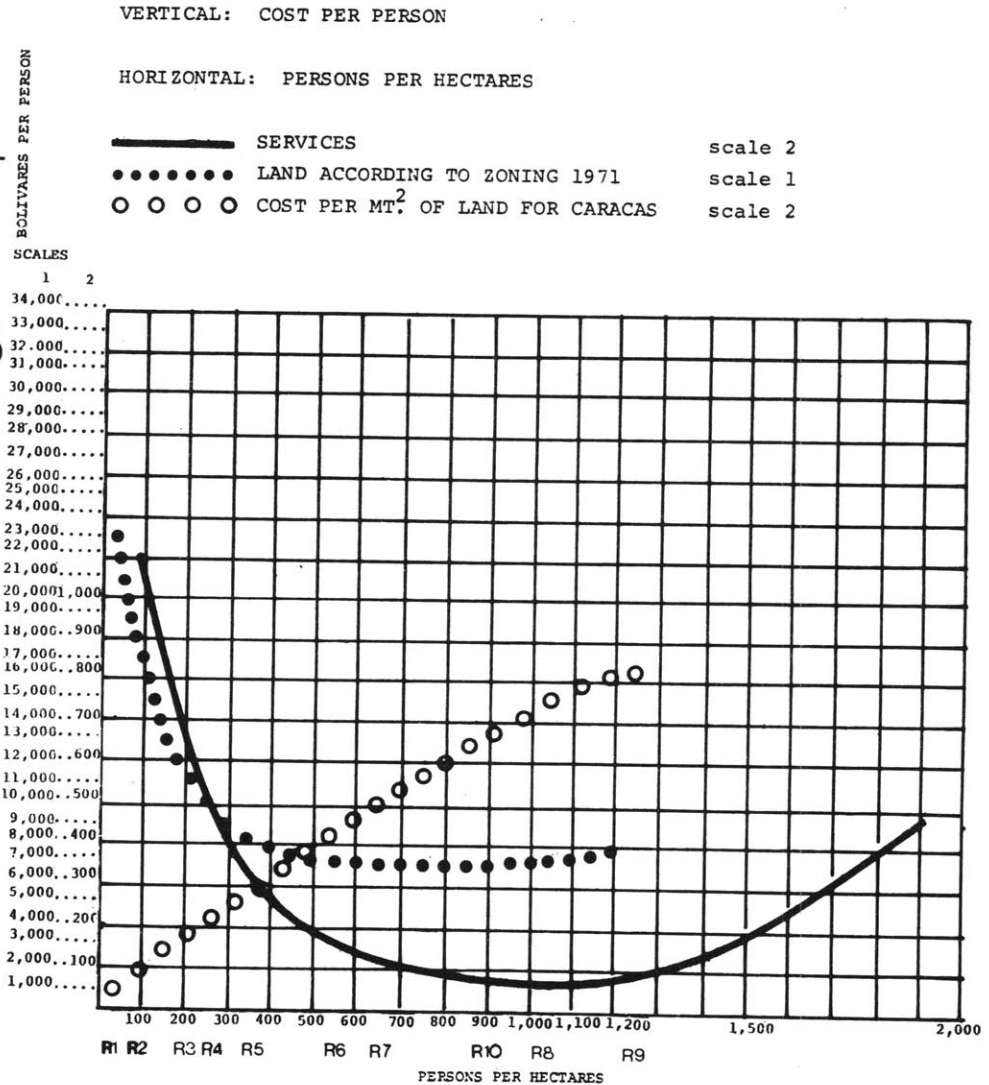


COST PER PERSON IN FUNCTION OF DENSITY

A cost of land per capita curve as a function of the density was prepared on the basis of the price of land in 1971, including the rationalization created by zoning regulations in Caracas. This curve shows that the cost per capita in a density of 100 inhabitants per hectare was Bs. 17,000 (3,794.64 U.S.). As the density increases, the cost decreases up to a cost of Bs. 8000 (1785.71 U.S.\$) per capita with a density of 400 inhabitants per hectare. Beyond this point, the cost remains almost stable in spite of the increase in density. A reduction of the cost per capita is produced even if the price of a square meter of land increases, but reaches a point in which by increasing the density, the cost per capita is maintained or increases very slowly. Therefore, the highest increases in land costs of urban land use for multi-family housing, with densities above 400 inhabitants per hectare are for 6 to 9 story high structures.

Source of Chart.

Urdaneta, Alberto. *Costos de Urbanización en Venezuela*. Cuadernos de la Sociedad Venezolana de Planificación No. 84-85. 1971.



CIUDAD LOSADA

REGIONAL GROWTH CENTER

INTRODUCTION:

The metropolitan area of Caracas faces the problem of the overuse of its services. This is a very large problem, but can be outlined as follows:

ANTECEDENCES

- Scarce flat lands, high cost of the urban areas and consequent incapacity to contain the population growth (Caracas is close to its saturation point; it has occupied almost completely the valley and the adjacent mountains, around 36,000 Ha.)
- Inadequacy of the massive transportation system, as well as of the rail system of the city.
- Uncontrolled growth of the marginal population, caused by the concentration of services and opportunities in Caracas.
- Uncontrolled growth of the commercial areas caused by the lack of a comprehensive policy about the allocation of employment sources.

OBJECTIVES

The basic objective behind the development of the Valle del Tuy Medio as a "regional growth pole" and consequently, the city of Diego Losada is to implement a policy of decentralization and redistribution of the industry now all concentrated in Caracas. By accomplishing such decentralization, it is expected to simultaneously be able to fulfill a number of other objectives:

- To obviate the high level of congestion that exists in the Metropolitan area of Caracas
- To promote the development of the Valle del Tuy Medio and the new town of Losada, as well as of the other cities of the Valley.
- By providing the adequate urban equipment, sources and infrastructure, incentives for allocation of industry, with a clear policy of decentralization of Caracas in order to estimate the growth of Ciudad Losada, it would promote the investment by the private sector in the zone.
- To attract at least part of the migrant population that now goes to Caracas.

ORIGINS

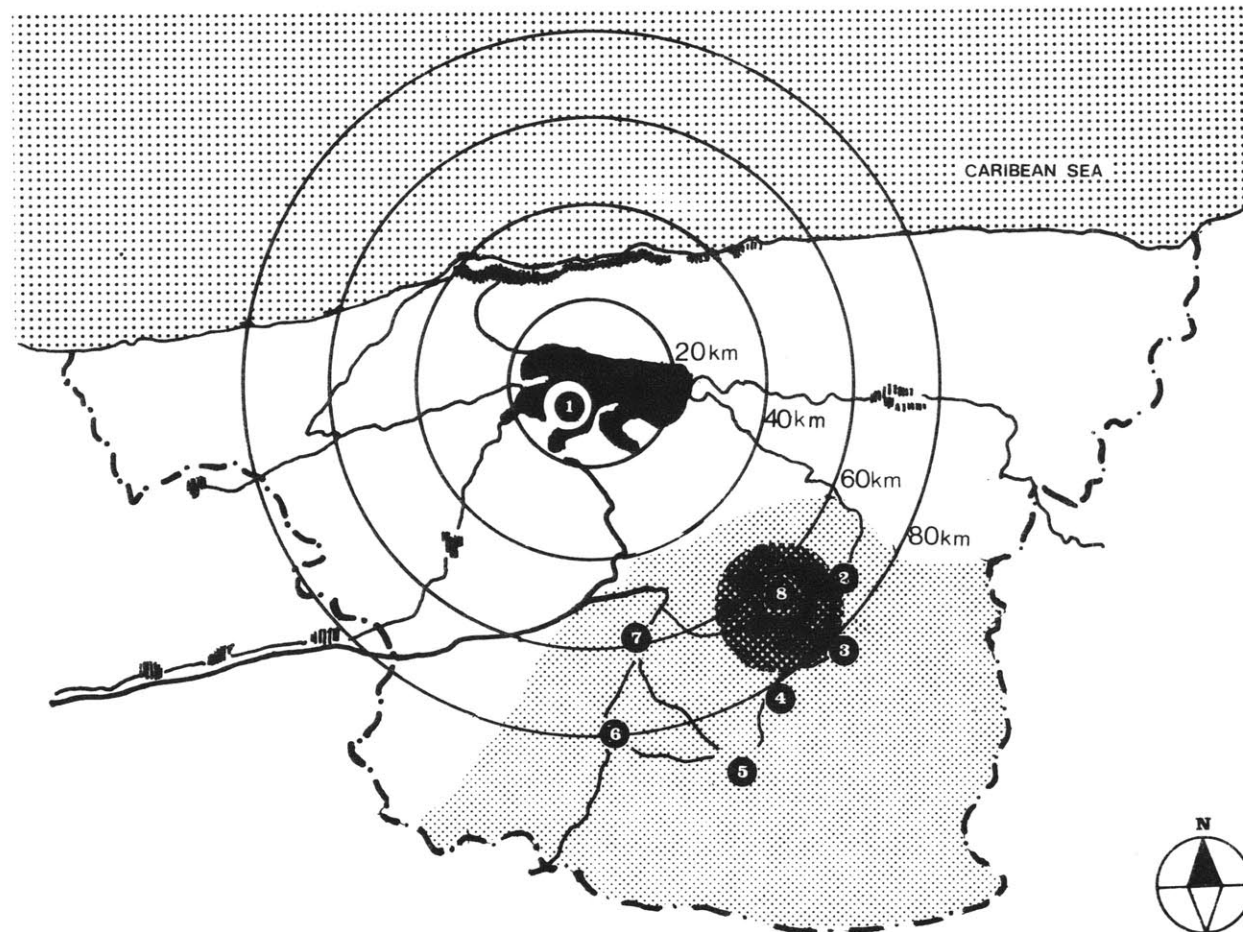
- 1957 The preliminary work for the development of the region of the Valle del Tuy started in 1957, when the expropriation of 6900 Ha.'s of land for the construction of the new town of Ciudad Losada took place.
- 1968 In 1968, a preliminary proposal for the development of the Valle del Tuy Medio was completed by the Government Planning Agencies and an English consultant planning team. The construction of a new town was introduced in the proposal as an expansion of the towns in the region.
- These preliminary studies also proposed to establish a committee in charge of carrying out the program.
- 1972 In 1972, an administrative committee, of the I.N.A.V.I. (Instituto de la Vivienda), was constituted for the supervision and control of the construction of the new town, as well as the expansion and development of the other towns (Charallave, Ocumare, Cua, Sta. Teresa and Sta. Lucia). From this year on, studies for the construction and the implementation of the urban policies were started by "La Gerencia de Desarrollo de Ciudad Losada" with joint cooperation of other government institutions.
- 1974- The final proposal and an investigative report of the area were
1976 elaborated by the government agencies.

Today, Ciudad Losada is under construction. Some of the industries have already been allocated and are functioning. Two public housing developments have been completed and are functioning. Two public housing developments have been completed and are ready to be accepted.

**METROPOLITAN
REGION**

- 1 CARACAS
- 2 SANTA LUCIA
- 3 SANTA TERESA
- 4 SAN FRANCISCO DE YARE
- 5 OCUMARE DEL TUY
- 6 CUA
- 7 CHARALLAVE
- 8 CIUDAD LOSADA

 VALLES DEL TUY



The Valle del Tuy Medio is located on the southern region of the Metropolitan area of Caracas in the sector of the river Tuy's basin, right before it enters the Barlovento Plains. The Valley is surrounded by mountains of the Andes system. On the northwest, it is separated from the Metropolitan area of Caracas by mountains as high as 1000 meters above sea level. On the south, the Serrania del Interior, with altitudes between 1200 and 1600 meters above sea level, separates the Valle del Tuy from the Plains of Llanos. On the west, hills divide the Valley from the lake Valencia and on the east similar hills separate it from the Barlovento Plains.

The Valle del Tuy has an area of 5200 Ha, from which the proposed new town would occupy 7500 Ha. The topography varies from slopes of up to 40% to almost flat areas of 5% to 15% slope.

REGIONAL POLICIES

The government plans are to coordinate with the Regional Development Planning in a 20 year program for the development of the sub-region of the Valle del Tuy. From an existing population of 116,339 in 1971 (census), it is expected the population will reach 1,200,000 by the year 1996. This population is planned to be distributed in the towns, cities and agricultural land as follows:

	1971	1996
Charavalle	11,267 Hab.	230,000 Hab.
Cua	12,880	230,000
Denmare de Tuy	24,229	250,000
S. Francisco de Jape	2,738	25,000
Santa Lucia, Santa Teresa and Ciudad Losada	15,696	450,000
Rural Areas	<u>49,520</u>	<u>75,000</u>
TOTAL	116,330	1,260,000

According to the commission in charge of the industrial decentralization of the metropolitan area of Caracas, 11,000 industries must be moved out of the city. About 70% of the decentralized industry will be relocated in the Valle del Tuy, about 20% in the Valles of Guarenas and Guatire and 10% will be placed in other areas within the metropolitan area.

Due to the growing tendency of the industries related to the population growth, it is estimated that by the year 1996 3,855 industries will exist in the Valle del Tuy, providing 192,500 jobs. These industries will be located in an area of approximately 2700 Ha.

The expected 1,200,000 inhabitants by the year 1996 will require approximately 215,000 housing units, a 87% increase over the existing housing stock of the region in 1975 (26,848 units). To reach this expected growth, an annual

construction of 1075 housing units is necessary. This construction rate will be the combined effort of the private and the public sectors between 1976 and 1996.

The total area designated for housing in the Valle del Tuy is of 15,500 Ha., and 1,500 Ha. have been designated as agricultural land.

Ciudad Losada, the proposed new town, will absorb 400,000 inhabitants out of the sub-region concentrating them in an area of 7673.40 Ha. This population includes 115,000 expected inhabitants by the year 1996 for each one of the towns of Santa Lucia and Santa Teresa.

The first stage of development involves residential, industrial and commercial areas with a total of 1282 Has. and aims to accommodate 52,600 new inhabitants. Ciudad Losada is already under construction.

An important part of the regional program is that of revitalization of the agricultural land. Agricultural production has decreased up to 25% from 1961 to 1971; furthermore, the amount of land destined for agricultural use has, in the same period, also decreased 26%, from 26,800 Ha. to around 19,800 Has. This trend has continued; by 1975, only 3000 Ha were cropped.

The government plan has designated 30,000 Ha. out of the total 52,000 Ha. of the region, for agricultural use, and several irrigation systems have been considered for the Valle del Tuy.

Regional-Metropolitan and Urban Services

The program for the Regional Growth Centers includes:

Regional Facilities - A regional park
- Recreational and tourist facilities
- Reconditioning of the river beaches and their facilities

Metropolitan Facilities - 1600 Has. for institutional buildings

Urban Facilities - The towns within the Valle del Tuy each have their own master plan. Therefore, the provided facilities depend directly on the characteristics and needs of each town. These urban facilities include: Hospital, churches, recreational and sport facilities, social and cultural activity centers, public parks, cemeteries, national, commercial and administrative buildings.

Services - Transportation/roads, infrastructure/utilities/services, environmental considerations.

System of Public Roads - An integration with the existing road system has been proposed as part of the plan. An existing intra-community highway connects the towns of Charallave, Cua, Ocumare del Tuy, Santa Teresa and Santa Lucia; providing a continuous metropolitan and urban communication.

There is also a freeway/throughway/tollroad, interstate highway that connects the Valle del Tuy, and the regional and metropolitan areas within it, to the major cities of Venezuela.

Minor arterials connect the metropolitan areas with the agricultural areas, as well as with the communities that are settled in the mountains.

A railroad system and a regional airport have been proposed by the Board of Metropolitan and Regional Planning.

Utilities/Services/Infrastructure - Existing services and utilities in the region are deficient. The new town, Ciudad Losada, has already been provided, by the government agencies, with the basic network of utilities. They include water supply, sewage disposal and electricity for the urban residential and industrial areas; gas and telephone lines for industrial areas. Intercommunity highways and access roads have been provided with storm drainage. The following services/utilities/infrastructure have been programmed for the Valle del Tuy: Public transportation, police and fire protection, refuse collection, health services, schools, kindergartens, open recreational spaces, treatment plants for water and irrigation systems (Ministerio de Obras Publicas/ Direction General de Planeacion Urbana - Valle del Tuy - Plan de Ordenamiento Rural)

Environmental Considerations - The two main rivers of the valley, the Tuy river and the Guaire river, are both polluted. Their water will be treated and improved, and they will be used as drainage for the agricultural land. Protection of natural resources within the region, using them as regional parks, has also been considered.

HOUSING PROGRAM FOR CIUDAD LOSADA The magnitude of the housing program for Ciudad Losada can be appreciated through these figures: In the next few years, the public sector will have to build 47,715 housing units, or 63.25% of the total amount, and the private sector will build 27,741 housing units, representing 63.75%. In 20 years, 75,492 units are expected in an area of 1.584,44 Ha. of land.

Contrary to expectations, most of this population will have low income. The industry will be attracting workers with little or no training, looking for employment. The construction of the city itself will require large numbers of unskilled laborers. Both of these reasons combined will bring a large low-income population to Ciudad Losada.

It is important that housing for this group be provided in the development of Ciudad Losada. At the moment, the proposed projects for the area fall within the categories of high-rise and detached single family house models. As it has been said earlier, either one of these models meet the needs of the low-income population.

URBAN CONTEXT - CIUDAD LOSADA, VENEZUELA

Ciudad Losada is located on the northeast side of the Valle del Tuy and on the west side of the towns of Sta. Lucia and Sta. Teresa. The boundaries of the new town are defined by natural as well as man made barriers. At the north, the mountains separate the new town from the Metropolitan area of Caracas. At the south, the interstate of ORIENTE, which is under construction, limits the town. The boundary at the east is the river GUAIRE, at the south, the freeway and at the west, the military zone.

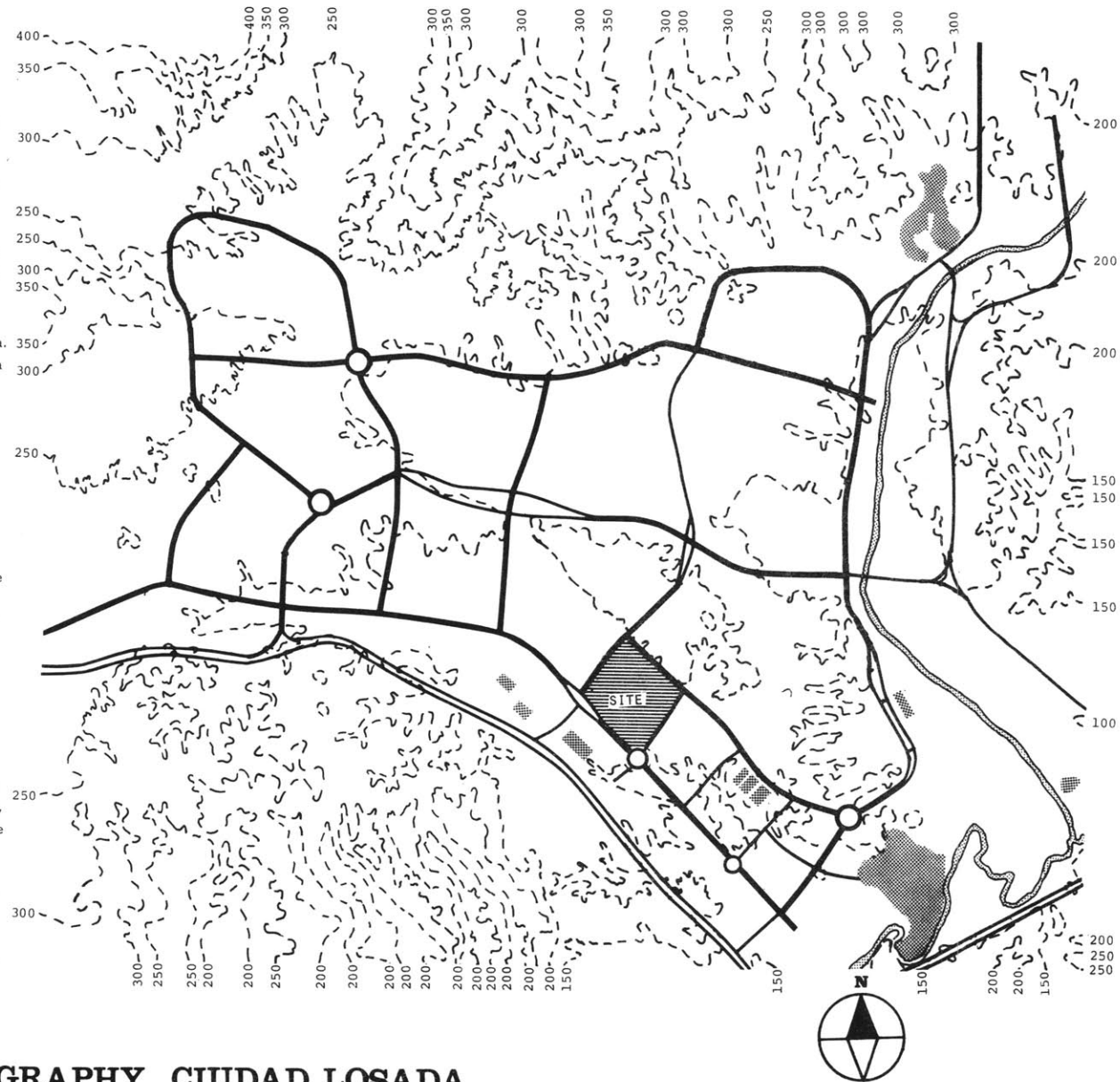
The total area occupied by the development of Ciudad Losada is approximately 7673.40 Ha. This figure includes the towns of Sta. Lucia and Sta. Teresa.

Climate

Ciudad Losada is located at latitude 10°5' North - 10°20' North. The temperature varies between extremes of 12.4°C (during December and January) and 37.8°C (during May). The average temperature is 26°C. The annual rainfall is between 700 mm and 1000 mm. The rainy period extends from May to November.

Demography

In the beginning of the development of Ciudad Losada, with the incentives produced by the allocation of resources and industry, it was expected that by the end of 1977, the population of Santa Teresa and Santa Lucia would be 60,000 inhabitants each; by 1978, 75,000 inhabitants, by 1979, 95,000 inhabitants and 115,000 inhabitants are expected by 1980. This would complete the anticipated population of 407,656 inhabitants for Ciudad Losada in the first 5 years of development.



CIRCULATION/ TOPOGRAPHY CIUDAD LOSADA

URBAN PROPOSAL

BASIC DATA

The "UNIT 4-20" housing project is located in the new town, Ciudad Losada, on the outskirts of the town of Sta. Teresa.

AREA OF THE SITE: 76.92 hectares

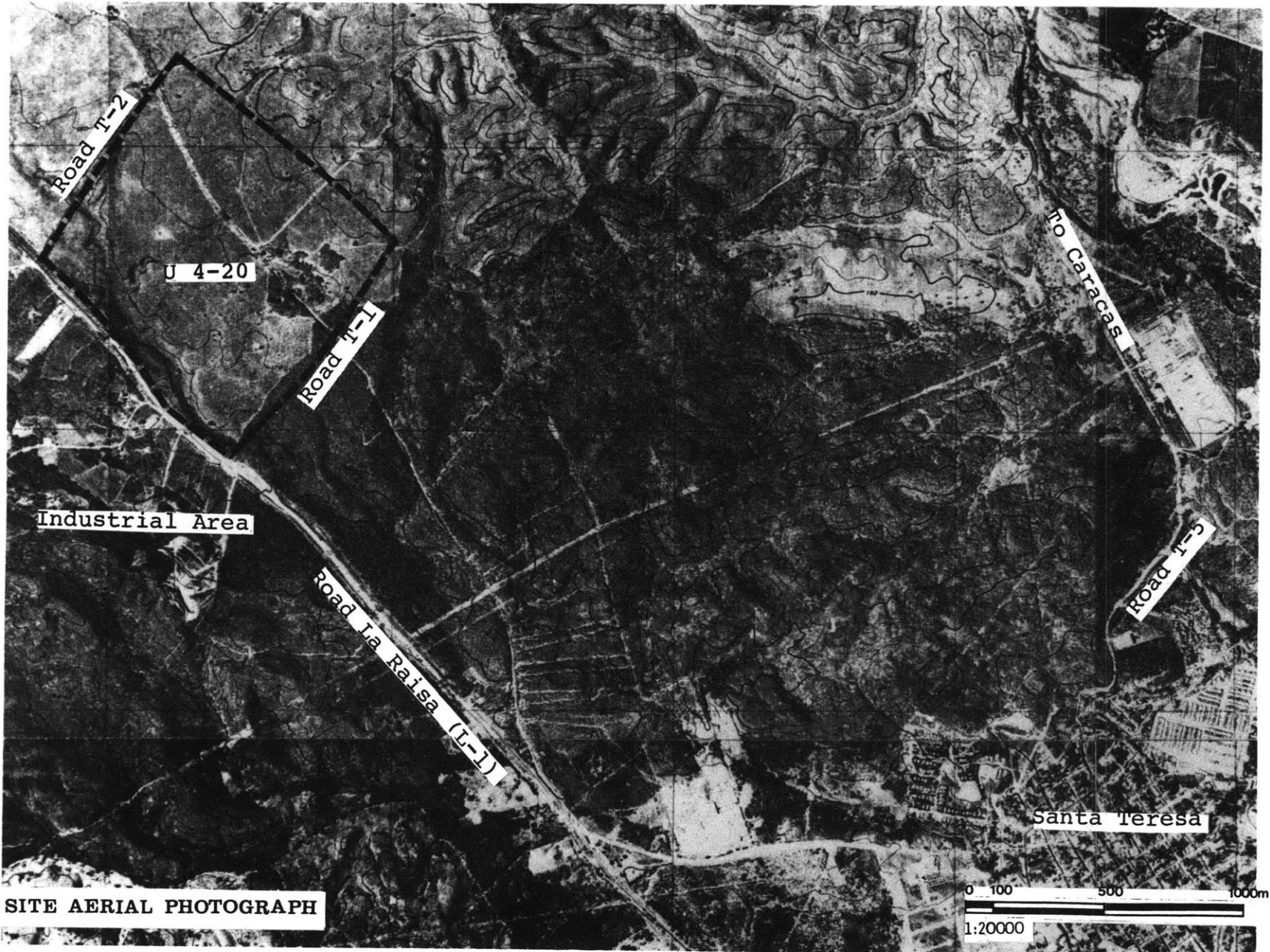
APPROXIMATE POPULATION: 24,306/30,000

NUMBER OF DWELLING UNITS: 4,600 - 5,000 units

SUPPORTING FACILITIES

- 4 primary schools
- 1 secondary school
- 1 church
- commercial facilities

APPROXIMATE DENSITY: 300/600 people/hectare



SITE AERIAL PHOTOGRAPH

BASIC SITE DATA**LOCATION:**

The site is located about 5 kms west of downtown Sta Lucia and about 2 kms south of the new industrial development along La Raisa road. The site is adjacent to a public housing project actually under construction.

BOUNDARIES:

The site is defined by perimeter streets which correspond to the main circulation network proposed for the new town, Ciudad Losada. On the west, south and north site boundaries, La Raisa or "L 1" road, the "T 1" road and the "L 2" road are main through streets for exclusive vehicular use. On the east site boundary, from the "L 1", an "L 2" road diverges the "T 2" road with a secondary through circulation.

The adjacent areas to the site are residential neighborhoods on the west and east sides, industrial parks on the south and a large recreational park on the north.

APPROACHES/ACCESS:

The main routes of approach are the three main perimeter streets of the site. The L 1 road and the L 2 road are parallel streets running from east to west, which lead to the industrial areas located along these routes, to the town of Sta. Teresa and basically provide access to other urban areas and continuity within the city. The "T 1" road, running from north to south has the same character as the other two main routes. It leads to other industrial areas (north), to the mountain (north) and to the town of Sta. Lucia (northeast).

SIZE/SHAPE:

- Gross area of the site: 76.92 Ha.
- Square shape

TOPOGRAPHY/NATURAL FEATURES/SOIL:

The site is irregular with slopes varying from 2% to 15%, with an average slope 5% for most of the site and up to 40% on the southwest along the "L 2" road.

LAND TENURE:

All the land in the site is owned by the government, since 1972, when 11,020 Ha. were expropriated for the development of Ciudad Losada.

OTHER FACTORS:

Smoke-odors-dirt: Detailed study must be done to know the type of industries adjacent to the site and the environmental effect they may have on the residential areas.

Flooding: The site is well drained.

INFRASTRUCTURE:

All utilities to the site are available from the main network of utilities provided within its boundaries.

Community facilities are almost non-existent. Ciudad Losada is in the first phase of its development, just a few limited commercial facilities exist along the LA Ralsa "L 1" road.

**PLANNING
POLICIES AND GOALS**

PRIMARY USE: RESIDENTIAL COMMUNITY

The site will be a residential community for 25,000 people that will occupy 76.92 Ha. of land at its full development.

TARGET INCOME GROUP: MIDDLE LOW AND LOW INCOME GROUPS

- The project intends to build public housing units for subsidized middle-low and low income groups. For the purpose of future development, middle and high income groups are expected to mix with middle and low income groups by selling part of units at the market rate.

INTENSITIES OF LAND USE: MEDIUM/HIGH DENSITY

- 300/600 persons per Ha.

FINANCING: PUBLIC AND PRIVATE

- According to the housing program proposed by the government, all the housing project will be constructed with public and private financing.

CIRCULATION NETWORK: PREDOMINANTLY PEDESTRIAN AND BUS SYSTEM

- Vehicles and pedestrians will be mixed in the public streets, but pedestrians will dominate over vehicles.

UTILITIES: CONNECTORS TO EXISTING NETWORK

- All utility systems will be connected to the already existing/planned city network.

FORM OF TENURE

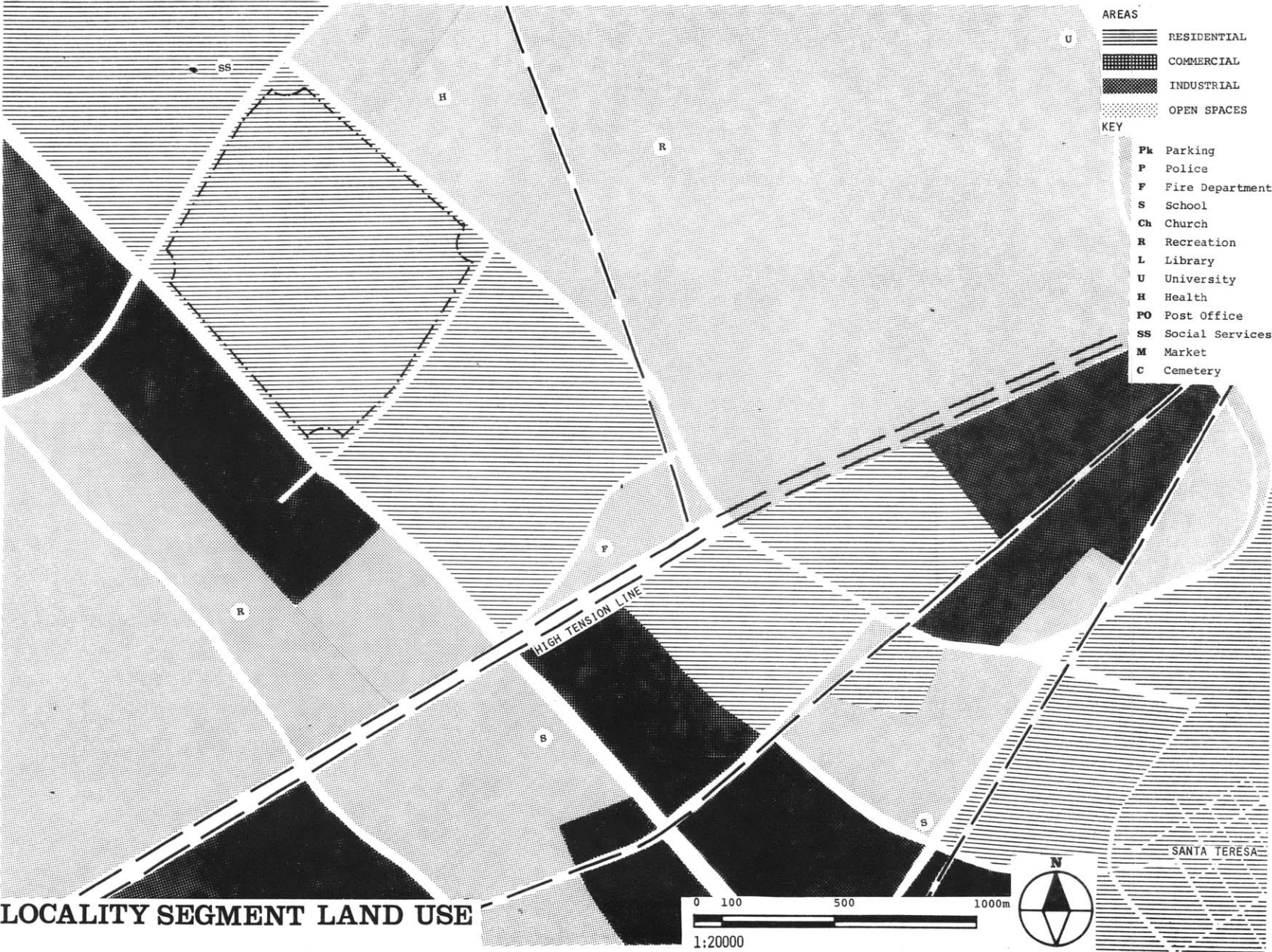
- Private/co-operative ownership and rental.

DEVELOPMENT MODE: INSTANT

- The instant development of this project is intended to provide low cost housing to the unskilled immigrants of the new town.
- The primary infrastructure networks (water, electricity, sewers, streets, street lighting) will be initially developed.
- Community facilities and the dwellings will be instantly or incrementally developed.

URBAN PROPOSAL (45)

- AREAS**
- RESIDENTIAL
 - COMMERCIAL
 - INDUSTRIAL
 - OPEN SPACES
- KEY**
- Pk Parking
 - P Police
 - F Fire Department
 - S School
 - Ch Church
 - R Recreation
 - L Library
 - U University
 - H Health
 - PO Post Office
 - SS Social Services
 - M Market
 - C Cemetery

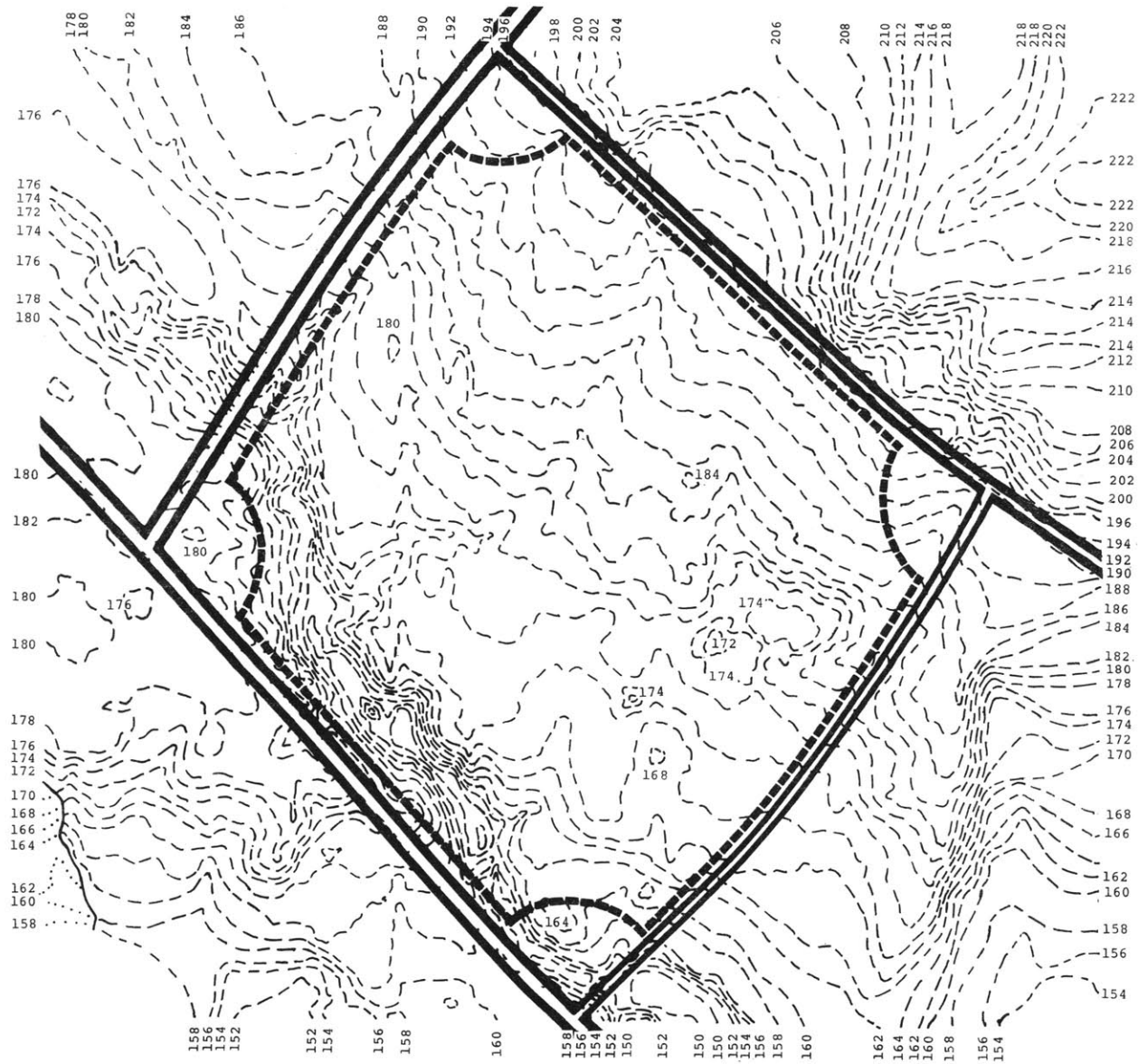


LOCALITY SEGMENT LAND USE

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1:20000



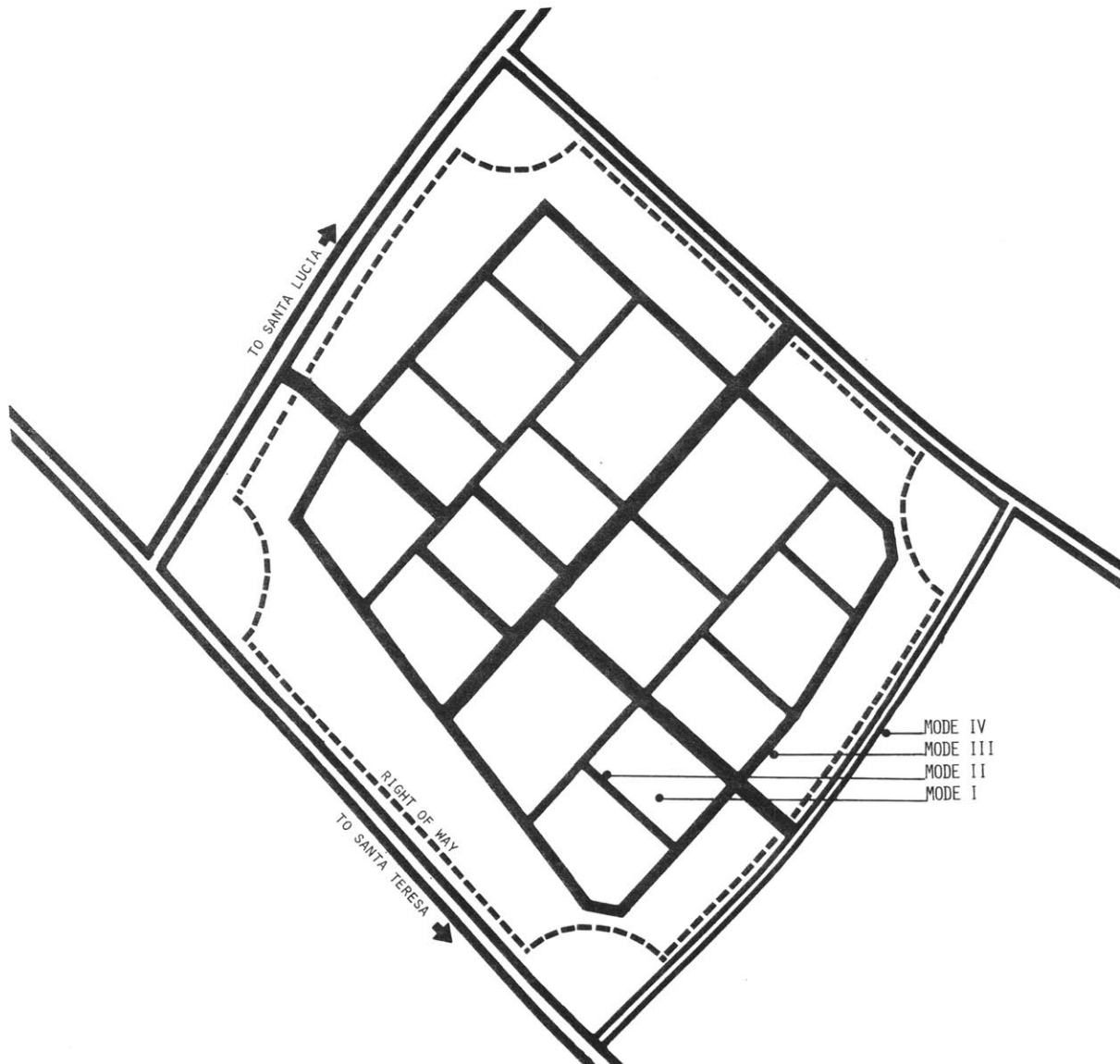
SANTA TERESA



SITE TOPOGRAPHY



URBAN PROPOSAL (48)



- MODE I: Pedestrian walkways and cluster court. Exclusive use by pedestrians.
 - MODE II: Residential streets. Pedestrian and vehicles mixed, pedestrians dominate over vehicles. Used mainly as access to the dwellings, clusters and community facilities.
 - MODE III: Secondary streets. Vehicles and pedestrians mixed, vehicles dominate but do not control circulation. Used mainly around the plaza where the major commercial activities are concentrated and to connect the site to adjacent residential neighborhoods.
 - MODE IV: Primary street (La Raisa road, the L-1 road and the T-2 road). Vehicles and pedestrians mixed, vehicles dominate, relatively high speed traffic with moderate volume. They are used to connect the site with the major industrial areas as well as other employment centers within the area.
- Parking areas are located in the semiprivate clusters, in the first floor of the dwelling units and around semipublic facilities.

MODE IV
MODE III
MODE II
MODE I

PROPOSED SITE CIRCULATION



CIRCULATION SYSTEM

The system of circulation forms one of the most important parts of the urban layout. It not only channels the pedestrian and vehicular movements, but it also determines patterns of land utilization, land subdivision and layout of utilities. They include: street paving, street lighting, storm drainage, electricity, sewage disposal and water supply.

The pattern of circulation proposed for the new town, Ciudad Losada, forms the framework for the proposed circulation network and site development.

The network also provides utility lines throughout the site by providing access for maintenance and control. The utility lines are considered to be under public control.

The circulation layout is based on:

The proposed circulation layout connects the site with its immediate neighborhood, the town of Santa Lucia and the adjacent industrial areas through main streets.

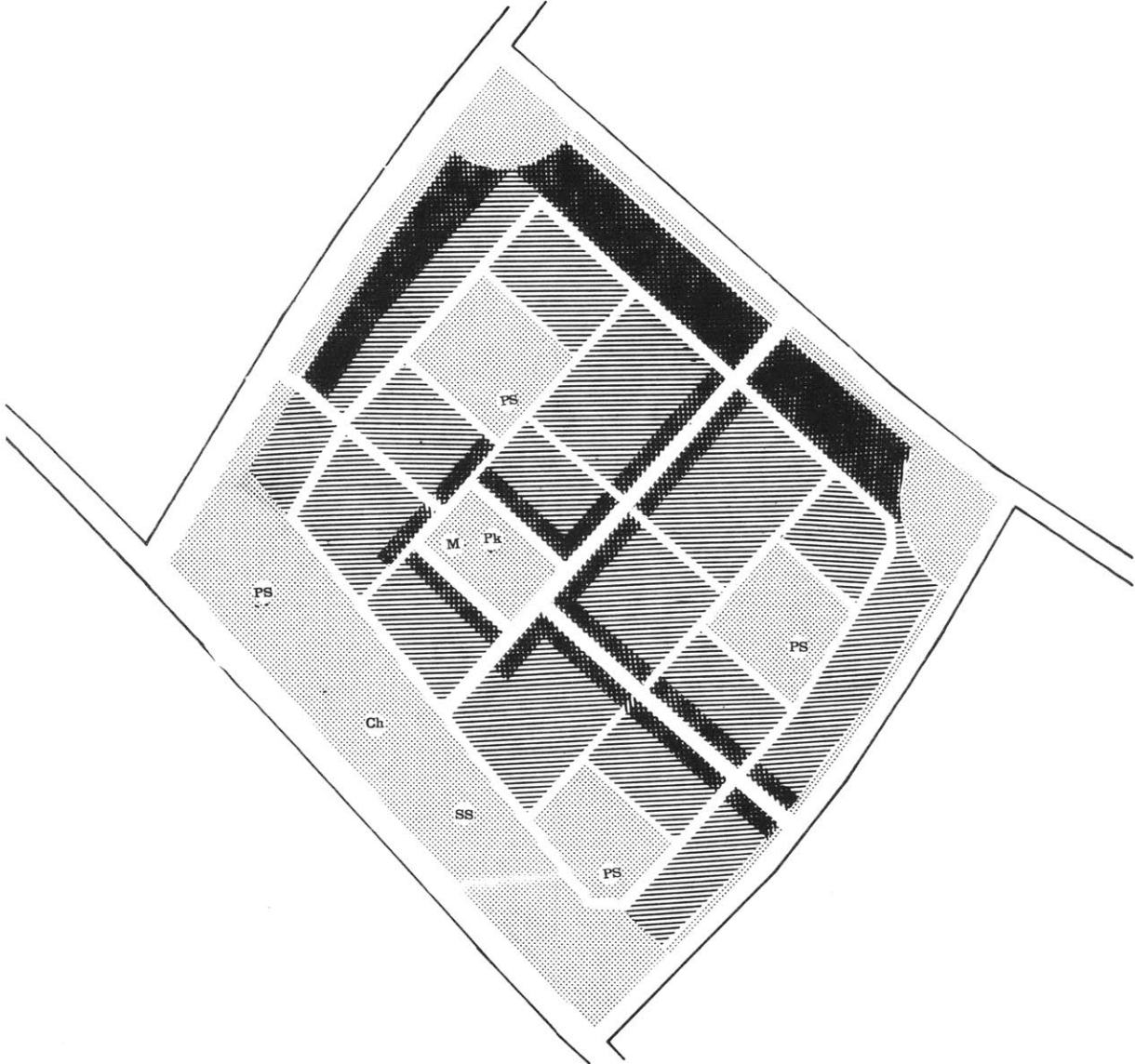
To minimize circulation length and length of utility networks per area served meaning less government burdens, responsibilities and services.

Promoting pedestrian mode of circulation within the site.

- MODE I: Pedestrian walkways and cluster court. Exclusive use by pedestrian.
- MODE II: Residential streets. Pedestrian and vehicles mixed, pedestrians dominate over vehicles. Used mainly as access to the dwellings, clusters and community facilities.
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Definitions

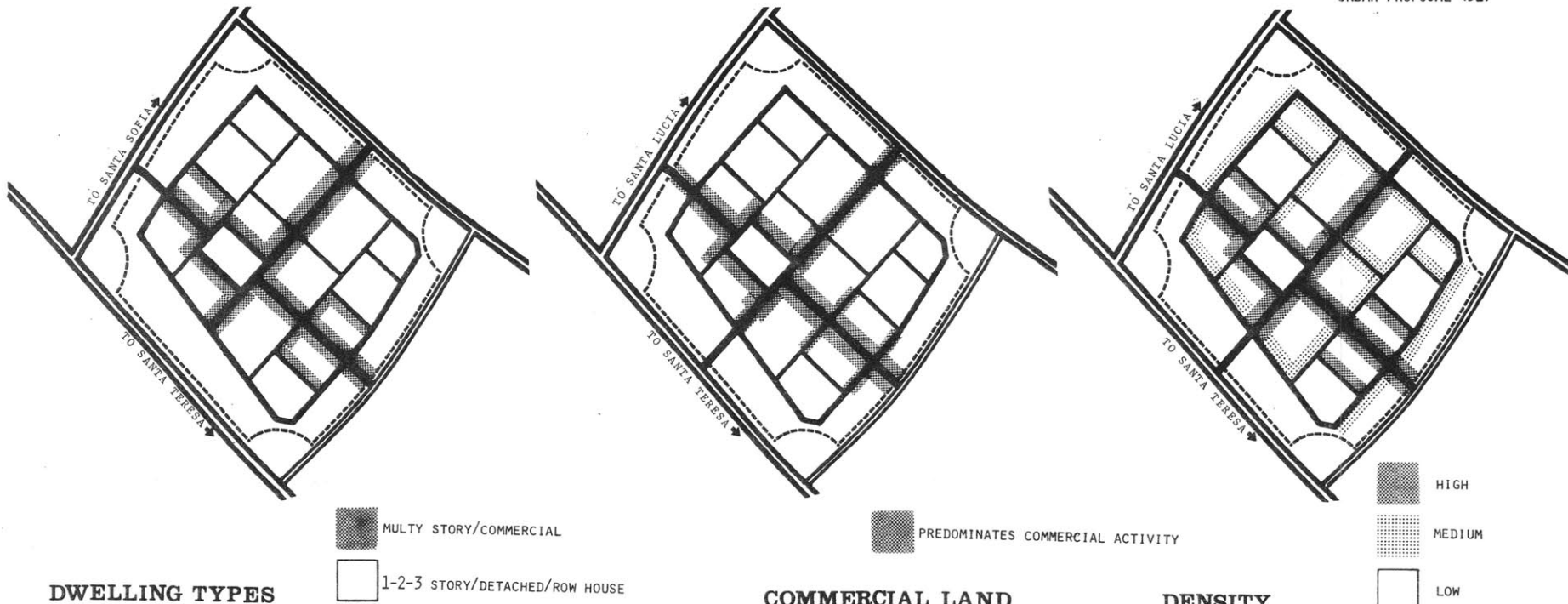
Camino, H. and Goethert, R.,
Urbanization Primer, Urban Project
 Department, World Bank, Washington,
 D. C., 1976.



- AREAS
- RESIDENTIAL
 - COMMERCIAL
 - OPEN SPACES
-
- SS Secondary School
 - PS Primary School
 - M Market
 - Pk Parking
 - Ch Church

SITE LAND USE







DWELLING TYPES

The dwelling types reflect the aspects of land use, land value, population densities and income groups.

A variety of dwelling types are planned to meet conditions of groups at different economic levels, each providing a means for incremental development, thereby maximizing flexibility to meet each groups' needs, according to their financial possibilities and family growth. Based on these conditions, housing units are planned in different sizes and in incremental phases.

Consequently, the sub-division of land has to be flexible enough to meet a variety of dwelling types in relationship to income groups:

-  MULTY STORY/COMMERCIAL
-  1-2-3 STORY/DETACHED/ROW HOUSE

- The dwelling types for moderately low and middle income groups, the detached/row houses, are located along the minor streets (Mode II) where the land value is moderately low.
- The dwelling types for low income groups, the detached/row houses, are located around the inner areas (cluster courts), where the land value is low.
- The dwelling type for higher income groups, the walk up apartments, are located in the commercial land use function areas where the land value and population densities are higher.

COMMERCIAL LAND

Commercial activities extend along the major circulation network which also provides the major transportation routes.

An arcade is planned along the main streets and around the plaza. The 4.40 mt. cover area of the arcade provides enough protection against the sun while it provides room for commercial activities of minor scale (street vendors). The plaza provides the space for an open market.

Scattered convenient commercial activities will develop in a random pattern within each neighborhood. The location of such retail establishments is generally the corner lots of intersections.




-  PREDOMINATES COMMERCIAL ACTIVITY

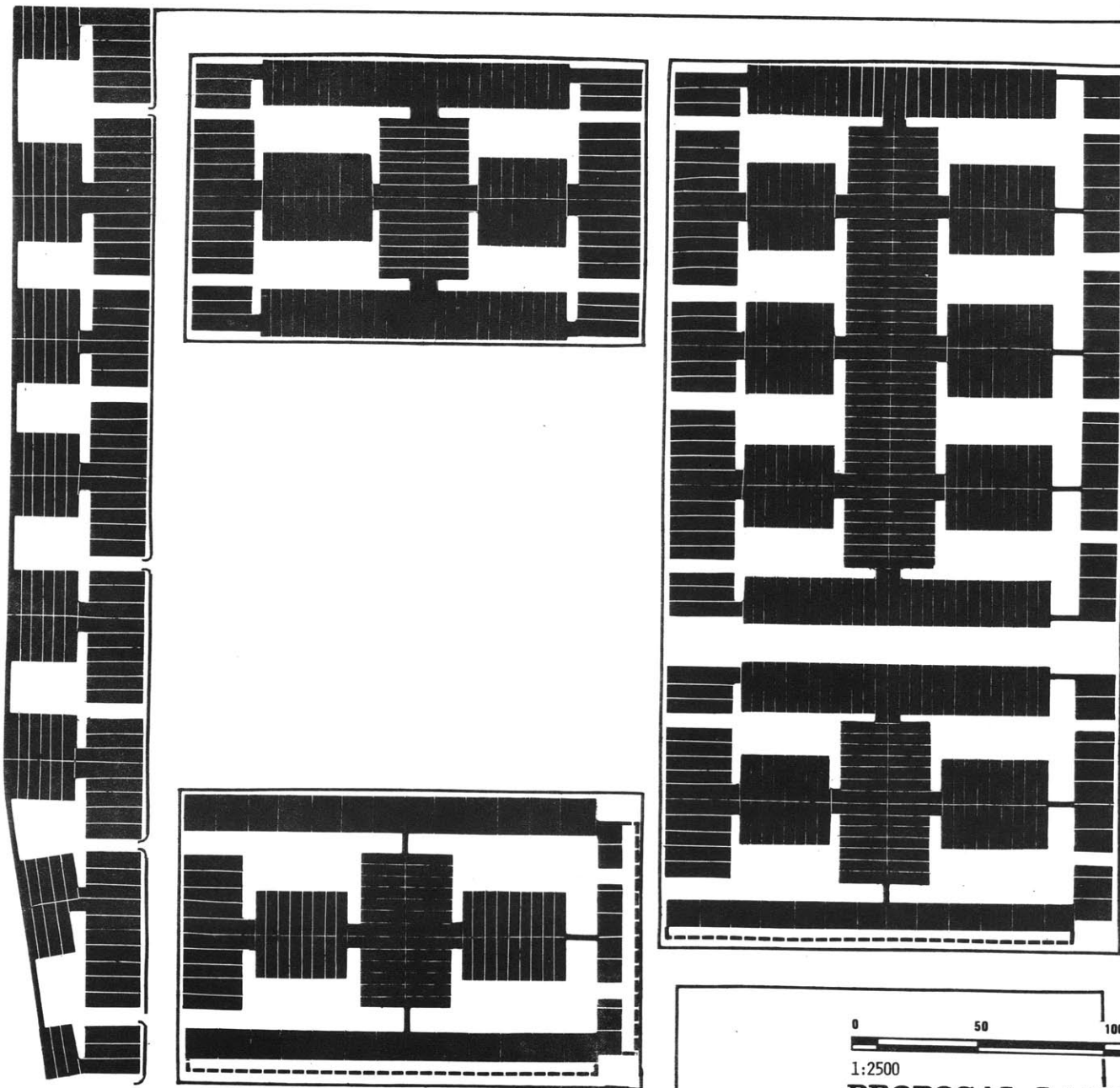
DENSITY

The population density is higher in the areas of larger commercial activity, along the main streets and around the plaza, decreasing in relation to the distance from the main connector street.

Nevertheless, population density may vary through time depending on the influence that the adjacent industries will have over the development due to their proximity to it.

The industries will attract workers that will have to be accommodated near by, consequently, the development is planned to be re-adjusted over time without destroying its basic layout.

-  HIGH
-  MEDIUM
-  LOW



LOCALITY BLOCK LAND UTILIZATION DATA

DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	905	750	120
DWELLING UNITS	1594	750	212
PEOPLE	9564	750	1274

AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	5.34	27
SEMI-PUBLIC (open spaces, schools, community centers)	3.46	17
PRIVATE (dwellings, shops, factories, lots)	7.50	37
SEMI-PRIVATE (cluster courts)	3.85	19
TOTAL	20.12	100



1:2500

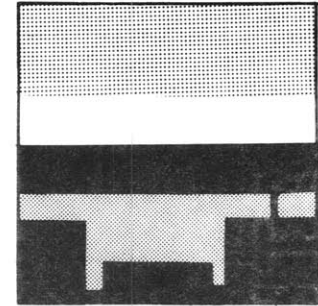
PROPOSAL: LAND SUBDIVISION



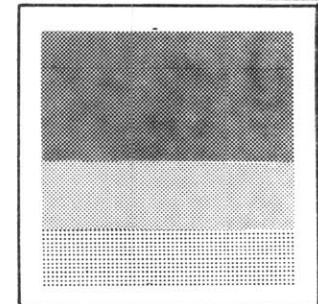
URBAN PROPOSAL (53)

LAND UTILIZATION DIAGRAMS

1 Hectare



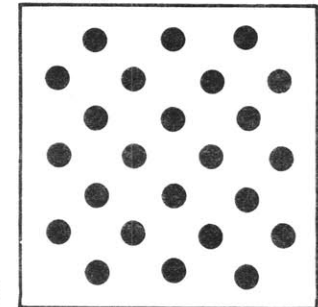
- Public: streets/walkways
- Semi-Public: playgrounds
- Semi-Private: cluster courts
- Private: lots
- 1 Hectare dwellings



PERCENTAGES

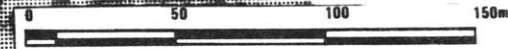
Streets/Walkways	27%
Playgrounds	17
Cluster Courts	19
Dwellings/Lots	37

1 Hectare



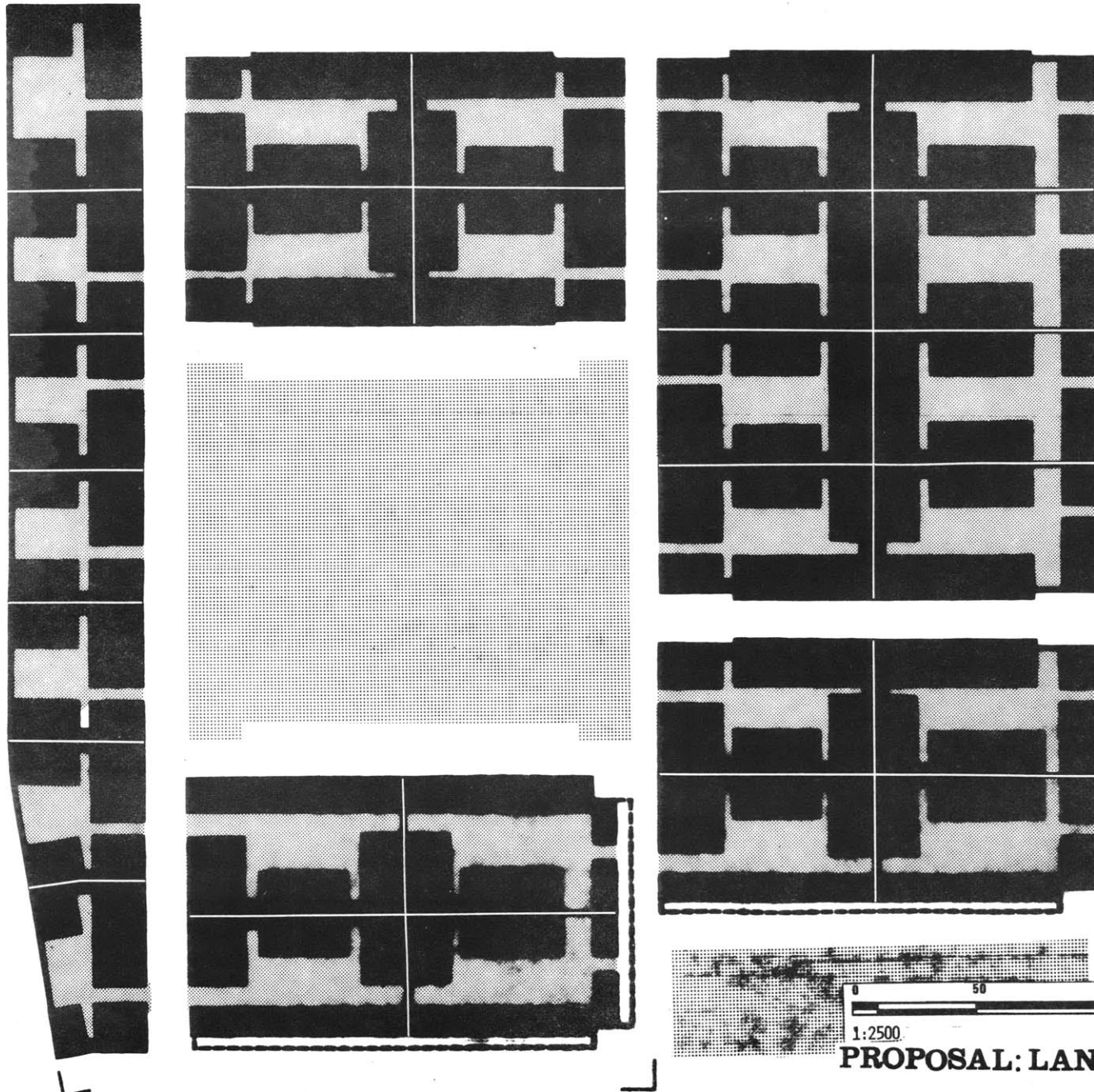
DENSITY Persons/Hectare 475

● 20 Persons



1:2500

PROPOSAL: LAND USE



BLOCKS, LOTS AND CLUSTER COURTS

- BLOCK is a portion of land bounded and served by lines of public streets and walkways.
- LOT is a measured parcel of land having fixed boundaries and access to public streets, walkways or cluster courts.
- CLUSTER COURT is a group of lots owned individually or in condominium around a semiprivate common area.
- CONDOMINIUM is a system of direct ownership of a single unit in a multi-unit whole. The individual owns the unit in much the same manner as if it were a single family dwelling; he holds direct legal title to the unit and a proportionate interest in the common land and areas. Two types of condominiums are recognized: HORIZONTAL: detached, semidetached, row/grouped dwelling types; VERTICAL, WALK-UP: high-rise dwelling types (USDP).

The block layout proposed is based on the following policy:

MINIMIZATION OF: Public ownership of land; lengths of infrastructure; government burdens, responsibilities and services.

MAXIMIZATION OF: Private ownership of land; and private responsibility.

The blocks contain horizontal condominiums or clusters, where dwelling units are grouped around a common court that serves as an access space as well as a semiprivate open space and the occupants share the use of this court as well as the responsibility for the maintenance of the cluster court.

The cluster courts are organized around a semipublic space to accommodate the community facilities and serve as a focus for the group of clusters around it. The semipublic space has an urban scale to contrast the domestic scale of the cluster courts, and also to contain playgrounds, a social cluster, religious clusters and a primary school.

Surveillance over the cluster court, established by visual relation and control of every dwelling unit into it, is responsible for maintaining the safety and the semiprivate use of the court.

The court proportion is around one third to one fourth of the total cluster area, depending on the height and number of dwellings.

The layout permits:

- FLEXIBILITY IN LAND USES

Blocks are similar in shape and dimensions. Still they permit the accommodation of different land uses (residential, residential/commercial, light industries, school, playgrounds, sport fields.

- FLEXIBILITY IN RESIDENTIAL DENSITIES AND HOUSING SYSTEMS WITHIN THE SAME LOT STRUCTURE

Several alternatives are proposed within the project in terms of densities, dwelling types and construction mode.

- Medium and high densities
- Instant and/or incremental development
- Houses and expandable houses; apartment units and expandable apartment units.
- Row, grouped, walk-up combinations.

- EXPANSION OF HOUSING SYSTEMS

Cluster courts facilitate expansion and transformation of buildings without changing lot cluster configurations or the circulation network planned initially.

- Horizontal: addition on the ground
- Vertical: addition of extra stories

- DIFFERENT TYPES OF LAND TENURES

A variety of land tenures are proposed in each lot cluster:

- Ownership: individual
condominium
- Rental: individual
cooperatives

LAND USE

The U.S.D.P. at M.I.T. has formulated some guidelines for the proportions of the different spaces ranging from public to private areas. These guidelines are based on case studies in the U.S. and in Latin America, and they are used as reference points for comparison purposes.

The urban proposal responds to the need of minimizing areas and length of circulation while maximizing areas under the responsibility of individuals or groups of users. Therefore, land utilization percentages must be optimized. The function of the public area is to serve the private area, and the public area has costs of construction or capital costs and cost of operation (administration and maintenance). This means that public ways require paving, maintenance, cleaning, lights and signals, public control and safety administration. All these functions represent costs that have to be paid by the users of the served private land. Therefore, the larger the relationship between public and private area, the higher the price paid by the users. In the measure that the public area can be reduced within specified minimum requirements, resources can be stretched to benefit more people.

The following definitions are necessary to determine the type of areas, the use and responsibility assigned to each one of them.

PUBLIC AREA: Urban area devoted to circulation of vehicles and pedestrians, including streets, pedestrian ways and open spaces under responsibility of the public sector. The public area has a minimum or no control.

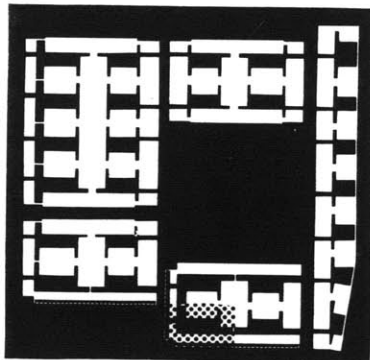
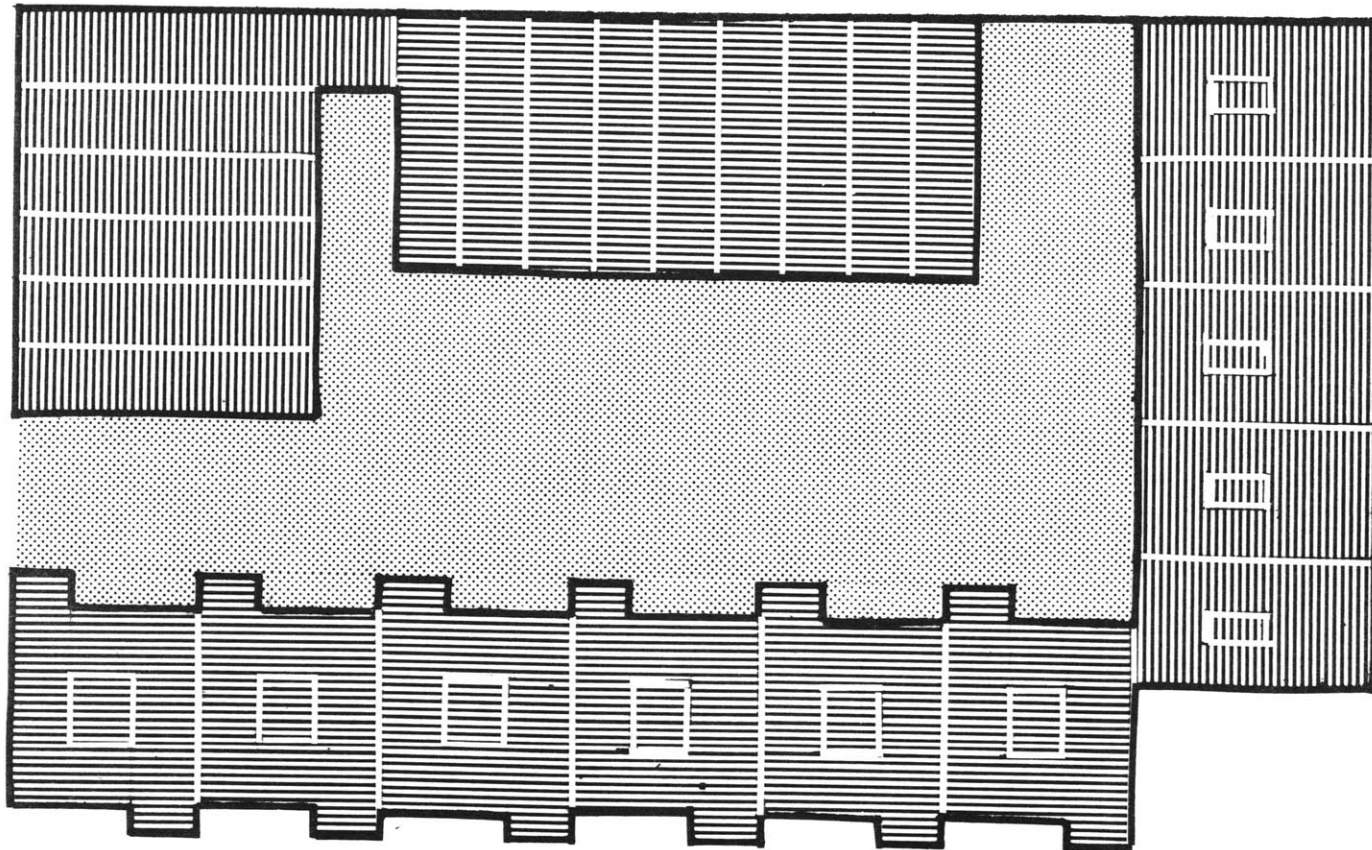
SEMIPUBLIC AREA: Urban area devoted to the utilization of the community, including open spaces, playgrounds, schools or other community facilities; under the responsibility of users and public sector with partial or complete control (USDP).

SEMIPRIVATE AREA: The semiprivate area is the urban area called "cluster" where a few dwellings are grouped around a common court that serves as an access space as well as open space. The semiprivate area is owned in condominium by the people of the dwellings around the court. These people control and share the use and the responsibility for the maintenance of the court (USDP).

PRIVATE AREA: The private area is the urban area devoted to residential, commercial or light industry, under complete control and direct responsibility of individual users (USDP).

Definitions

Camino, H. and Goethert, R.,
Urbanization Primer, Urban Project
Department, World Bank, Washington,
D. C., 1976.



CLUSTER UNIT



LAND UTILIZATION DATA			
DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	26	0.48	54
DWELLING UNITS	36	0.48	75
PEOPLE	216	0.48	450

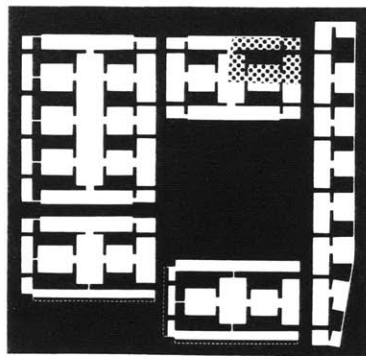
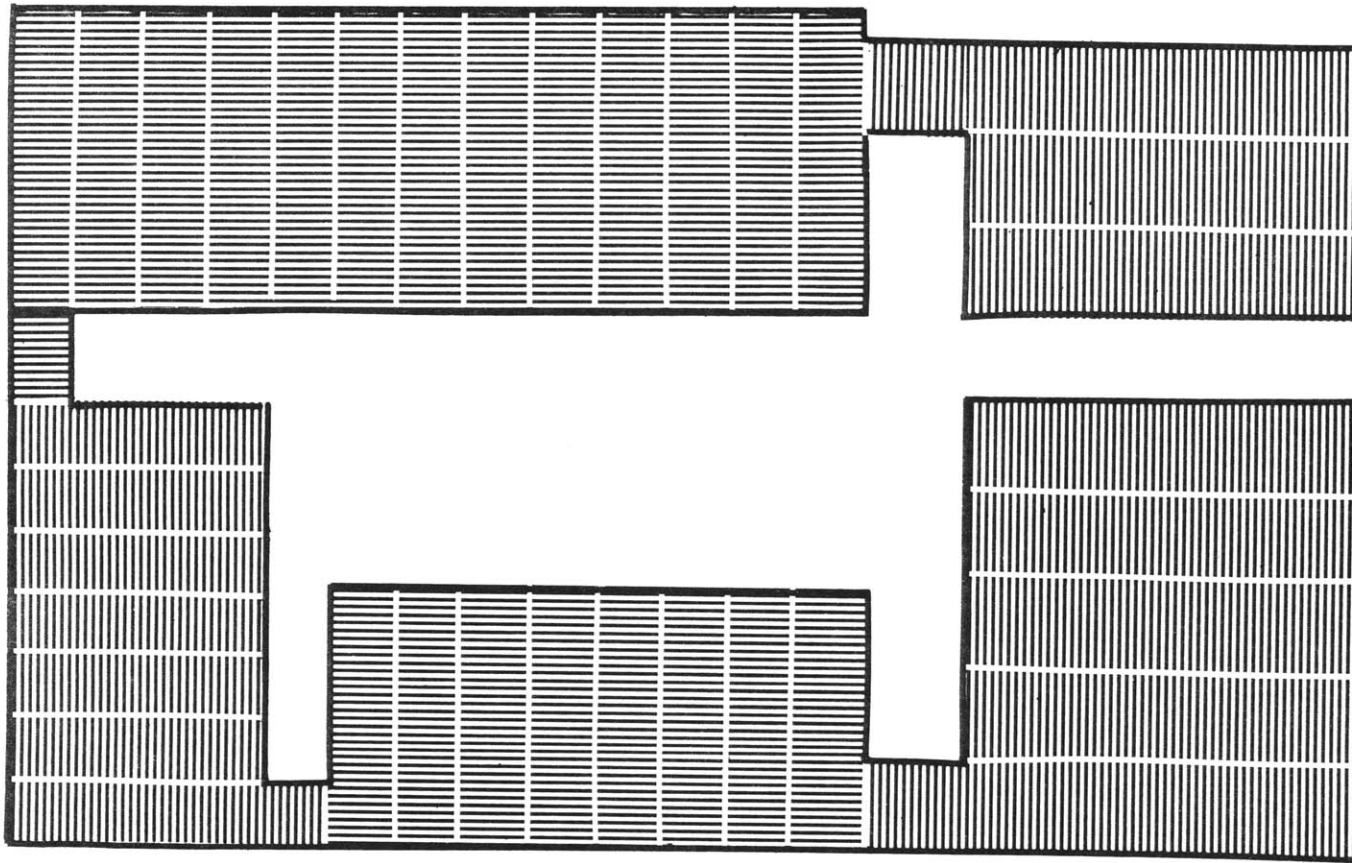
APARTMENT OPTICNS: (initial area)

- 57 mt² 66mt² 77mt²
- 81 mt² 108mt²
- 90 mt²

HOUSES OPTIONS: (initial area)

- 92 mt²
- 39 mt²

Ground floor has commercial use.

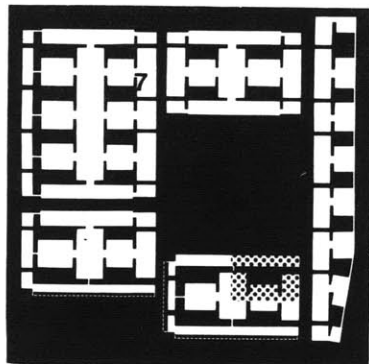
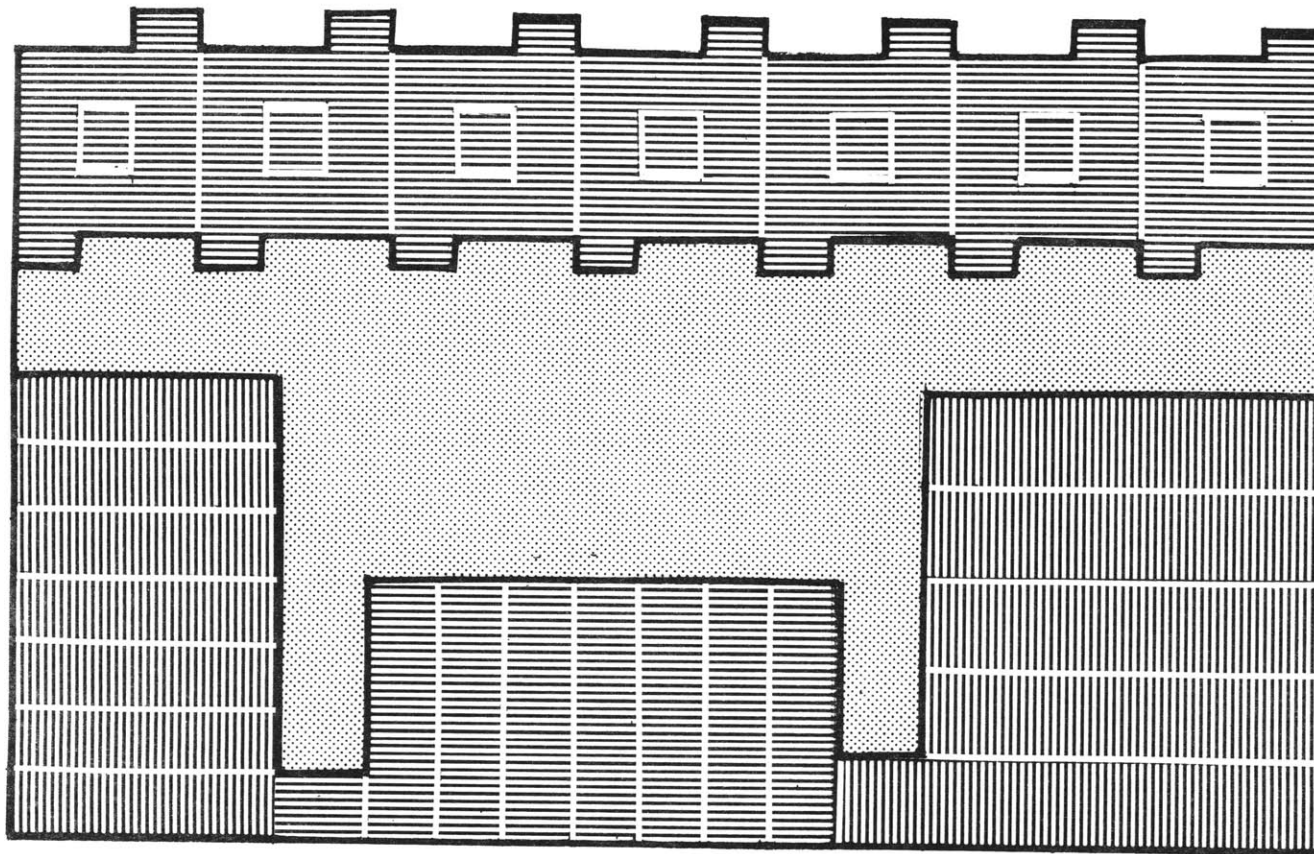


CLUSTER UNIT

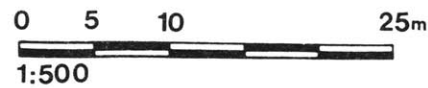


LAND UTILIZATION DATA			
DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	36	0.48	75
DWELLING UNITS	44	0.48	91
PEOPLE	264	0.48	550
HOUSES OPTIONS: (initial area)			
	- 39 mt ²		
	- 63 mt ²		
	- 85 mt ²		
	- 160 mt ²		

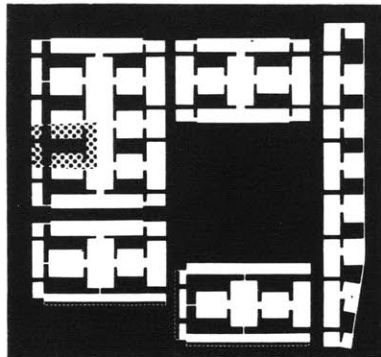
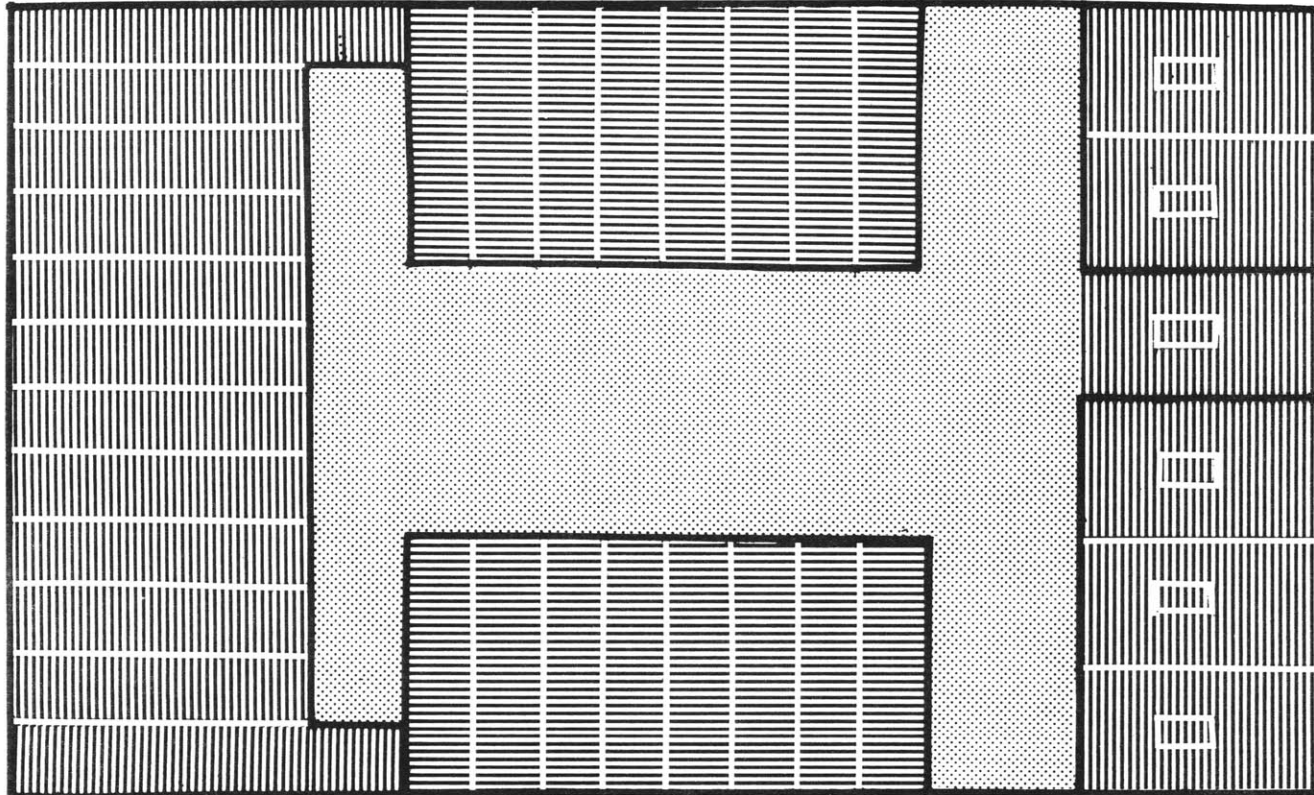
URBAN PROPOSAL (60)



CLUSTER UNIT



LAND UTILIZATION DATA			
DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	26	0.47	55
DWELLING UNITS	38	0.47	80
PEOPLE	228	0.47	450
APARTMENT OPTIONS: (initial area)			
	- 81 mt ²		
	- 90 mt ²		
	- 108 mt ²		
HOUSES OPTIONS: (initial area)			
	- 92 mt ²		
	- 39 mt ²		
MULTIFAMILY OPTIONS: (initial area)			
	- 65 mt ²		
	- 160 mt ²		



CLUSTER UNIT

LAND UTILIZATION DATA			
DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	34	0.46	73
DWELLING UNITS	46	0.46	268
PEOPLE	576	0.46	1052
APARTMENT OPTIONS: (initial area)			
	- 57	mt ²	
	- 66	mt ²	
	- 77	mt ²	
HOUSES OPTIONS: (initial area)			
	- 39	mt ²	
	- 85	mt ²	



HOUSING PROPOSAL (62)

HOUSING PROPOSAL

HOUSING PROPOSAL The proposed housing project attempts to maximize the household responsibility and effort through a housing system based on an incremental development within structures up to five stories high. The design of the dwelling units is planned to be completed and expanded inside with floors and partitions according to the family's financial situation. As a result, the cost of the dwelling units is minimized to offer more alternatives in the initial investment with shorter term interest payments to be paid by the family. At the same time, in an incremental development program, the initial capital investment by the government is minimized for the same number of units provided. Therefore, more dwelling units can be built to benefit more families within the same government budget devoted to building mass housing for a limited number of families.

DESIGN PRINCIPLES

The dwelling units design features include:

- The apartment units have a maximum of eight families sharing the stairs in order to facilitate, control, maintenance and responsibility in its use.
- The balconies in the apartment units have enough size for multi-purpose function or for future expansion of the dwelling.
- All the dwelling units are planned as a basic shell or skin that can be expanded and completed inside with floor and partitions according to the user's financial situation.
- The frontage of the dwelling units was intended to be the minimum in order to have a larger number of units sharing the use of the street and the open spaces (clusters).
- The design of the dwelling units allows alterations within the units without changing or damaging the basic structure. The following alterations can be expected with time:
 - The groundfloor of the housing units can be used as a dwelling, a shop or a private garage.
 - The two stories high dwelling units can be divided into two dwellings. This condition would require the installation of another service unit. Thus, careful attention must be given to the design of the plumbing lines.
 - Alterations in the building's facade.
 - Alterations within the units to change the uses and the dimension of rooms. Thus, a basic space for more efficient use,

maximum flexibility and efficient dimensions is provided in each dwelling unit to allow these alterations to happen without changing the original design or requiring extensive changes in the structure.

- The area of each room was planned to have multiple purposes, except kitchens and bathrooms. Each room can be transformed into different uses: sleeping, dining, living or working area. The minimum dwelling width is 4.40; this dimension allows:
 - To use the rooms for different functions
 - To divide the room in two small rooms while still allowing the location of two beds
 - To have a circulation area plus one room
- The dwelling units are provided with one bathroom and one sink for the kitchen. To make the bathroom more efficient, the lavatory, the water closet and the shower are separated in most cases by partition walls. This would allow more than one person to use the bathroom at the same time.
- A 0.20 cm duct space for utilities can supply the necessary vertical ventilation for kitchens and bathrooms. The duct is designed for self suction without mechanical ventilators.
- All dwelling units have simple minimal interior circulation. Most of the alternatives propose, the circulation is concentrated in the center of the units serving all the spaces and avoiding interference into the spaces themselves.
- The proposed housing types are: walk up apartment units and houses
- Walk up apartments:
 - Apartment units with one and two stories high
 - Apartment units with one and two stories high that need to be completed and expanded by the occupants.
- Houses:
 - Houses with two and three stories high
 - Houses with two and three stories high that need to be completed and expanded by the occupants

Special importance is given to the following features for the design of the housing construction system:

- BUILDING HEIGHT: 2 TO 5 FLOORS
Two and three stories high for the houses and up to five stories high for walk-up apartments. The advantages are maximum land utilization, adequate population density and the minimization of the ratio of land cost to total property value.
- The apartment units and houses are adjacent to each other to share at maximum the structural elements (foundations, columns, beams and bearing walls) minimizing the construction cost.
The kitchen and the bathroom plumbing connections are back to back to allow all the plumbing lines and ventilation ducts to be connected in a common duct. A simpler system design and saving of materials are achieved.
- In the dwelling units, only the essential elements are provided (a shell, a service unit, an entrance door, a bathroom door and the minimum windows needed for ventilation and illumination. Elements that do not have prime priority were eliminated (interior doors, partitions, extra bathrooms, extra sinks, floor finishing or tiles and closets).
- If the cost of the housing units is to be kept as low as possible, undue reliance cannot be placed on mechanical means of controlling living conditions. Thus, the hot climate (26°C - 27°C) in which the project is going to be located demands maximum cross ventilation, adequate orientation for dwellings and maximum advantage of those features that promote comfort like sunbreakers for windows, minimum exterior exposure to the sun, balconies and openings as high as the ceiling.
- If the dwelling units have two stories rather than one for the same total area of the dwelling (twice higher but half the width), it allows the second floor to remain unbuilt for future expansion by the user while maximum land utilization is achieved by minimizing the lot areas. As a result, if the roof area of the dwelling is reduced by nearly half and if the proportion of the units is larger than wider, saving in cost could be achieved by reducing exterior material construction.
- The partition walls as well as floor and ceiling are parallel, forming a simple and an acoustical barrier providing maximum privacy to the household to transform and expand its house without annoying the neighborhood.
- Interior and exterior walls are planned:

HOUSING PROPOSAL (66)

To minimize: wall length by avoiding turning corners, saving material cost and having a simple construction process.

To maximize: wall length between openings (doors-windows) to reduce the number of connections between walls and openings.

INCREMENTAL DEVELOPMENT

The housing construction system was designed, taking into consideration the incremental development of the dwelling units. As it has been described in the housing proposal, all the dwelling options consist of a basic shell with a minimum service unit which is provided by the government and built by a contractor, leaving the expansion and improvement of the dwelling to be built and financed by the owner.

FIRST PHASE

The first phase of the project provides the party and exterior walls, the roof slab, a service unit (kitchen and bathroom), plumbing and electrical wiring and the beams for supporting the second floor for those dwelling units with two and three stories.

SECOND PHASE

The second phase of the dwelling units has to be completed through time according to the users financial situation and needs. The following elements are left to the user to be added in the dwelling:

- Interior partitions - doors - closets - floor finishing

THIRD PHASE

The third phase of the dwelling units has to be expanded by the user or local contractor. The expansion of the units includes:

Construction of a second floor.

Expansion of the house could be possible by roofing the balcony and replacing the facade.

Expansion of the dwelling units could be possible by building an extra room on the terrace of the proposed housing units.

Installation of a service unit must be possible, if the dwelling units are divided into two dwellings.

Interior stairs, door, walls, light floor slab, floor finishing, closets and windows are left to the user to be added in the dwelling units.

ISSUES

The following aspects are important in an incremental self-help program:

TENURE

Ownership of the dwelling units is indispensable to a housing system based on an incremental development. The family will put more work and effort on its own house.

- AREA LEFT FOR FUTURE EXPANSION
The dwelling units that can be expanded allow an expansion of 40% or more of the original floor area, otherwise the effort required would not be worth it.
- CONSTRUCTION MATERIALS AND TOOLS MUST BE AVAILABLE TO THE HOUSE_
HOLD WITHIN THE LOCALITY
- THE STRUCTURAL SYSTEM HAS TO BE DESIGNED TO ALLOW FUTURE CONSTRUCTION OF A SECOND FLOOR

The proposed twin beams give room for the future expansion by allowing the support of secondary beams between bays.

In the design of the housing construction system, the industrialization used is:

- Reinforced precast concrete frame structures: Columns and beams are light enough so they can be erected by light mobile cranes. These elements can be manufactured either in central factories and transported to the site by intermediate size trucks, or fabricated on site without requiring heavy equipment.

- Prefabrication of small elements: The construction elements should be light weight in order to allow incremental developments using low to medium skilled laborers. The elements used are: Concrete blocks for structural floor and roof planks, and hollow concrete blocks for bearing walls and interior partitions. Each one of these elements is light enough to be carried by one person without any special equipment. They can be manufactured by hand or automatically, depending on the region's various conditions of development.

The precast concrete joists (maximum weight 130 kg.) can be erected by a light mobile crane or a pulley and a rope system. They can be lifted and set into place by 3 or 4 men. The floor blocks, that go between the precast concrete joists, must weigh less than 25 kg. for a person to be able to handle it alone. A maximum span of 50 cm. for the concrete blocks, and 60 cm. for the blocks between small concrete joists, can be achieved within this weight range.

FOUNDATION: Cast in place, footing and foundation wall.

STRUCTURAL ELEMENTS:

COLUMNS

LENGTH 2.60 mts. - 3.00 mts.
WIDTH 2 cms.
DEPTH 20 cms.

TWIN BEAMS

LENGTH 6.80 mts. - 6.40 mts.
5.40 mts. - 4.40 mts.
DEPTH 42 cms.
WIDTH 10 cms.

FLOOR SYSTEM

A. Precast concrete joist
TOP WIDTH 6 cms.
BOTTOM WIDTH 14 cms.
OVERALL DEPTH 14 cms.
BOTTOM LEDGE DEPTH 4 cms.
LENGTH 3.60, 4.40, 5.40
5.80 mts.

Hollow Concrete Blocks
OVERALL DEPTH 16 cms.
WIDTH 20 cms.
LENGTH 54 cms.

B. Lightweight floor for second expanded story for incremental development: wood or steel

C. Reinforced concrete slab on grade for first floor.

WALLS:

EXTERIOR

Hollow Concrete Blocks
LENGTH 40-20 cms.
WIDTH 20 cms.
DEPTH 20 cms.

INTERIOR

Hollow Concrete Block
LENGTH 40-20 cms.
WIDTH 10 cms.
DEPTH 20 cms.

BALCONIES:

The same as the floor system

STAIRS:

RISERS AND TREADS

Reinforced concrete, wood or concrete blocks.

LANDING

Precast concrete joists and concrete blocks.

EXTERIOR STAIRS

WIDTH 110 cms. (minimum)

INTERIOR STAIRS

WIDTH 80 cms. (minimum)

DOORS - WINDOWS:

DOORS

EXTERIOR 100 cms.

INTERIOR .

ROOMS

100 cms.

BATHROOM/ KITCHEN

80 cms.

Door dimensions are related to modular openings of the concrete blocks and the added thickness of the frames.

The width of kitchen and bathroom doors is 70 cms. while 90 cms. width is used for all other room doors. The wall openings are 80 cms. and 100 cms., respectively, to allow 10 cms. for the frame.

The height of the door is 200 cms., dimension that is a multiple of the 20 cms. concrete blocks. The height also depends on the type of the floor finishing that is initially given.

WINDOWS

MATERIALS

Wood or aluminum frames

TYPES

Louver and/or sliding windows

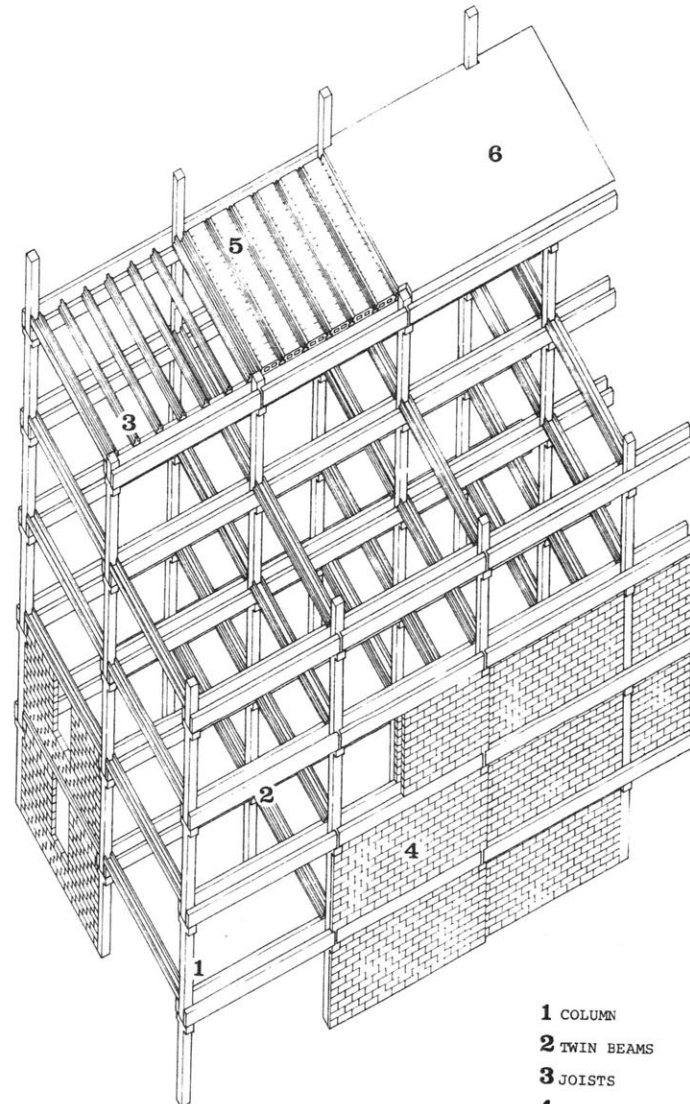
The dimension of the windows is also related to the modular openings of the concrete blocks and the frame thickness. The windows are located flush to the ceiling to avoid special construction of lintels.

ELECTRICITY

Conduits, outlets

SEWAGE/WATER

Connections, fixtures and reserve tank on terrace.



1 COLUMN

2 TWIN BEAMS

3 JOISTS

4 CONCRETE BLOCKS

5 FLOOR CONCRETE
BLOCKS

6 TOPPING

CONSTRUCTION SYSTEM

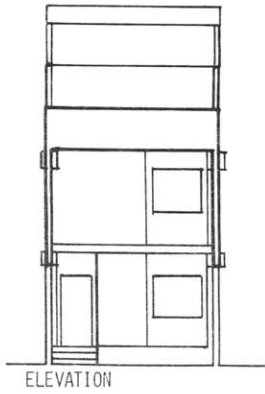
MODULAR COORDINATION

Modular coordination can be defined as a dimensional consistency between the different elements of a building construction system.

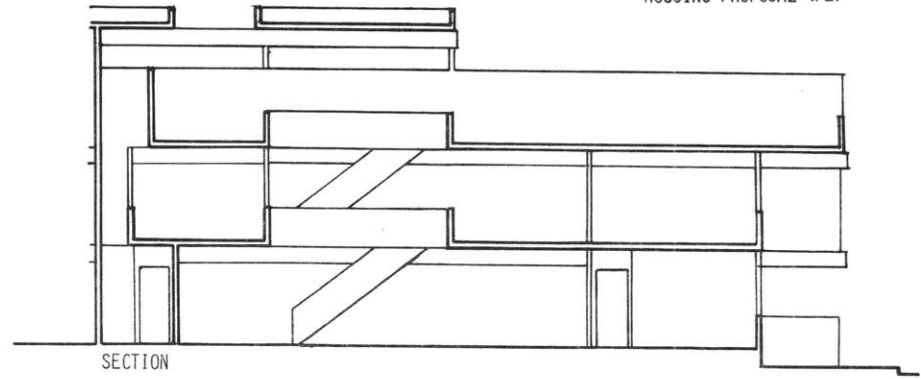
Special importance is given to determine the sizes of the prefabricated elements (columns and beams) proposed for the project if they are to be mixes with local construction (hollow concrete block for walls and floor slabs) and on-site construction.

The dimensional coordination of the dwelling units is based upon the dimensions of the hollow concrete block of 0.40 cm x 0.20 cm x 0.20 cm. Thus, all the dimensions of the dwelling units are multiples of 0.20 cm; which includes the size of columns and beams, length of party walls and openings for doors and windows.

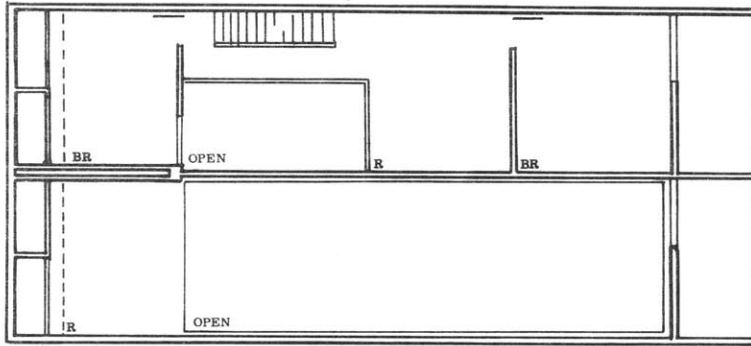
The joists are spaced 0.60 cm center lines; this tension is related to the 0.20 cm frequency of 0.40 cm staggered concrete blocks in the walls. As a result, the span between columns is sized on the basis of 0.60 cm ranging from 3.60 MTS to 6.60 MTS. Height between floor and ceiling has the minimum of 2.40 MTS required by local code.



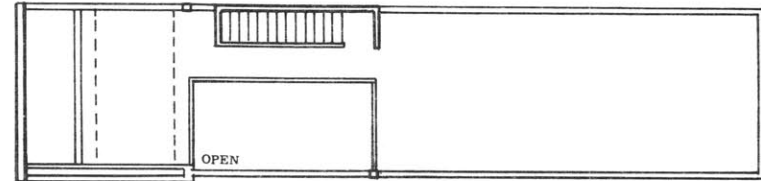
ELEVATION



SECTION



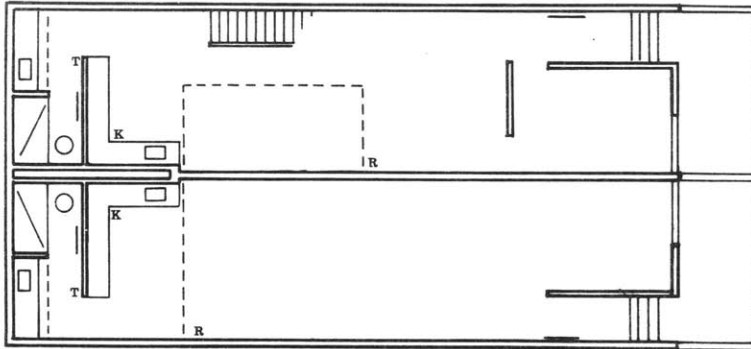
UPPER LEVEL



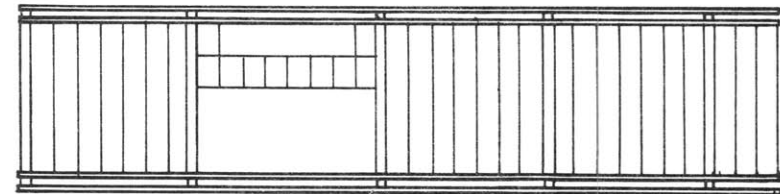
ROOF PLAN

LOWER LEVEL

COMPLETED AND EXPANDED



INCOMPLETED AND UNEXPANDED



STRUCTURAL PLAN

KEY

- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

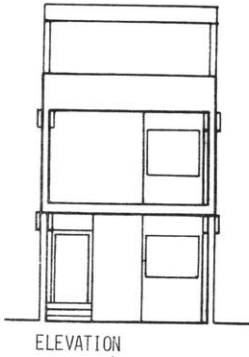
AREAS PER UNIT IN M²

INITIAL	85
EXPANSION	57
TOTAL	142

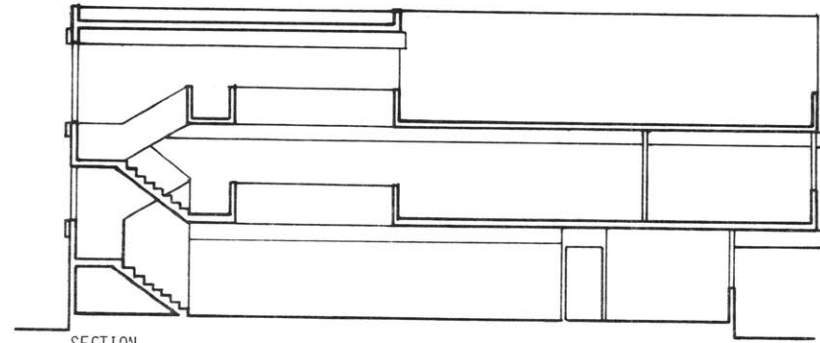


1:200

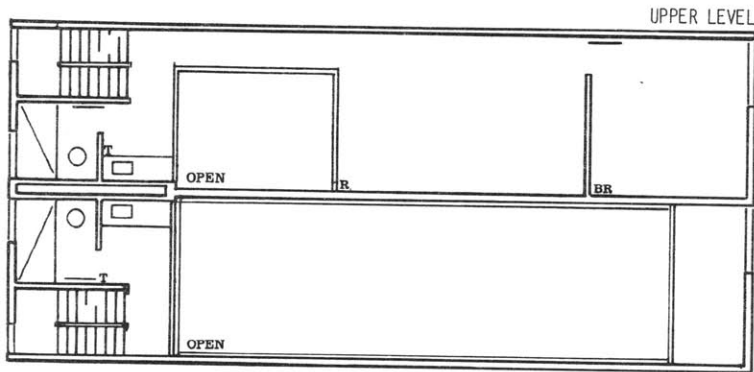
ROW SINGLE FAMILY HOUSE



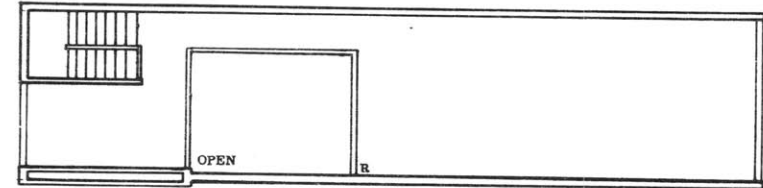
ELEVATION



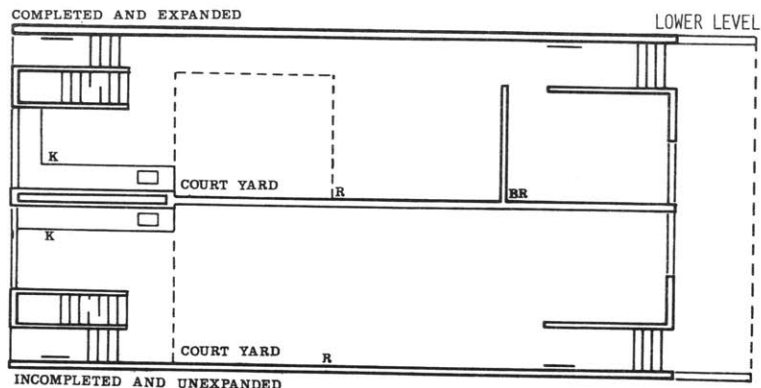
SECTION



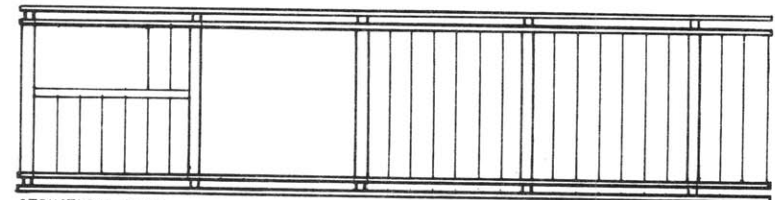
UPPER LEVEL



ROOF PLAN



LOWER LEVEL



STRUCTURAL PLAN

KEY

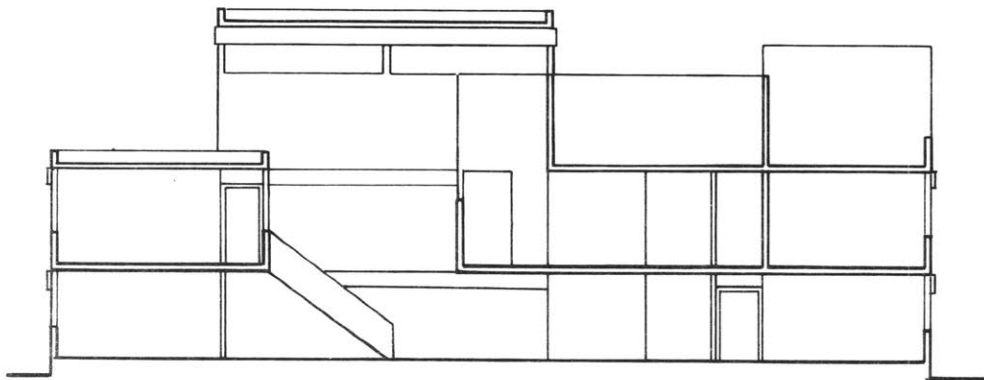
- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

AREAS PER UNIT IN M ²	
INITIAL	92
EXPANSION	58
TOTAL	150

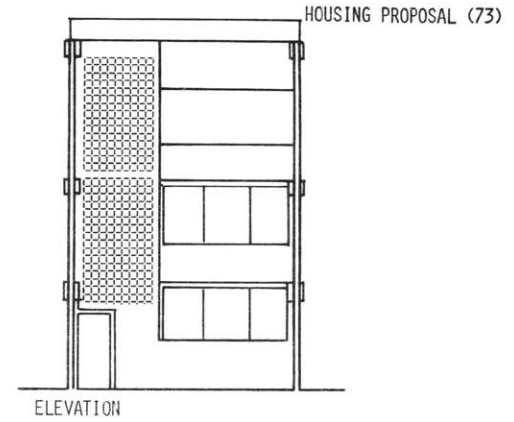


1:200

ROW SINGLE FAMILY HOUSE

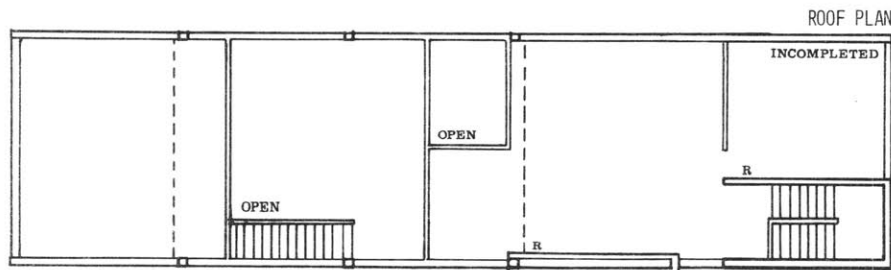


SECTION

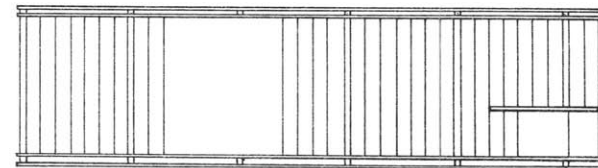


HOUSING PROPOSAL (73)

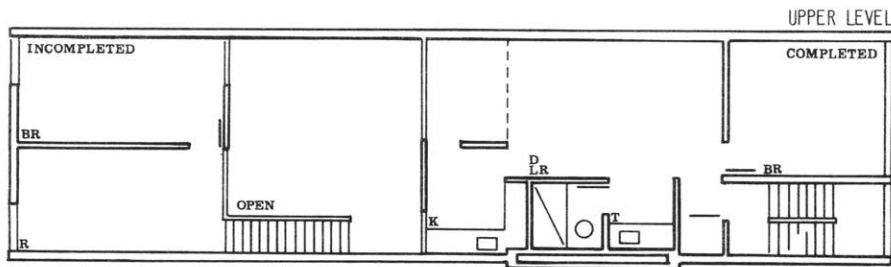
ELEVATION



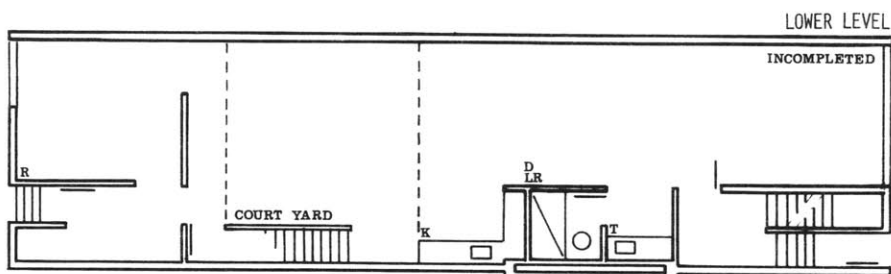
ROOF PLAN



STRUCTURAL PLAN



UPPER LEVEL



LOWER LEVEL

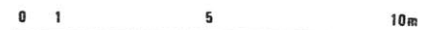
ROW MULTIFAMILY HOUSE

AREAS PER UNIT IN M ²	
INITIAL	160
EXPANSION	0
TOTAL	160

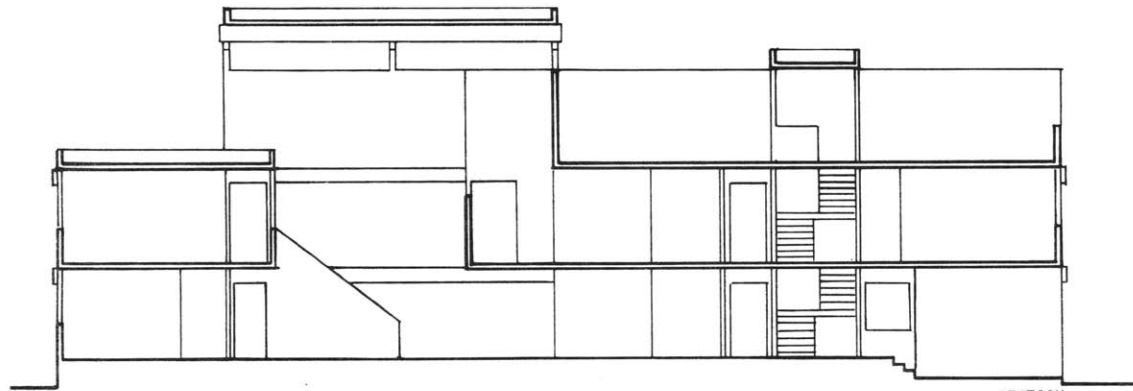
AREAS PER UNIT IN M ²	
INITIAL	145
EXPANSION	0
TOTAL	145

KEY

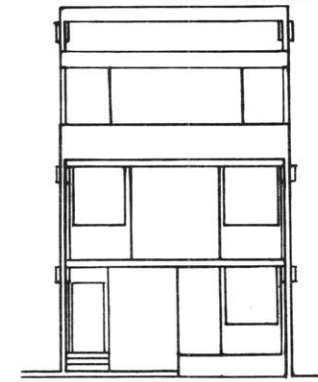
- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)



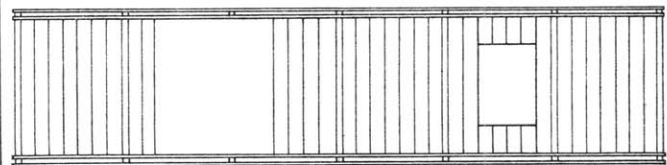
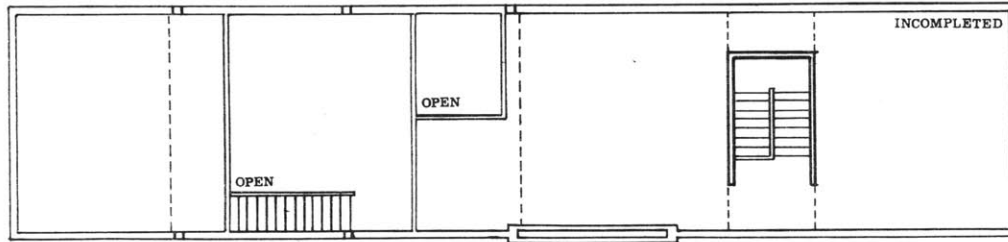
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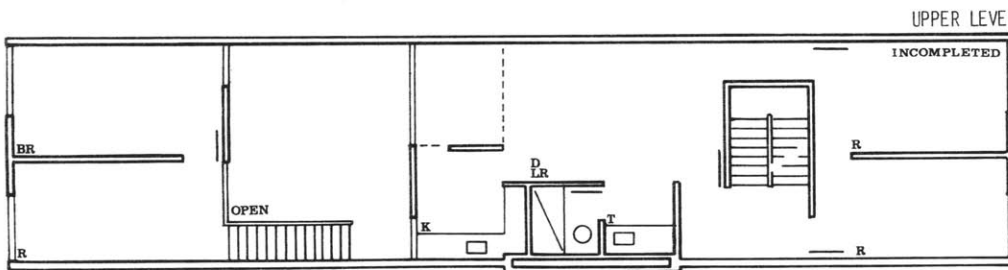
SECTION
ROOF PLAN



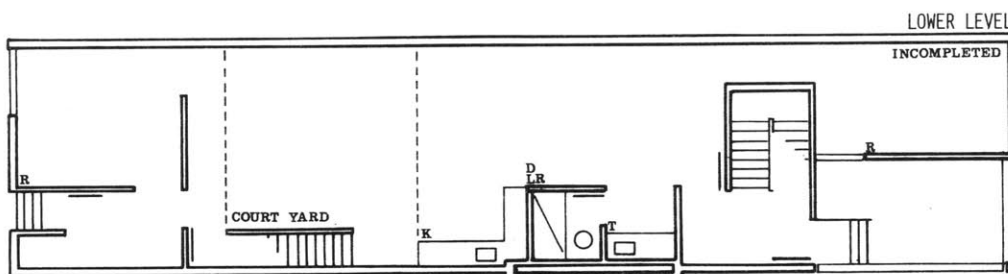
ELEVATION



STRUCTURAL PLAN

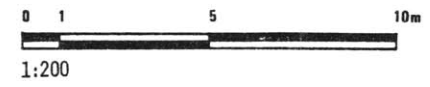


UPPER LEVEL

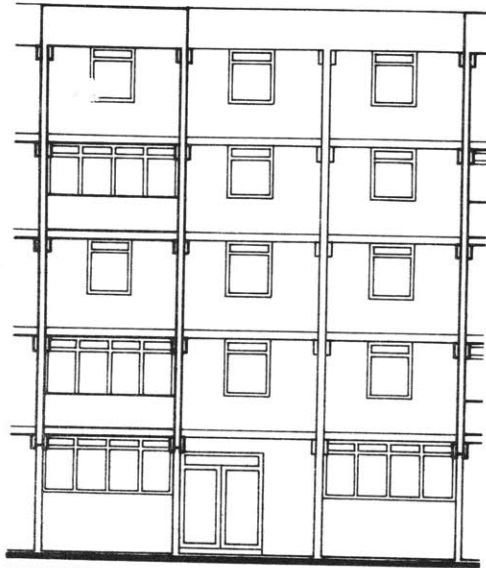


LOWER LEVEL

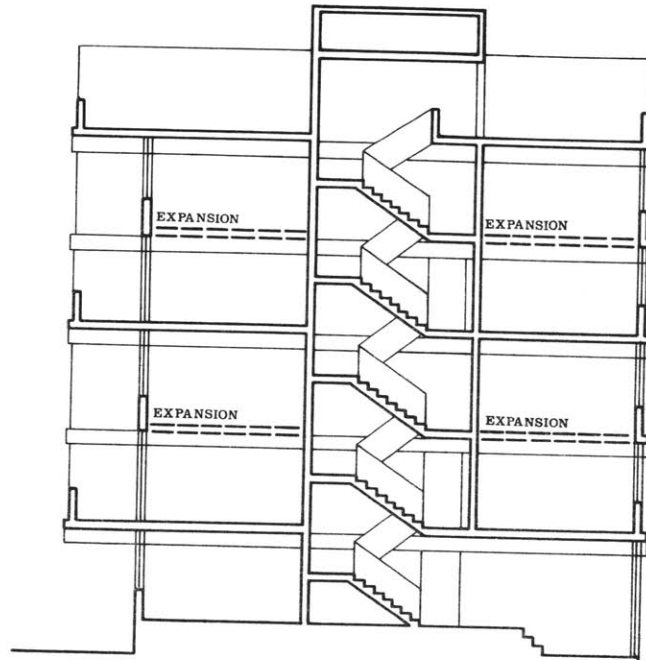
AREAS PER UNIT IN M ²		KEY
INITIAL	160	LR Living Room
EXPANSION	0	D Dining/Eating Area
TOTAL	160	BR Bedroom
		K Kitchen/Cooking Area
		T Toilet/Bathroom
		L Laundry
AREAS PER UNIT IN M ²		C Closet
INITIAL	95	S Storage
EXPANSION	0	R Room (multi-use)
TOTAL	95	



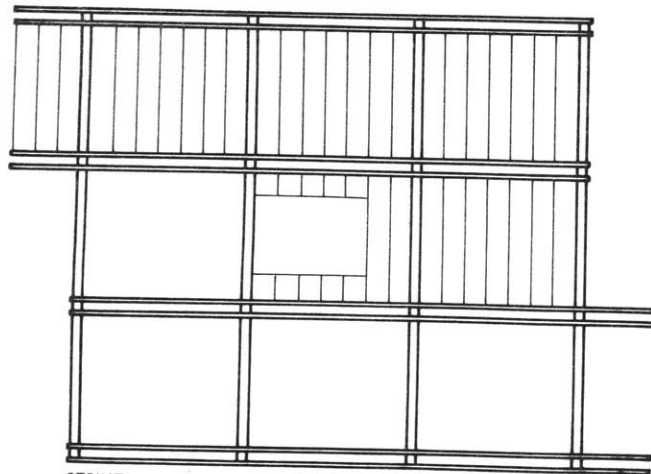
ROW MULTIFAMILY HOUSE



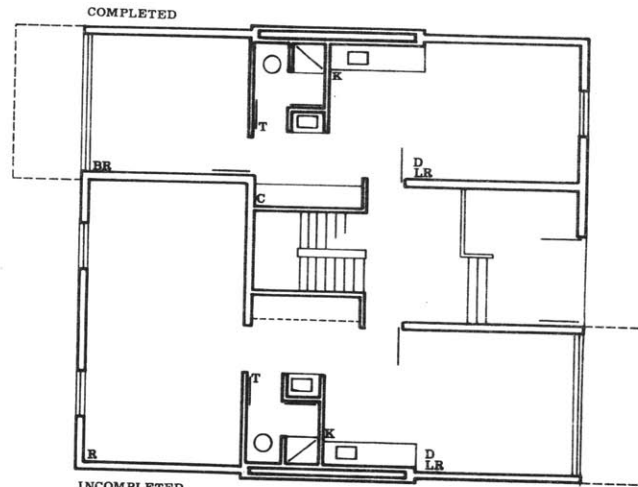
ELEVATION



SECTION



STRUCTURAL PLAN



INCOMPLETED

LOWER LEVEL

KEY

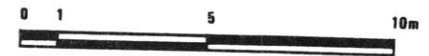
- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

AREAS PER UNIT IN M²

INITIAL	52
EXPANSION	0
TOTAL	52

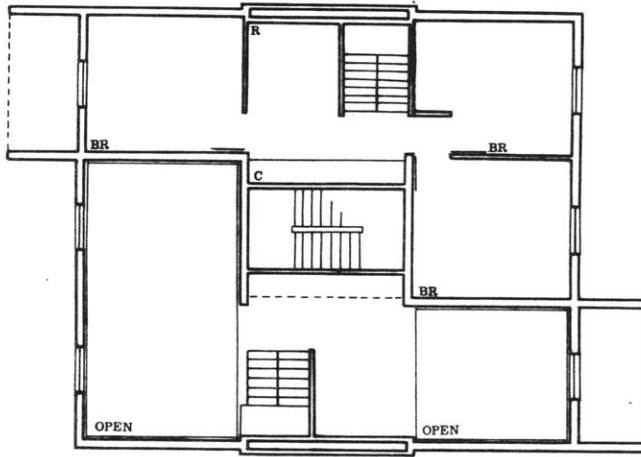
AREAS PER UNIT IN M²

INITIAL	79
EXPANSION	0
TOTAL	79

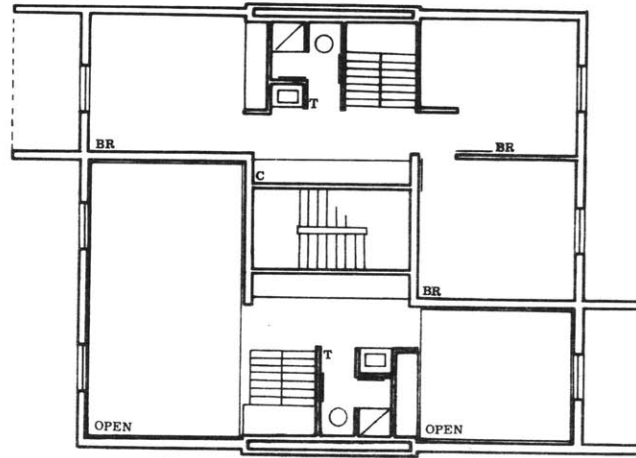


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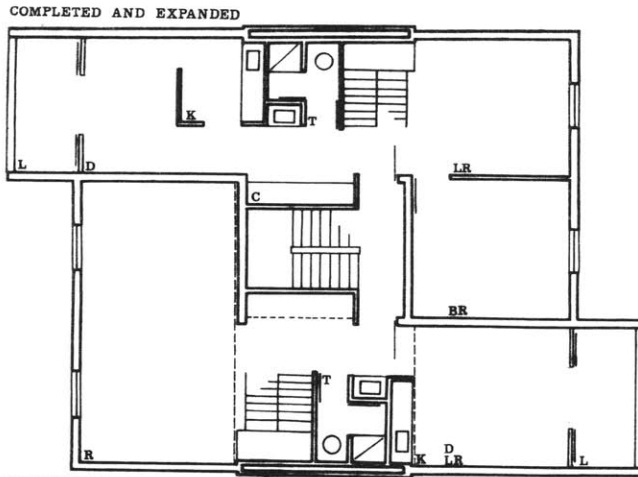
APARTMENT UNITS



UPPER LEVEL

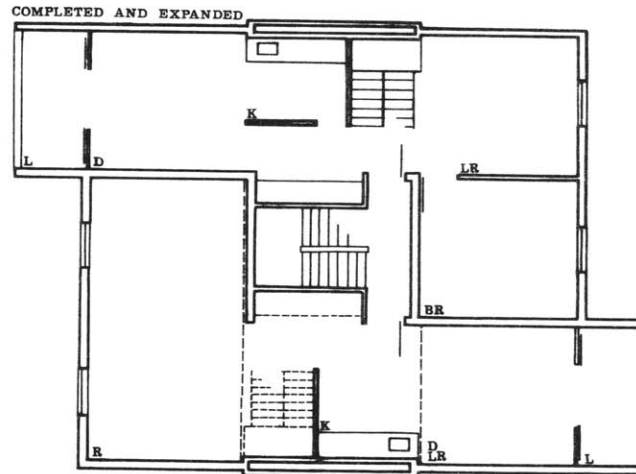


UPPER LEVEL



INCOMPLETED AND UNEXPANDED

LOWER LEVEL



INCOMPLETED AND UNEXPANDED

LOWER LEVEL

KEY

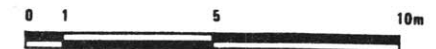
- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

AREAS PER UNIT IN M²

INITIAL	96
EXPANSION	50
TOTAL	146

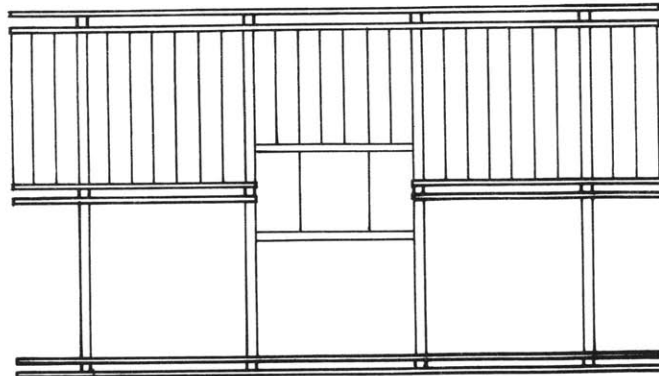
AREAS PER UNIT IN M²

INITIAL	96
EXPANSION	50
TOTAL	146



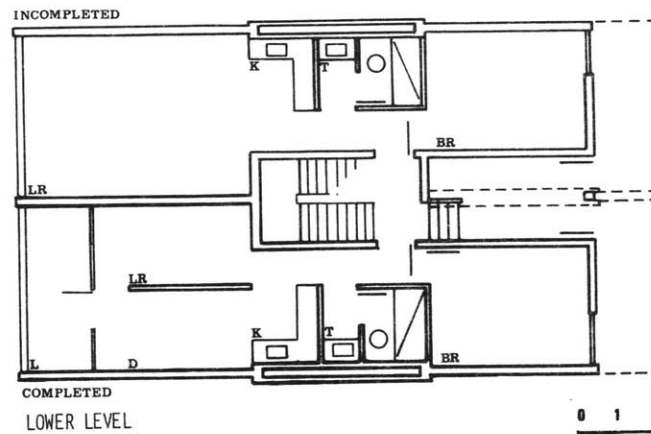
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APARTMENT UNITS



STRUCTURAL PLAN

APARTMENT UNITS



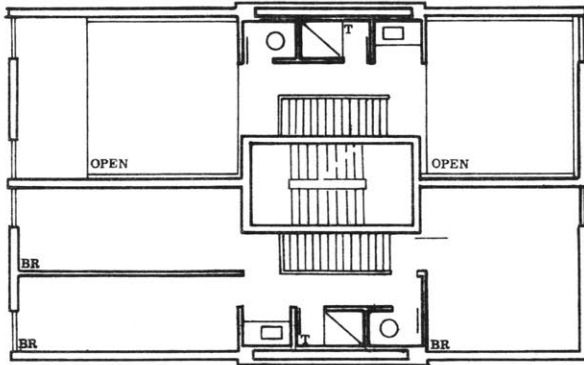
COMPLETED
LOWER LEVEL

- KEY
- LR Living Room
 - D Dining/Eating Area
 - BR Bedroom
 - K Kitchen/Cooking Area
 - T Toilet/Bathroom
 - L Laundry
 - C Closet
 - S Storage
 - R Room (multi-use)

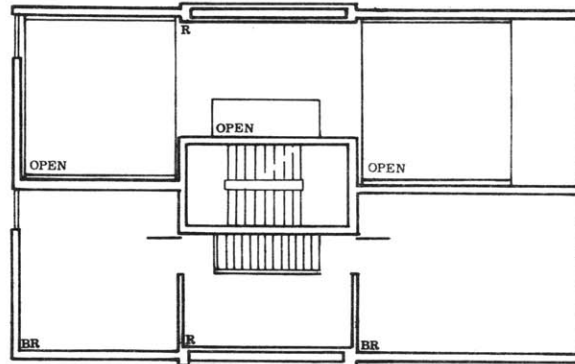
AREAS PER UNIT IN M²

INITIAL	57
EXPANSION	0
TOTAL	57

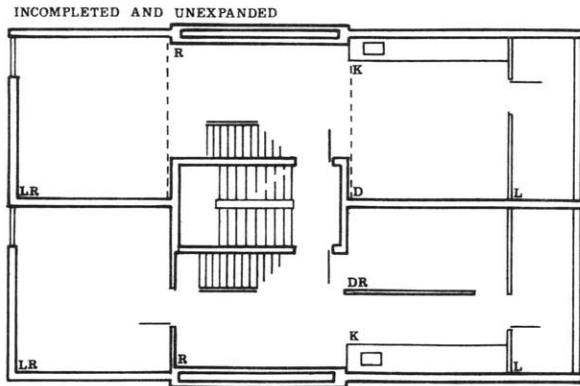




UPPER LEVEL

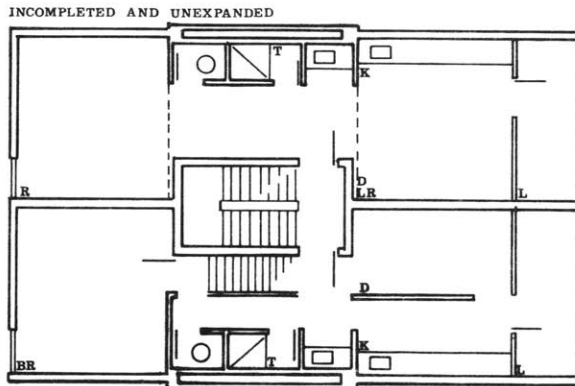


UPPER LEVEL



COMPLETED AND EXPANDED

LOWER LEVEL



COMPLETED AND EXPANDED

LOWER LEVEL

- KEY
- LR Living Room
 - D Dining/Eating Area
 - BR Bedroom
 - K Kitchen/Cooking Area
 - T Toilet/Bathroom
 - L Laundry
 - C Closet
 - S Storage
 - R Room (multi-use)

AREAS PER UNIT IN M²

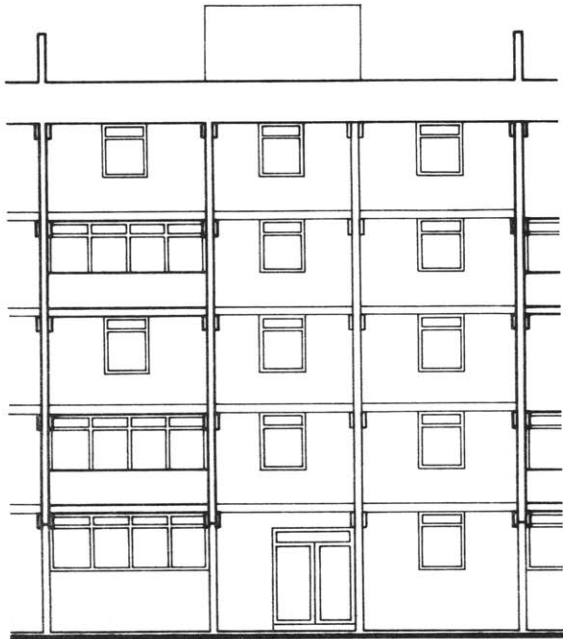
INITIAL	84
EXPANSION	39
TOTAL	123

AREAS PER UNIT IN M²

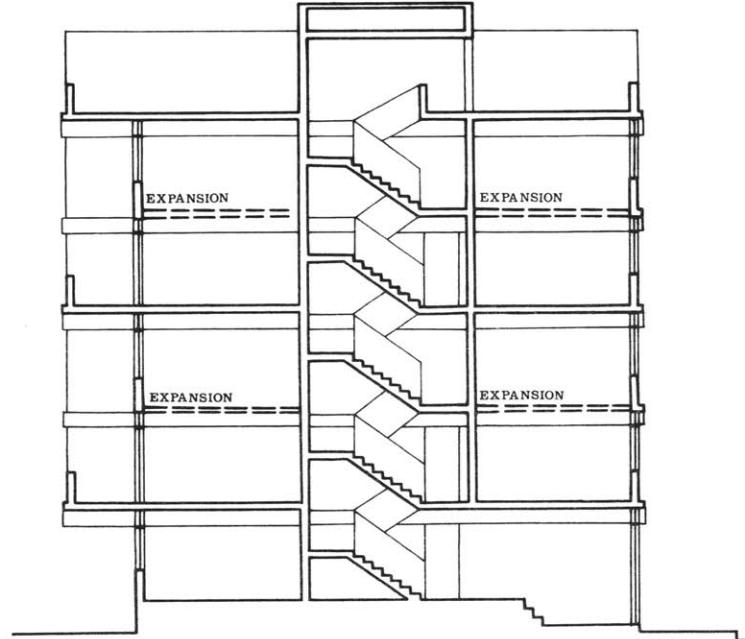
INITIAL	84
EXPANSION	39
TOTAL	123



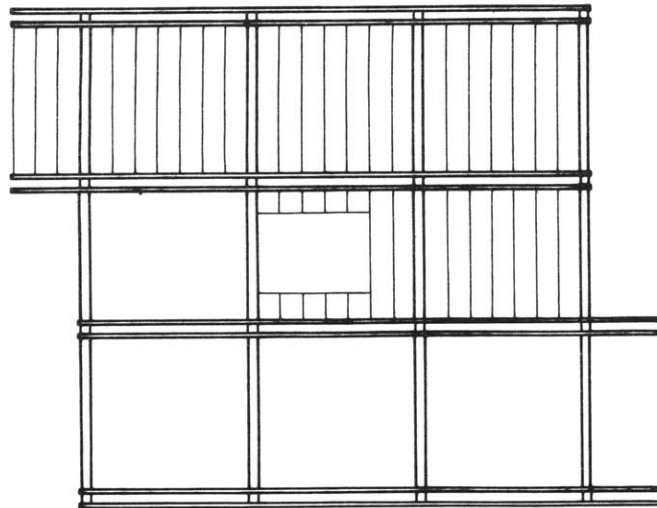
APARTMENT UNITS



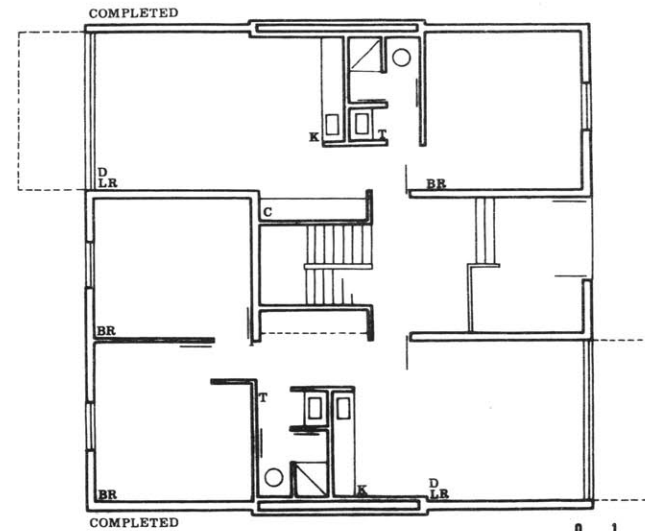
ELEVATION



SECTION



STRUCTURAL PLAN



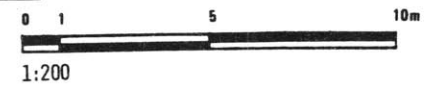
LOWER LEVEL

KEY

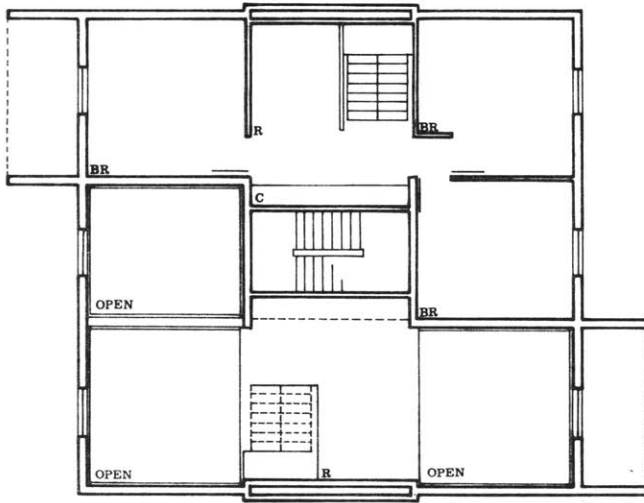
- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

AREAS PER UNIT IN M ²	
INITIAL	66
EXPANSION	0
TOTAL	66

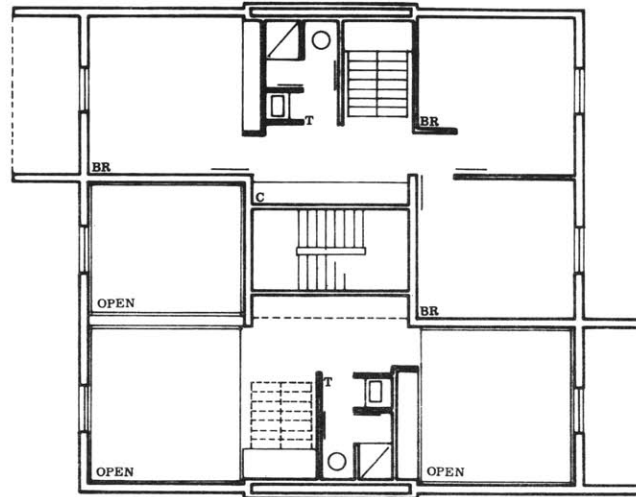
AREAS PER UNIT IN M ²	
INITIAL	77
EXPANSION	0
TOTAL	77



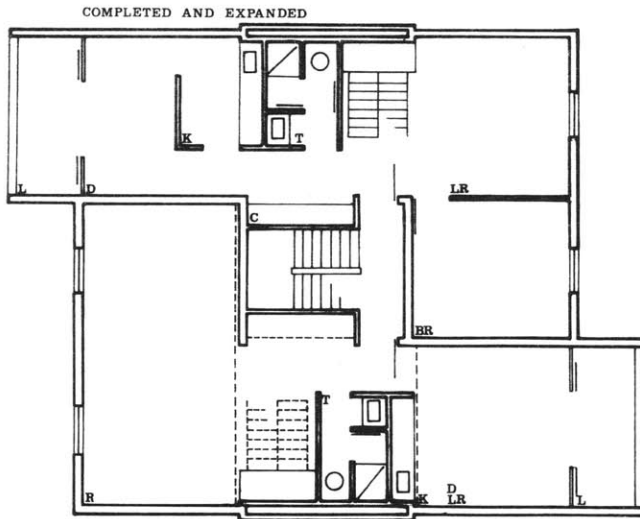
APARTMENT UNITS



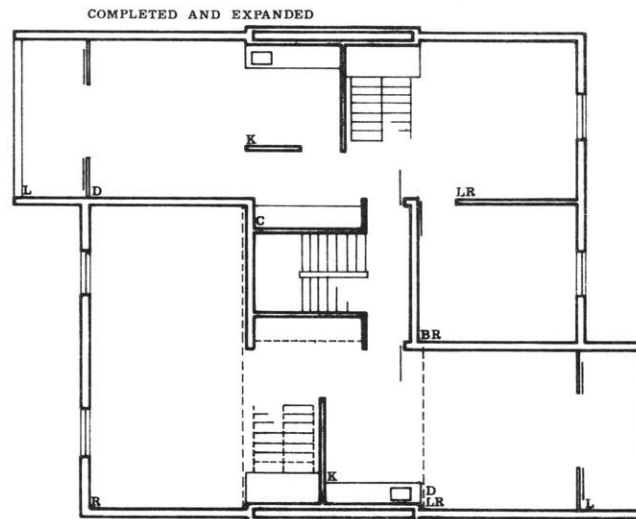
UPPER LEVEL



UPPER LEVEL



LOWER LEVEL



LOWER LEVEL

KEY

- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

AREAS PER UNIT IN M²

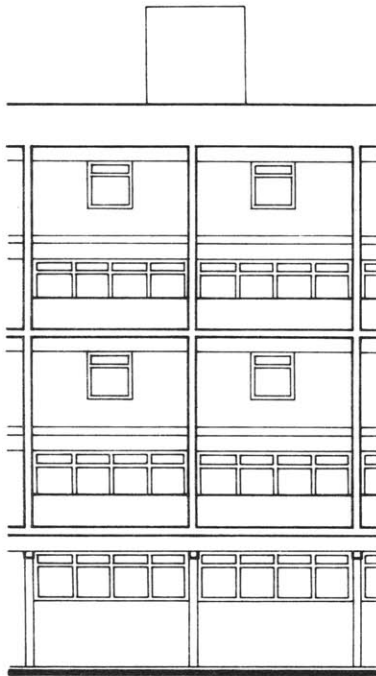
INITIAL	108
EXPANSION	55
TOTAL	163

AREAS PER UNIT IN M²

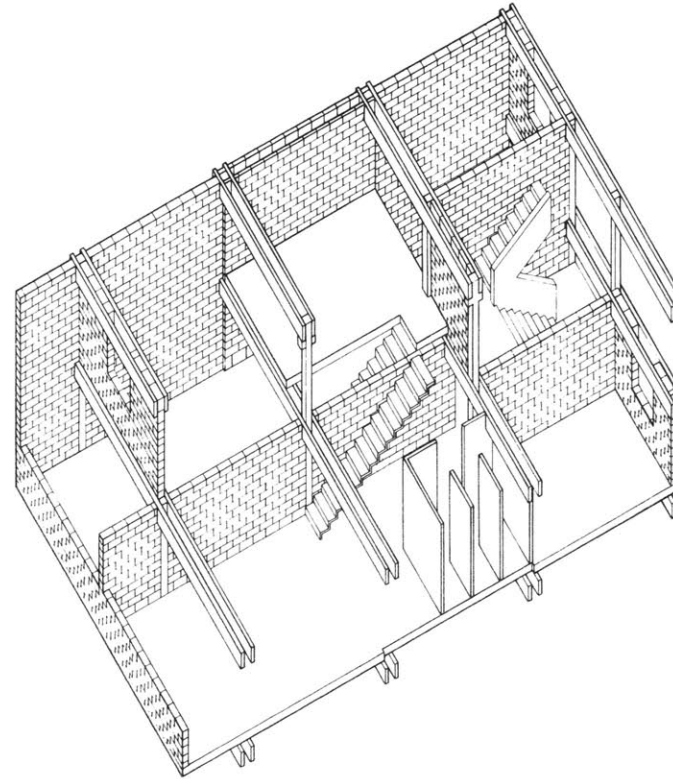
INITIAL	108
EXPANSION	55
TOTAL	163



APARTMENT UNITS

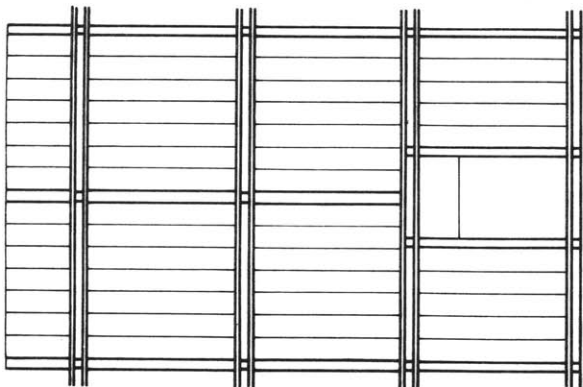


ELEVATION



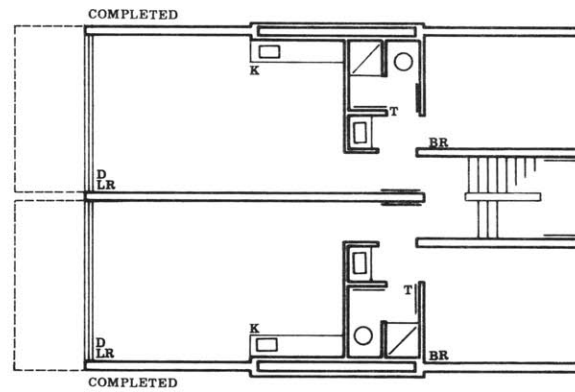
KEY

- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)



STRUCTURAL PLAN

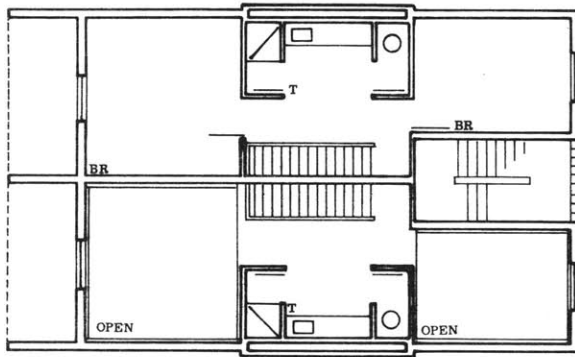
APARTMENT UNITS



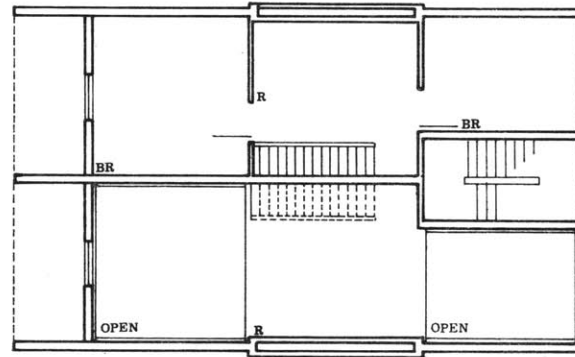
LOWER LEVEL

AREAS PER UNIT IN M ²	
INITIAL	53
EXPANSION	0
TOTAL	53

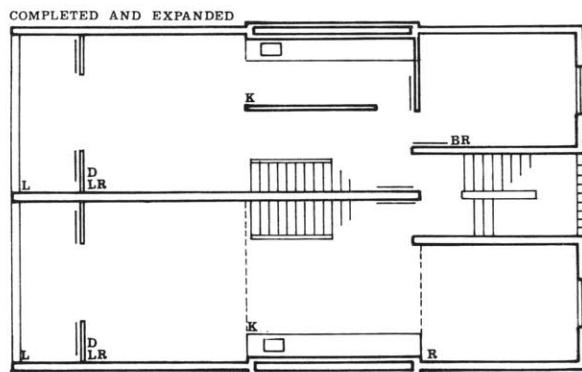




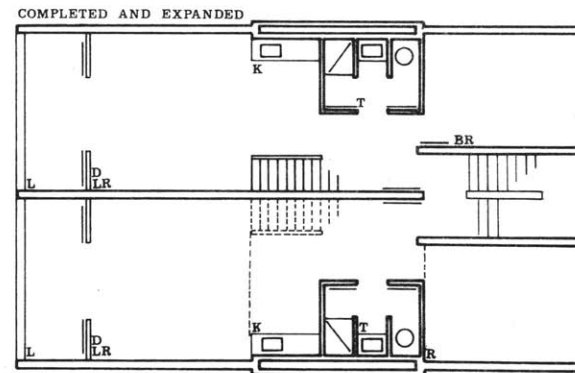
UPPER LEVEL



UPPER LEVEL



INCOMPLETED AND UNEXPANDED
LOWER LEVEL



INCOMPLETED AND UNEXPANDED
LOWER LEVEL

KEY

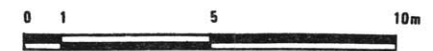
- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

AREAS PER UNIT IN M²

INITIAL	81
EXPANSION	34
TOTAL	115

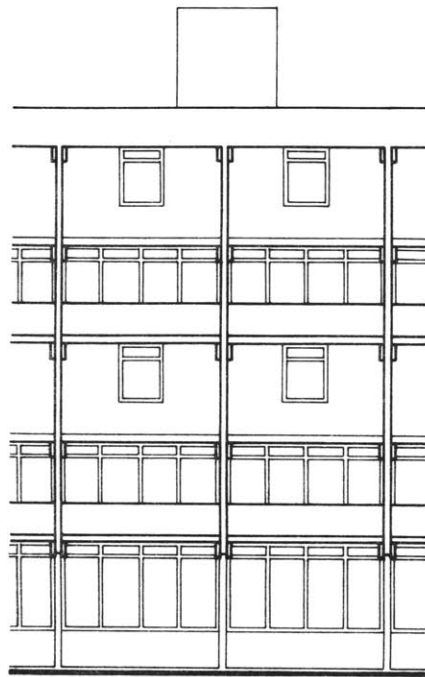
AREAS PER UNIT IN M²

INITIAL	81
EXPANSION	34
TOTAL	115

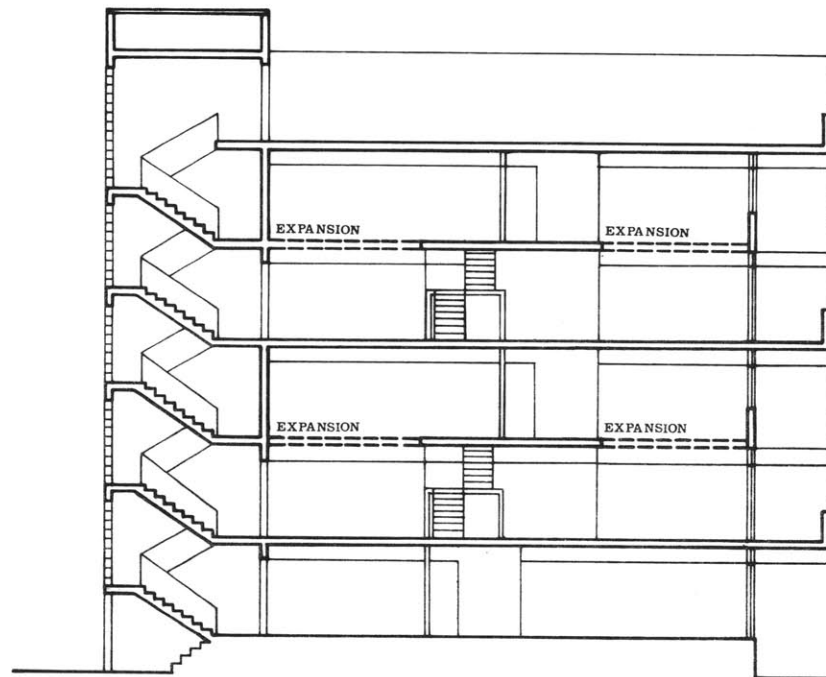


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APARTMENT UNITS

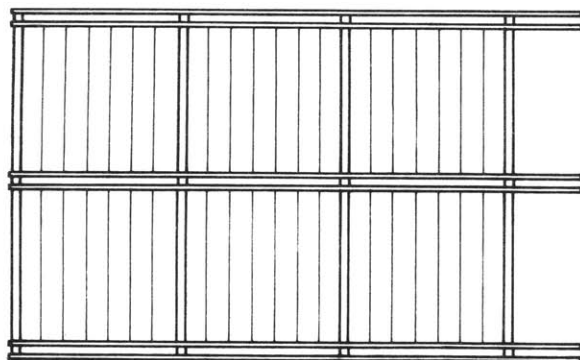


ELEVATION

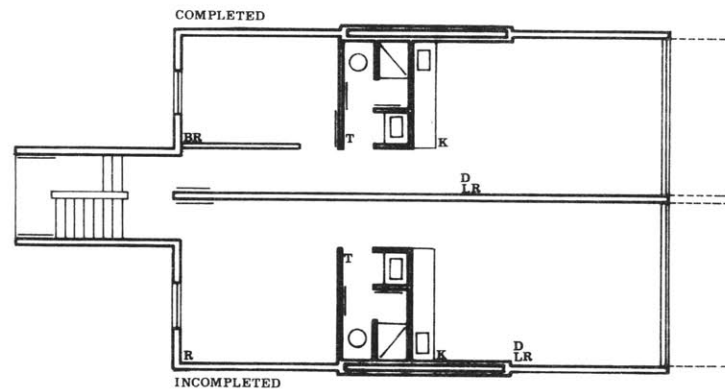


SECTION

- KEY
- LR Living Room
 - D Dining/Eating Area
 - BR Bedroom
 - K Kitchen/Cooking Area
 - T Toilet/Bathroom
 - L Laundry
 - C Closet
 - S Storage
 - R Room (multi-use)

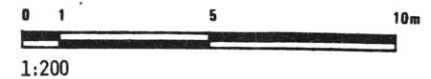


STRUCTURAL PLAN

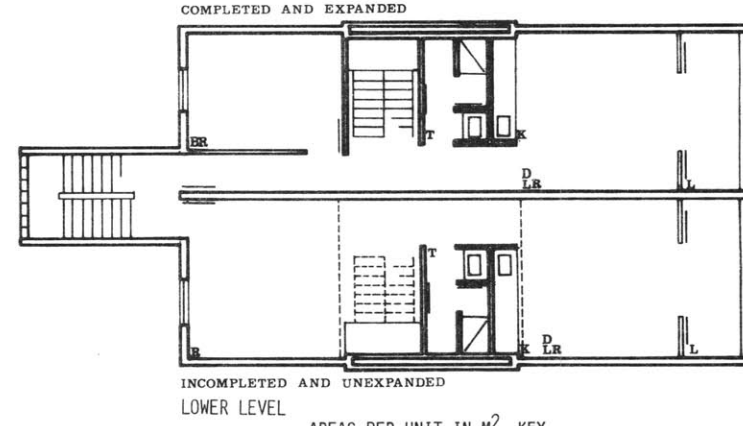
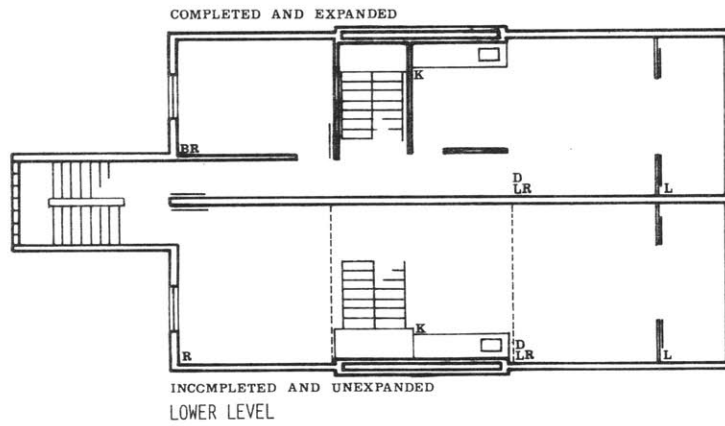
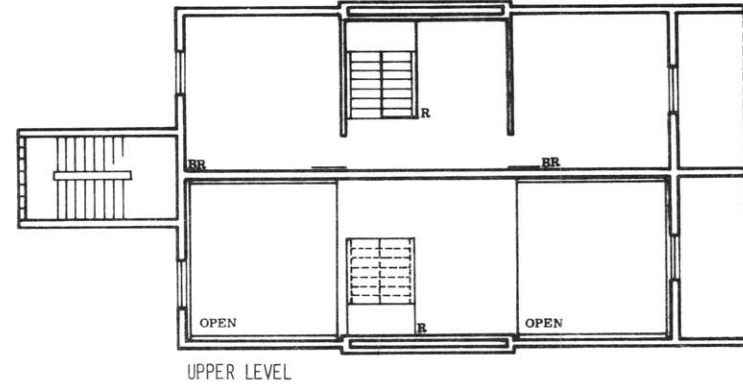
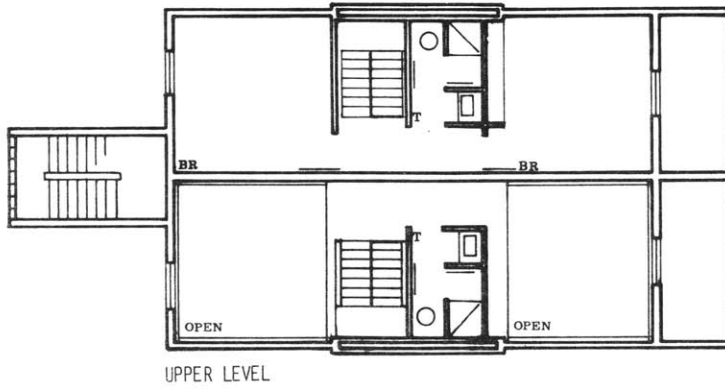


AREAS PER UNIT IN M²

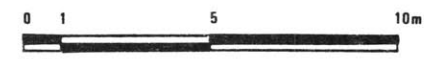
INITIAL	58
EXPANSION	0
TOTAL	58



APARTMENT UNITS

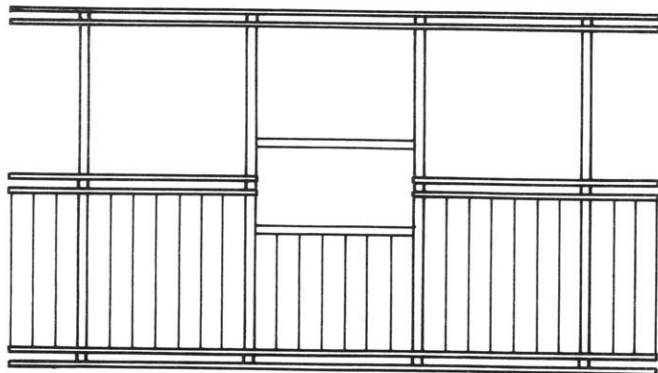


AREAS PER UNIT IN M ²		KEY
INITIAL	86	LR Living Room
EXPANSION	39	D Dining/Eating Area
TOTAL	125	BR Bedroom
		K Kitchen/Cooking Area
		T Toilet/Bathroom
		L Laundry
		C Closet
		S Storage
		R Room (multi-use)



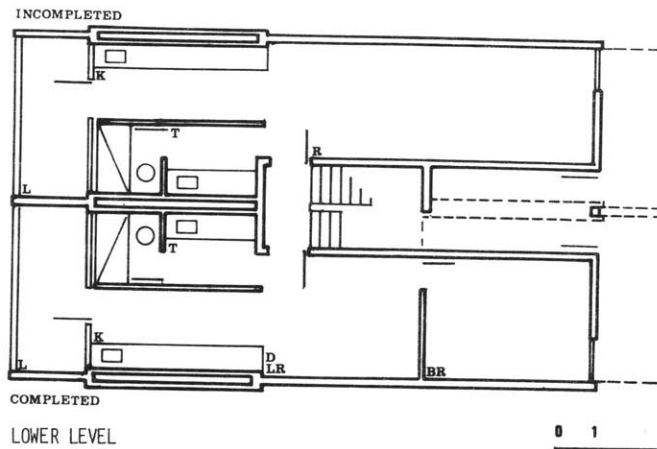
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APARTMENT UNITS



STRUCTURAL PLAN

APARTMENT UNITS



COMPLETED

LOWER LEVEL

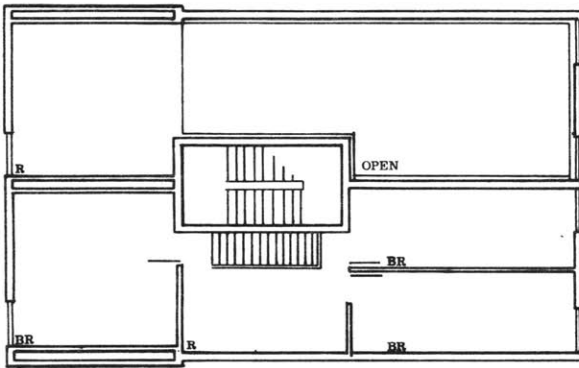
KEY

- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

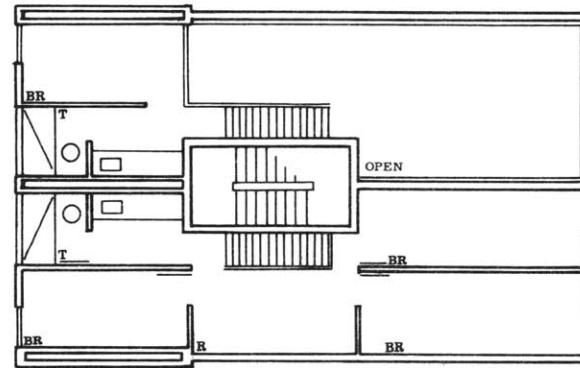
AREAS PER UNIT IN m²

INITIAL	57
EXPANSION	0
TOTAL	57





UPPER LEVEL

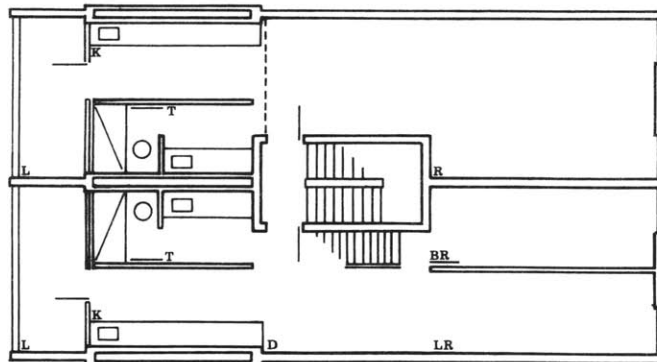


UPPER LEVEL

KEY

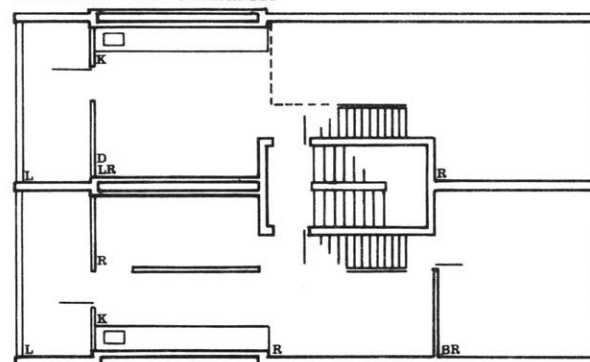
- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

INCOMPLETED AND UNEXPANDED



COMPLETED AND EXPANDED
LOWER LEVEL

INCOMPLETED AND UNEXPANDED



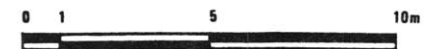
COMPLETED AND EXPANDED
LOWER LEVEL

AREAS PER UNIT IN M²

INITIAL	90
EXPANSION	42
TOTAL	132

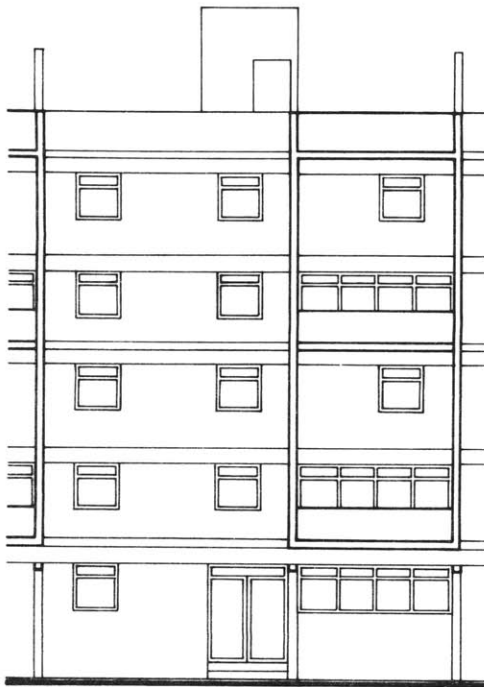
AREAS PER UNIT IN M²

INITIAL	81
EXPANSION	42
TOTAL	123

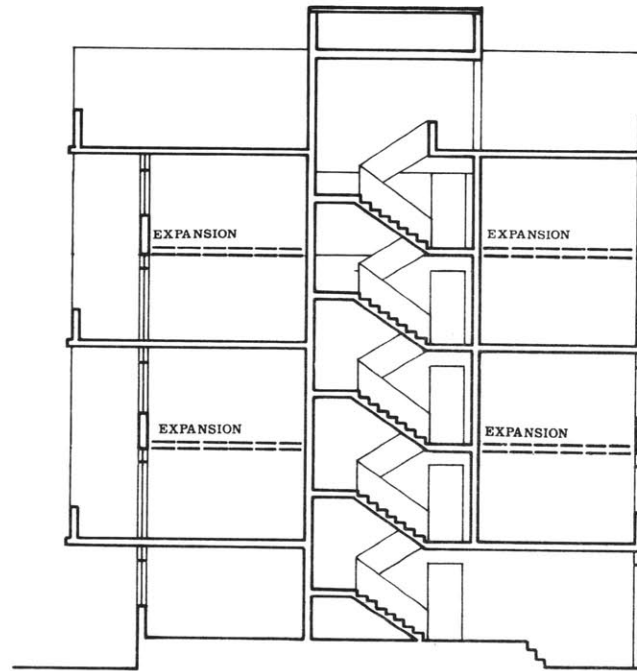


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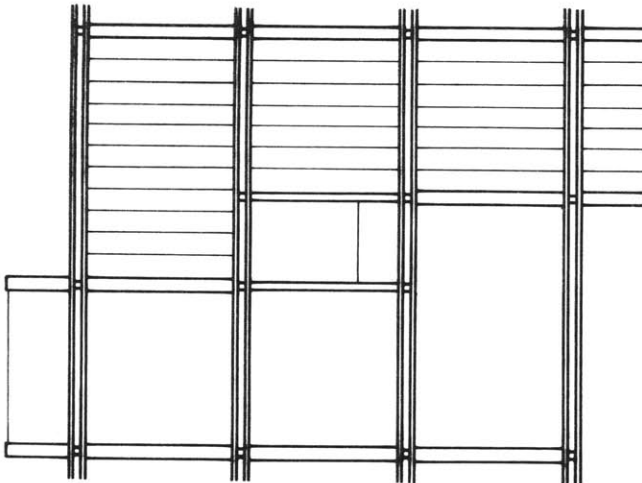
APARTMENT UNITS



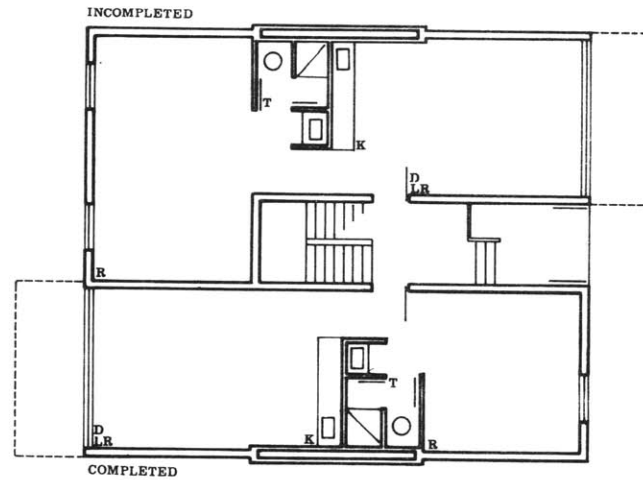
ELEVATION



SECTION



STRUCTURAL PLAN



LOWER LEVEL

KEY

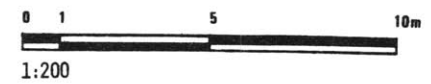
- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

AREAS PER UNIT IN M²

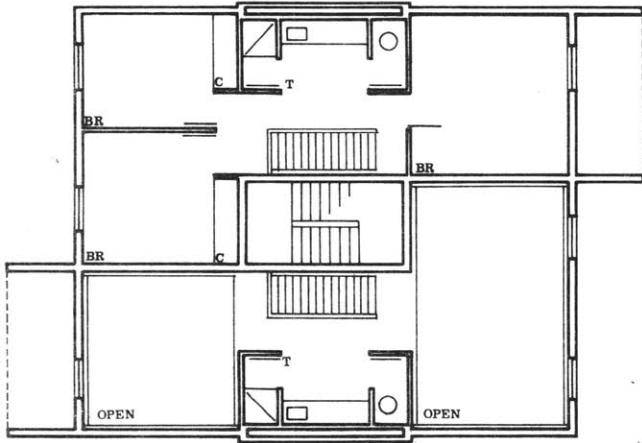
INITIAL	69
EXPANSION	0
TOTAL	69

AREAS PER UNIT IN M²

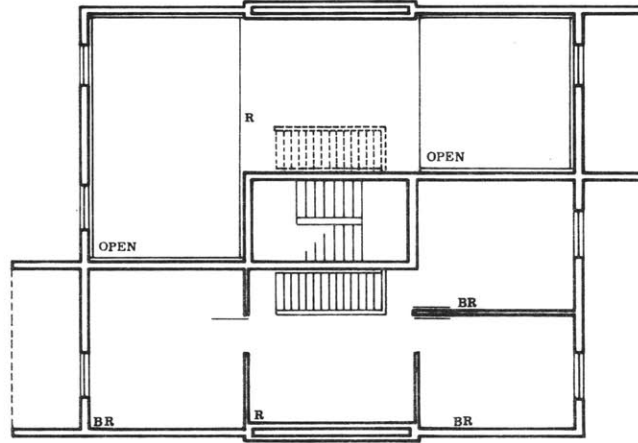
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EXPANSION	0
TOTAL	58



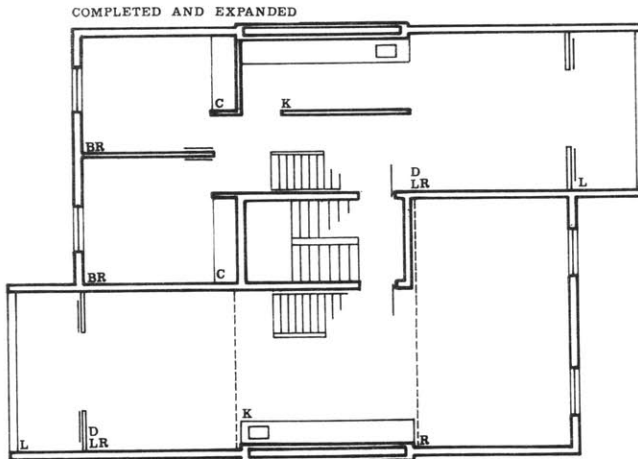
APARTMENT UNITS



UPPER LEVEL

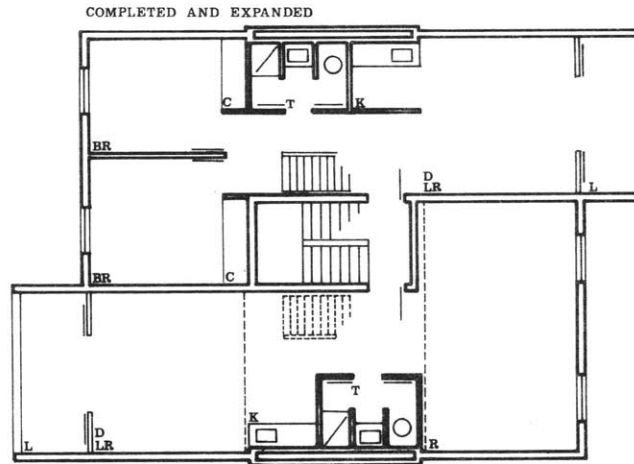


UPPER LEVEL



INCOMPLETED AND UNEXPANDED

LOWER LEVEL



INCOMPLETED AND UNEXPANDED

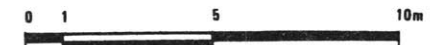
LOWER LEVEL

KEY

- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

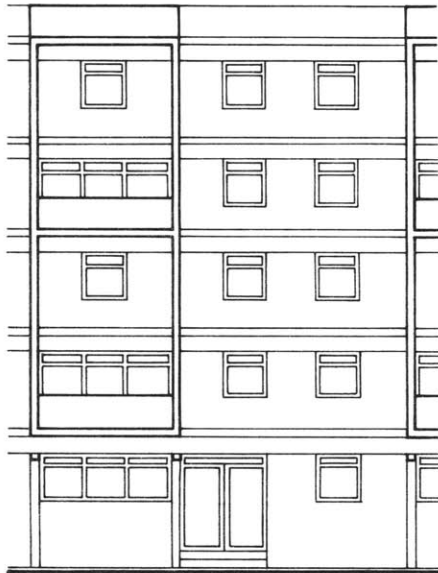
AREAS PER UNIT IN M ²	
INITIAL	96
EXPANSION	49
TOTAL	145

AREAS PER UNIT IN M ²	
INITIAL	96
EXPANSION	49
TOTAL	145

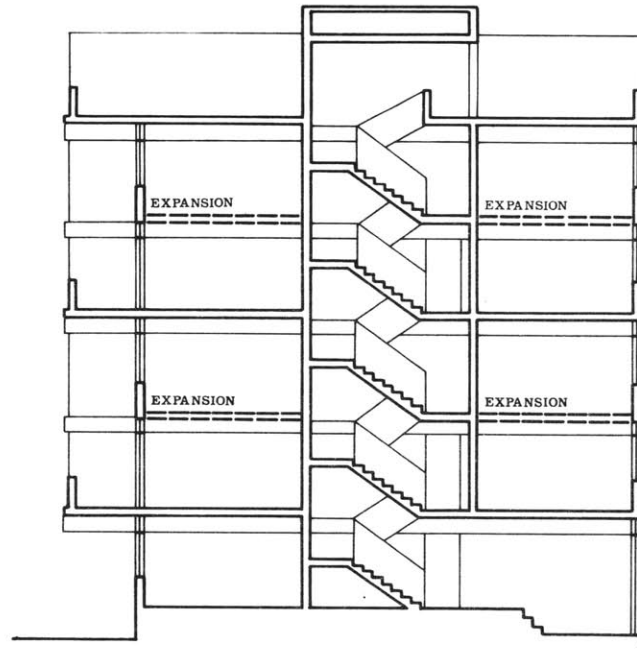


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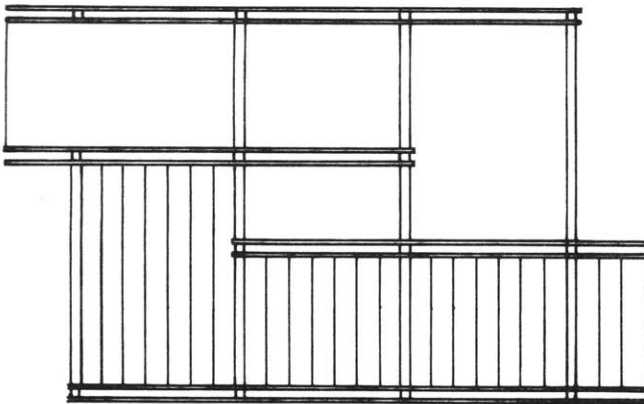
APARTMENT UNITS



ELEVATION

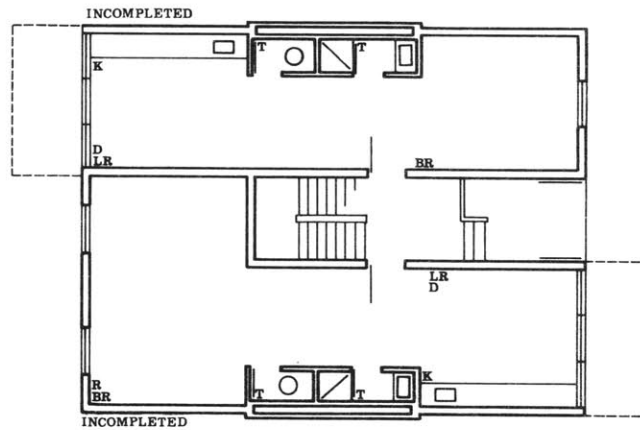


SECTION



STRUCTURAL PLAN

APARTMENT UNITS



LOWER LEVEL

KEY

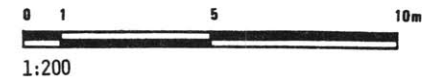
- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

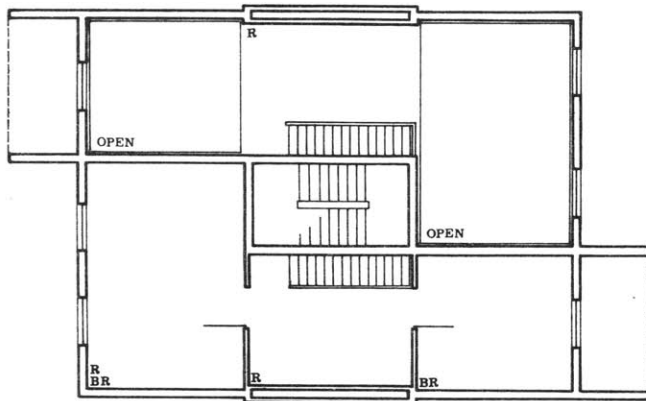
AREAS PER UNIT IN M²

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EXPANSION	0
TOTAL	50

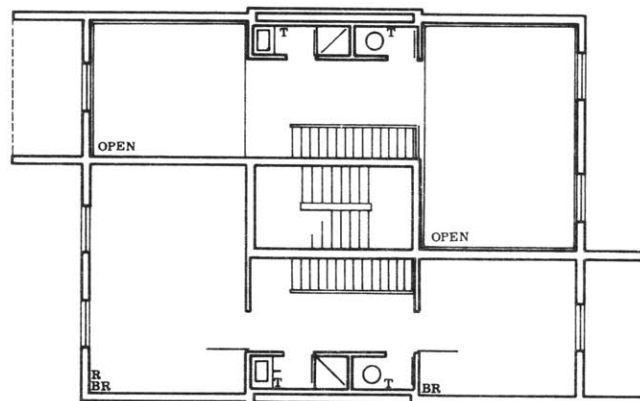
AREAS PER UNIT IN M²

INITIAL	61
EXPANSION	0
TOOTAL	61

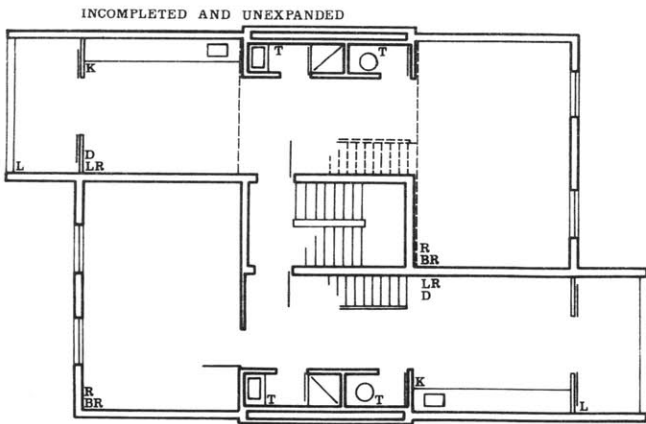




UPPER LEVEL

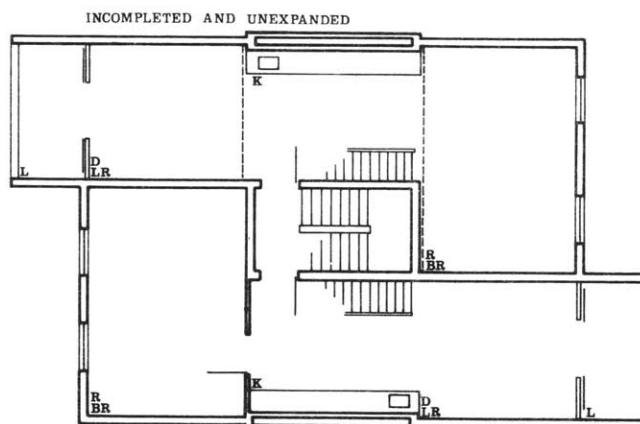


UPPER LEVEL



COMPLETED AND EXPANDED

LOWER LEVEL



COMPLETED AND EXPANDED

LOWER LEVEL

KEY

- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

AREAS PER UNIT IN M²

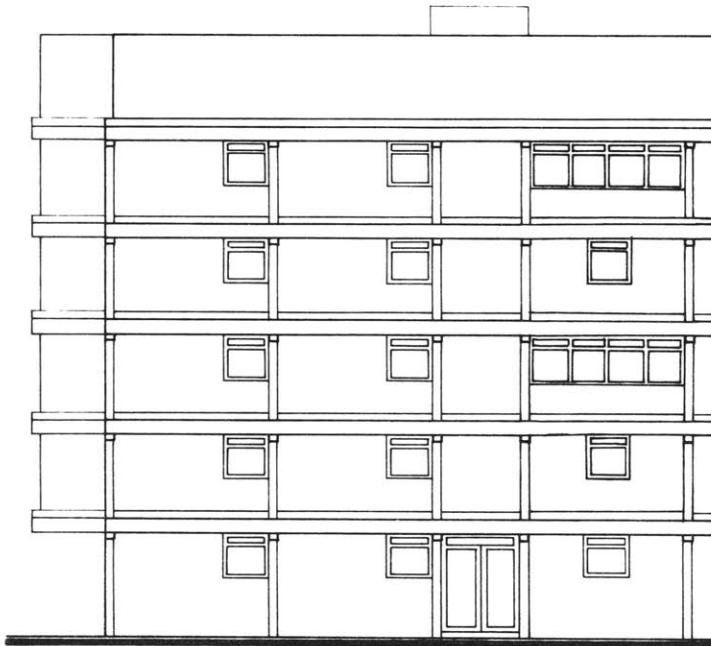
INITIAL	85
EXPANSION	44
TOTAL	129

AREAS PER UNIT IN M²

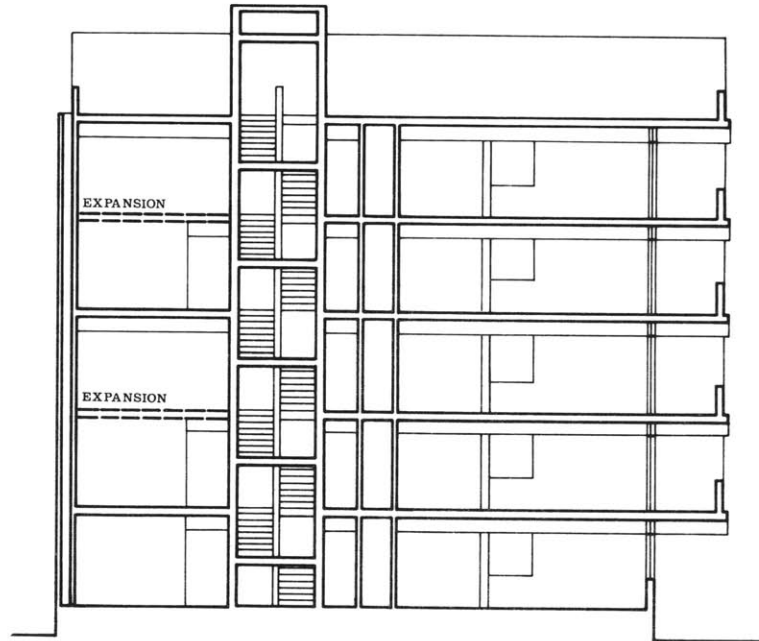
INITIAL	85
EXPANSION	44
TOTAL	129



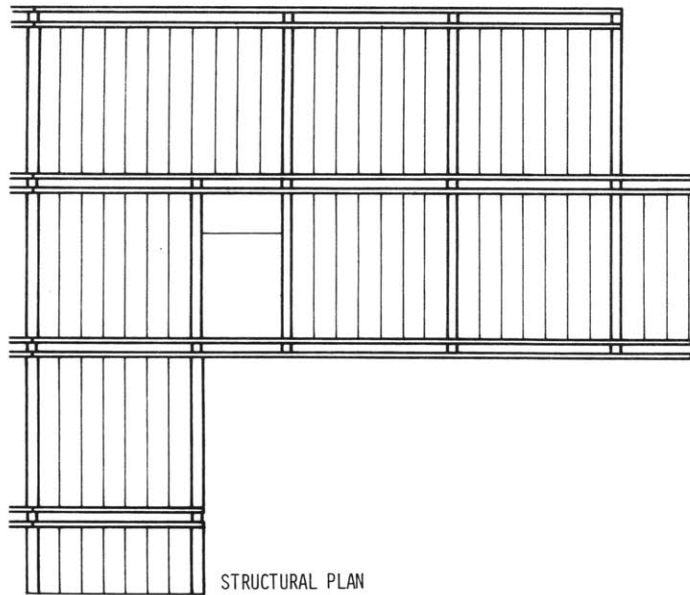
APARTMENT UNITS



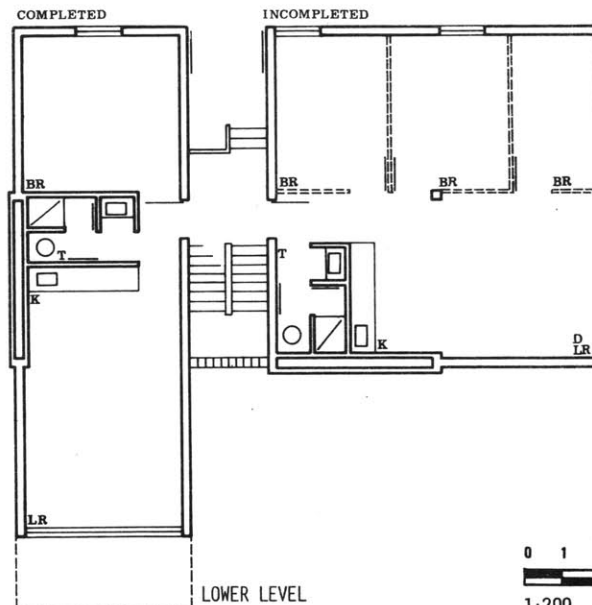
ELEVATION



SECTION



STRUCTURAL PLAN



LOWER LEVEL

KEY

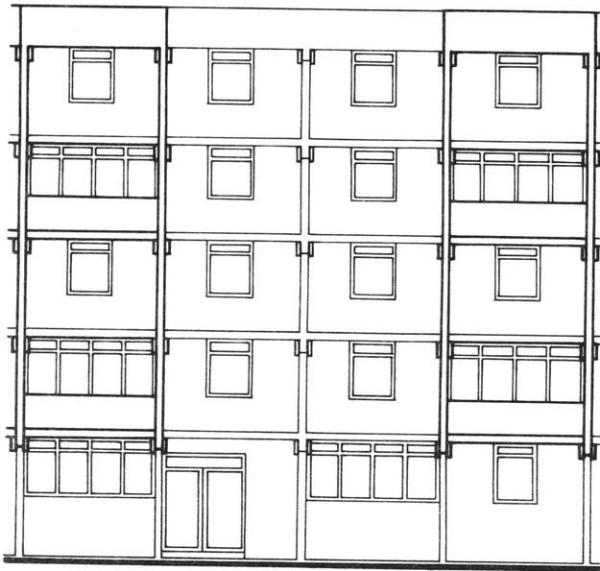
- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

AREAS PER UNIT IN M ²	
INITIAL	66
EXPANSION	0
TOTAL	66

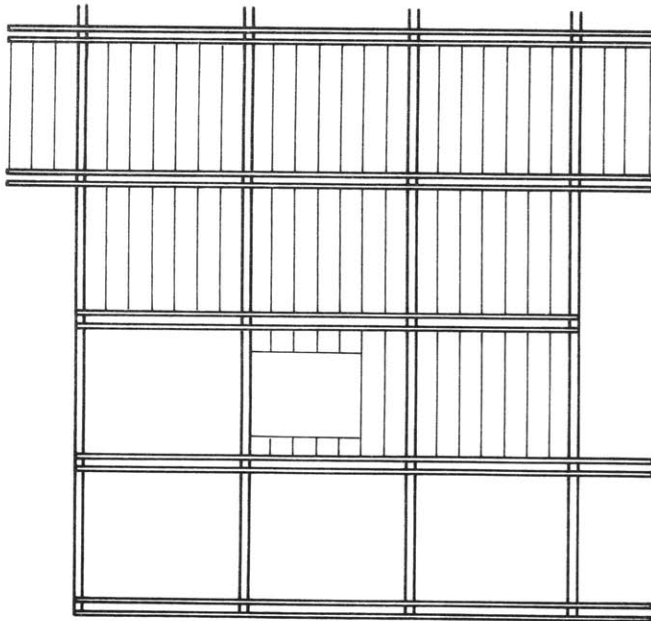
AREAS PER UNIT IN M ²	
INITIAL	77
EXPANSION	0
TOTAL	77



APARTMENT UNITS

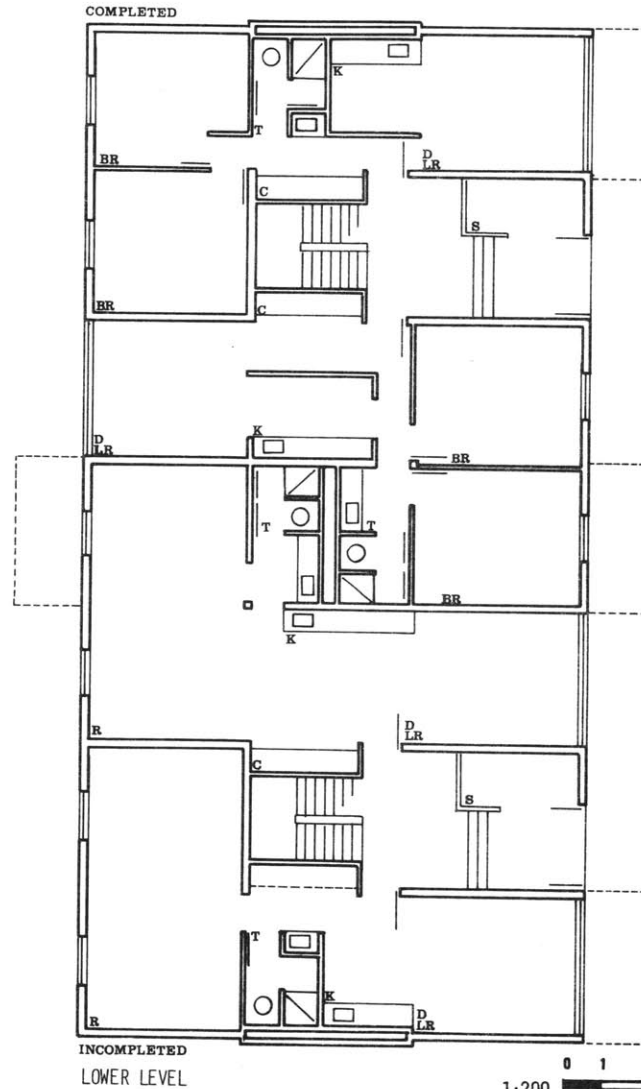


ELEVATION



STRUCTURAL PLAN

APARTMENT UNITS



INCOMPLETED
LOWER LEVEL

- KEY
- LR Living Room
 - D Dining/Eating Area
 - BR Bedroom
 - K Kitchen/Cooking Area
 - T Toilet/Bathroom
 - L Laundry
 - C Closet
 - S Storage
 - R Room (multi-use)

AREAS PER UNIT IN M²

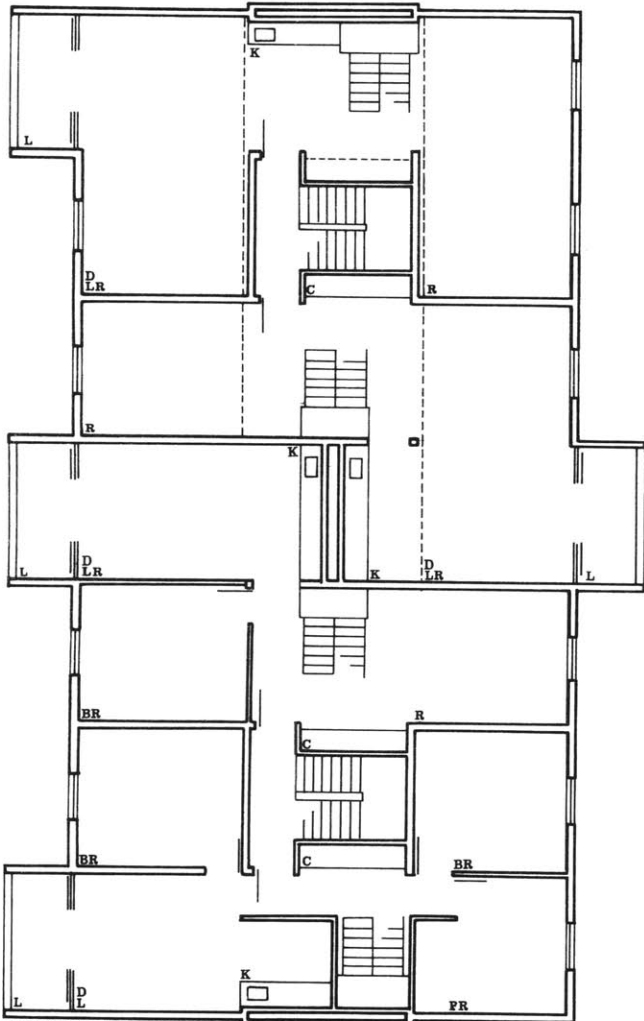
INITIAL	75
EXPANSION	0
TOTAL	75

AREAS PER UNIT IN M²

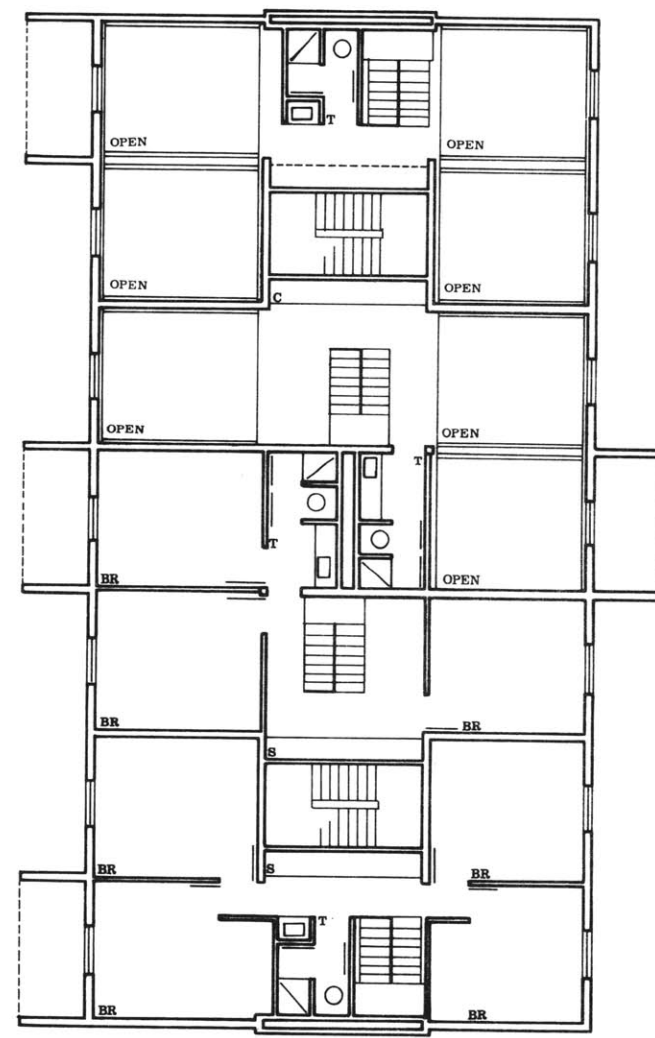
INITIAL	69
EXPANSION	0
TOTAL	69



INCOMPLETED AND UNEXPANDED



COMPLETED AND EXPANDED
LOWER LEVEL



UPPER LEVEL

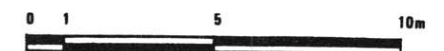
- KEY
- LR Living Room
 - D Dining/Eating Area
 - BR Bedroom
 - K Kitchen/Cooking Area
 - T Toilet/Bathroom
 - L Laundry
 - C Closet
 - S Storage
 - R Room (multi-use)

AREAS PER UNIT IN M²

INITIAL	113
EXPANSION	50
TOTAL	163

AREAS PER UNIT IN M²

INITIAL	113
EXPANSION	67
TOTAL	180

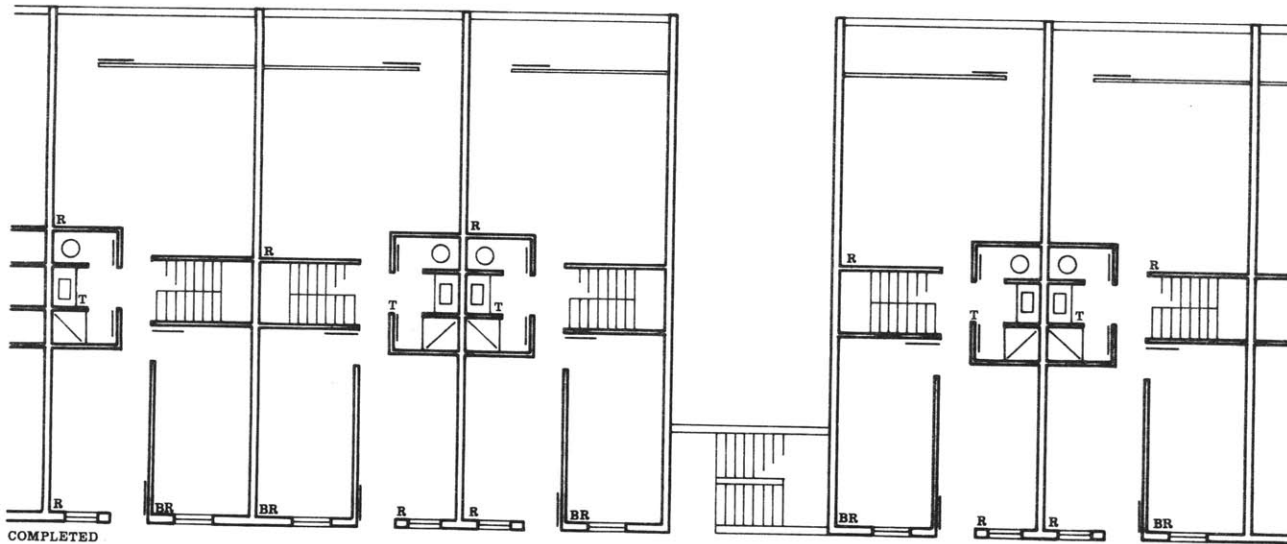


1:200

APARTMENT UNITS



ELEVATION



LOWER LEVEL

- KEY
- LR Living Room
 - D Dining/Eating Area
 - BR Bedroom
 - K Kitchen/Cooking Area
 - T Toilet/Bathroom
 - L Laundry
 - C Closet
 - S Storage
 - R Room (multi-use)

APARTMENT UNITS



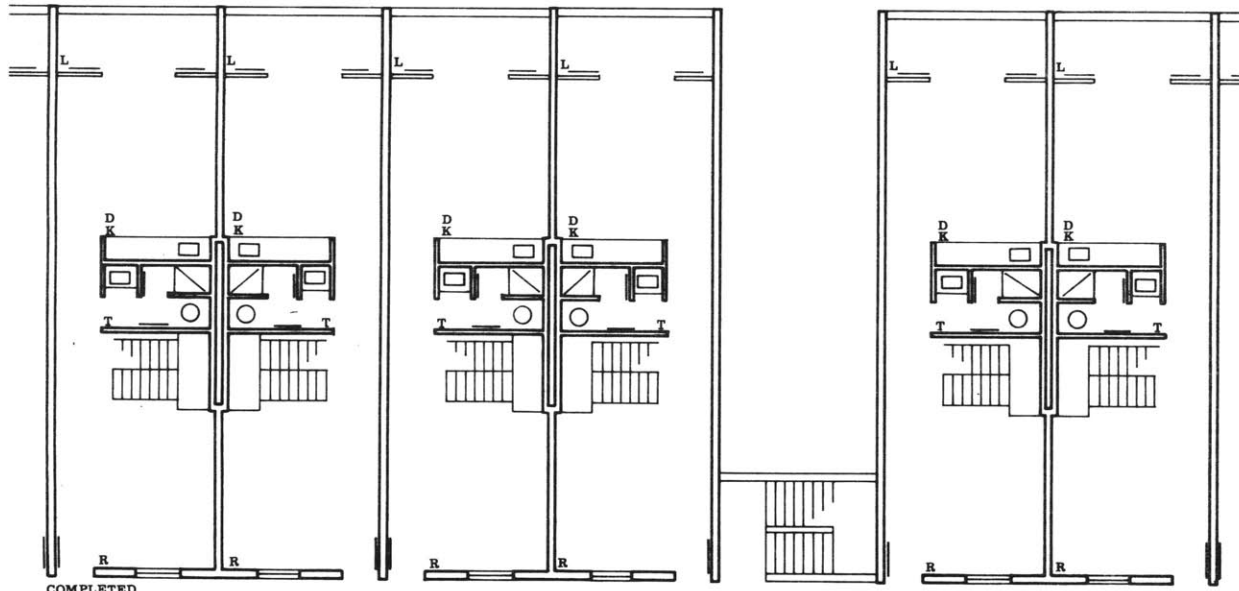
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ELEVATION



ELEVATION



COMPLETED

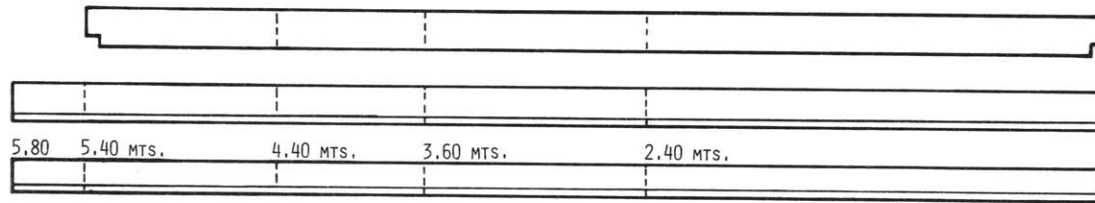
LOWER LEVEL

- KEY
- LR Living Room
 - D Dining/Eating Area
 - BR Bedroom
 - K Kitchen/Cooking Area
 - T Toilet/Bathroom
 - L Laundry
 - C Closet
 - S Storage
 - R Room (multi-use)

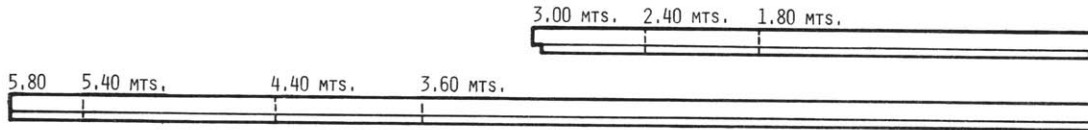
APARTMENT UNITS



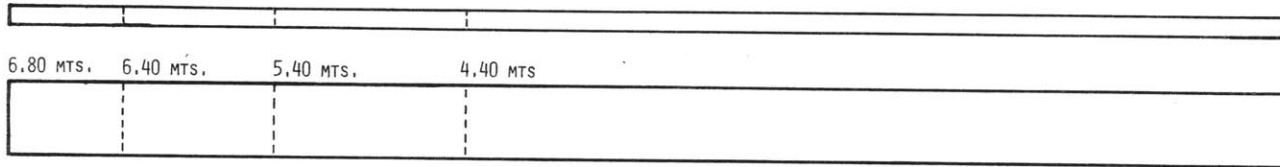
HOUSING PROPOSAL (96)



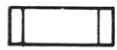
PRECAST CONCRETE LEDGER BEAM



PRECAST CONCRETE BEAMLET



PRECAST CONCRETE BEAM



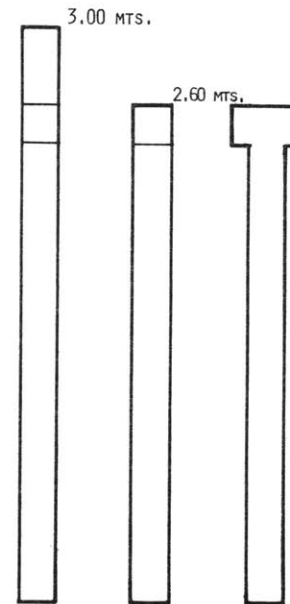
HOLLOW CONCRETE FLOOR BLOCK
54 X 20 X 16 CM.



HOLLOW CONCRETE WALL BLOCK
40 X 20 CM.

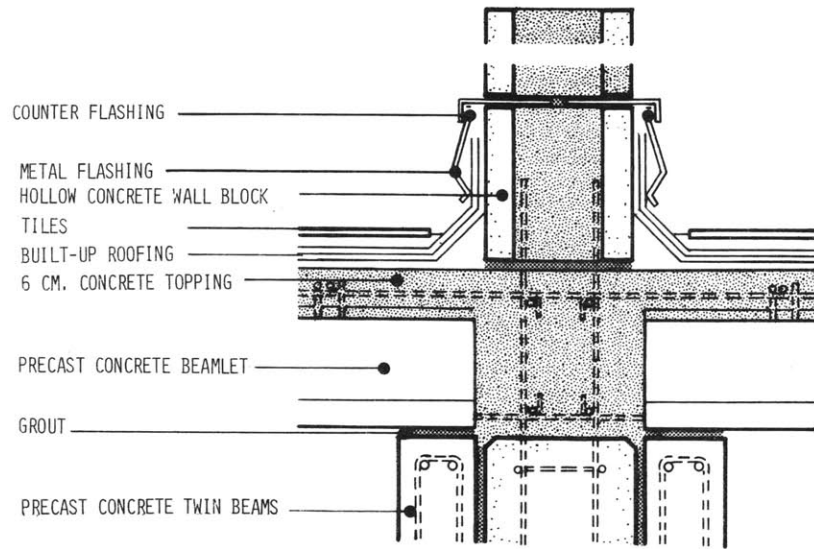


HOLLOW CONCRETE WALL BLOCK
20 X 20 CM.

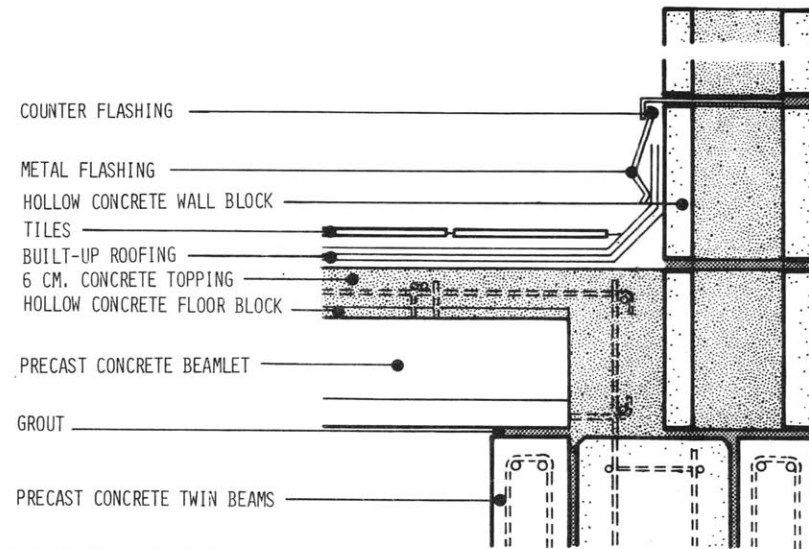


PRECAST CONCRETE COLUMN

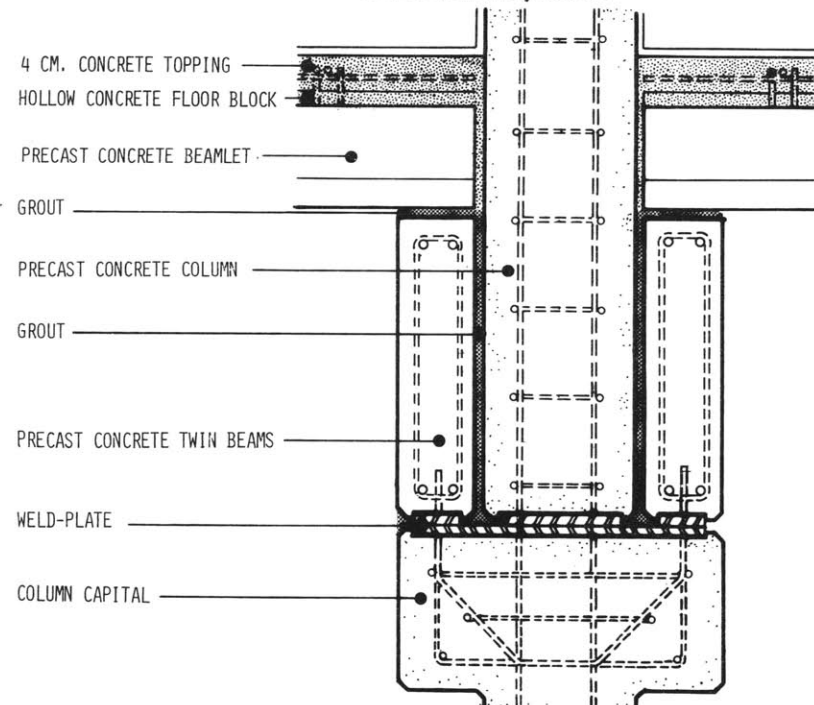
STRUCTURAL COMPONENTS



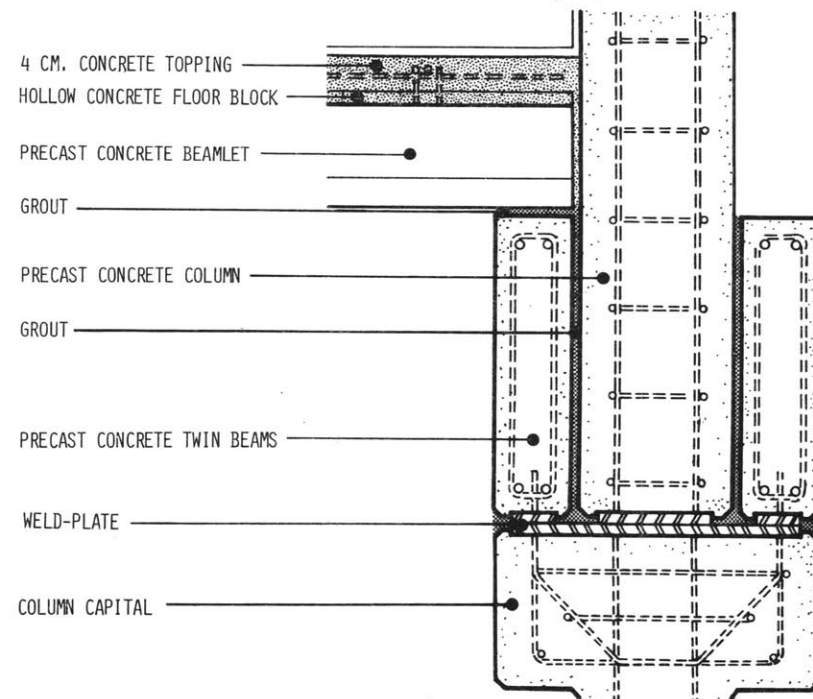
SECTION AT INTERIOR TWIN BEAMS/ROOF



SECTION AT EXTERIOR TWIN BEAMS/ROOF

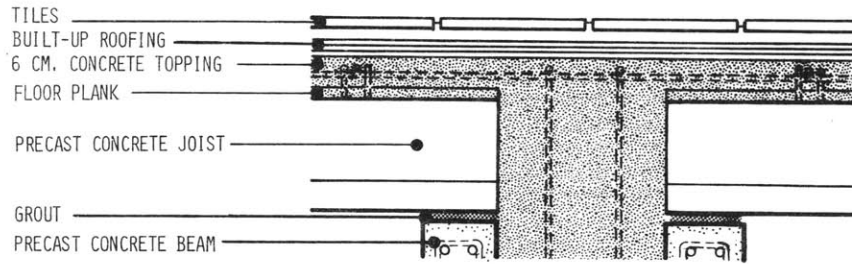


SECTION AT INTERIOR TWIN BEAMS/COLUMN CONNECTION CONSTRUCTION DETAILS

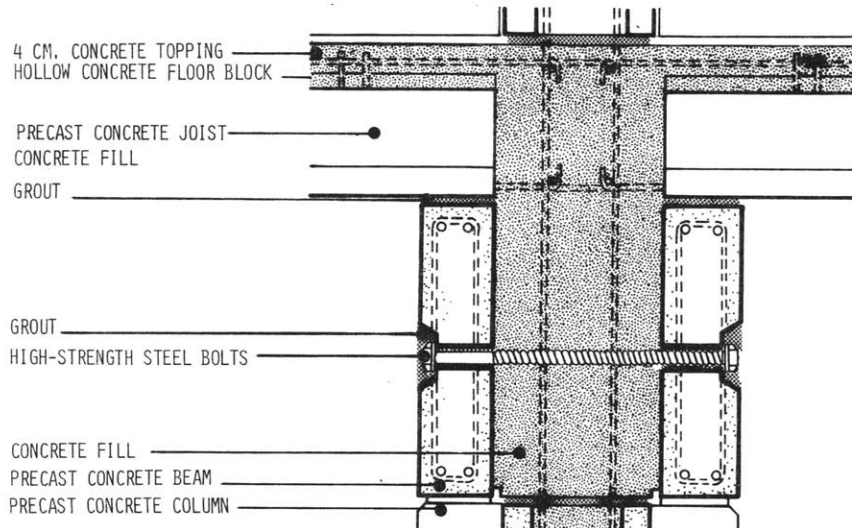


SECTION AT EXTERIOR TWIN BEAMS/INTERMEDIATE

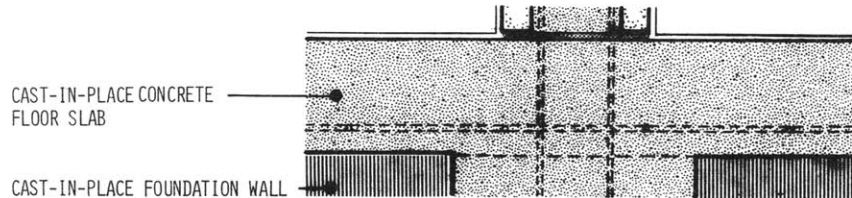




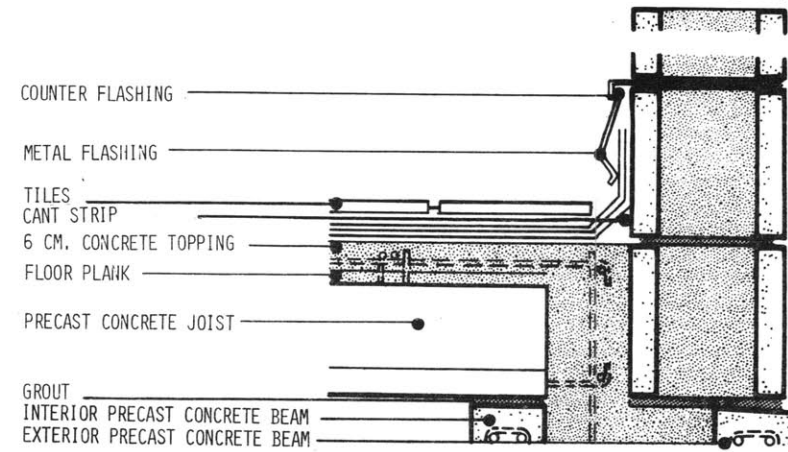
INTERIOR SECTION WALL AT ROOF



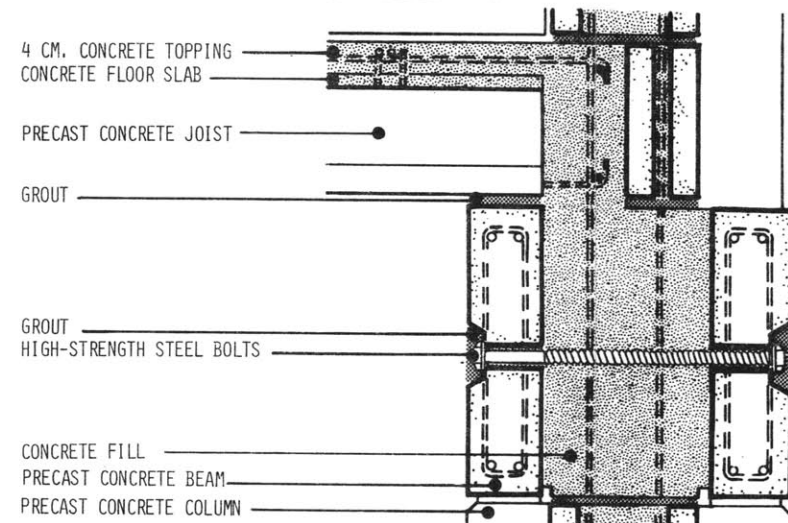
INTERIOR SECTION AT TWIN BEAMS/BOLT CONNECTION



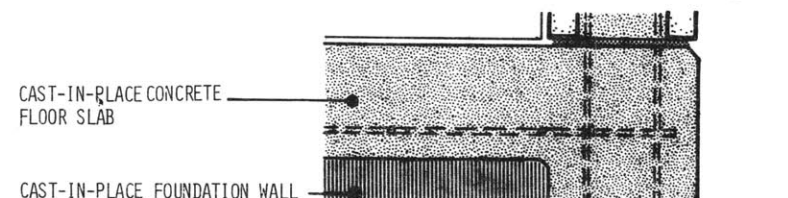
**INTERIOR WALL SECTION AT GRADE
 CONSTRUCTION DETAILS**



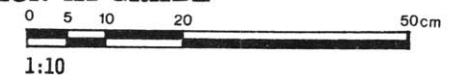
EXTERIOR SECTION WALL AT ROOF

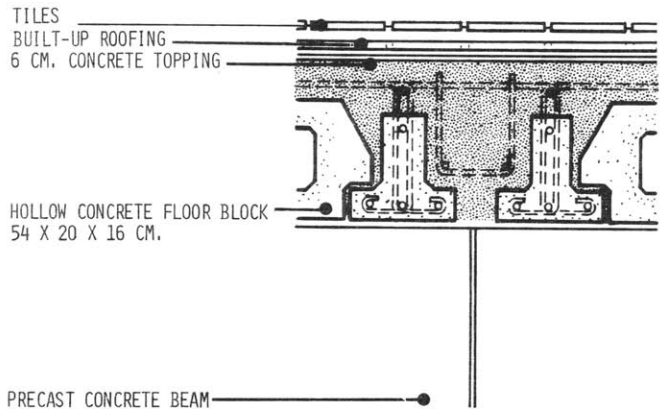


EXTERIOR SECTION AT TWIN BEAMS/INTERMEDIATE

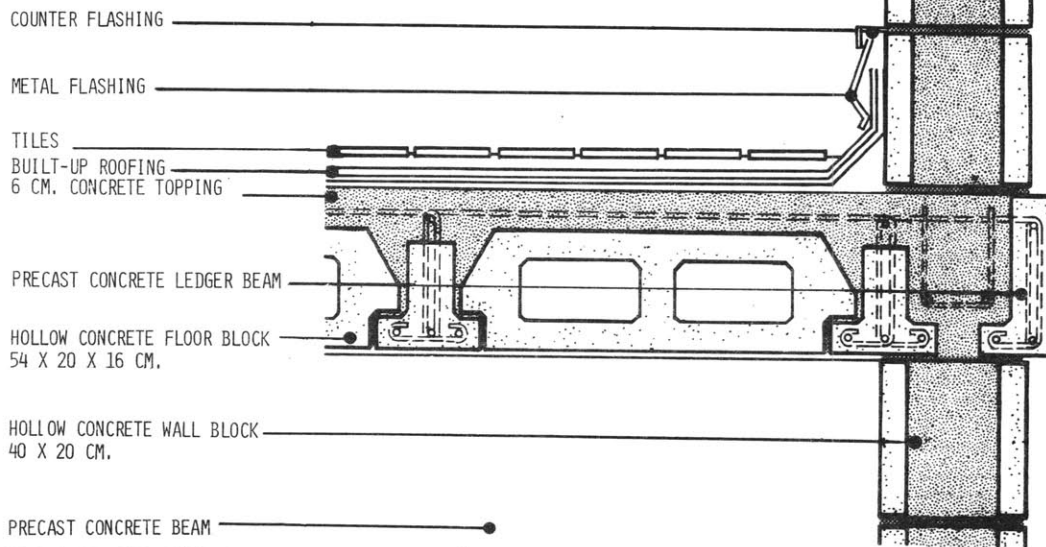


EXTERIOR WALL SECTION AT GRADE

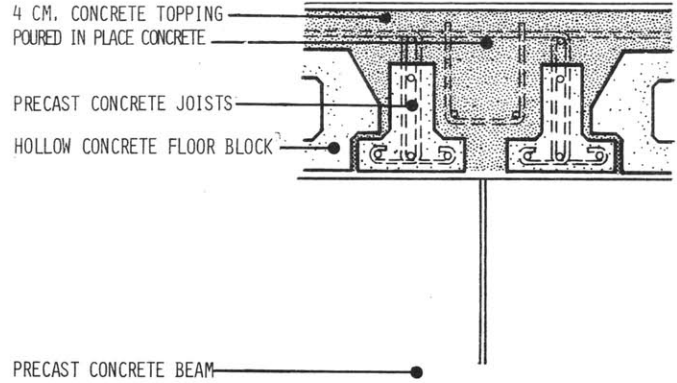




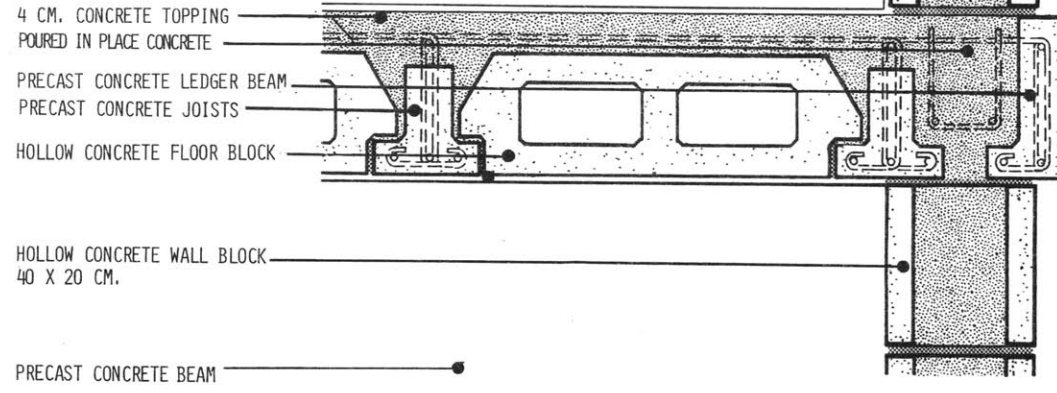
INTERIOR SECTION AT JOISTS/ROOF



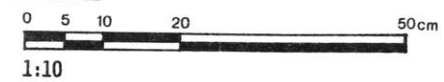
EXTERIOR SECTION AT JOISTS/ROOF

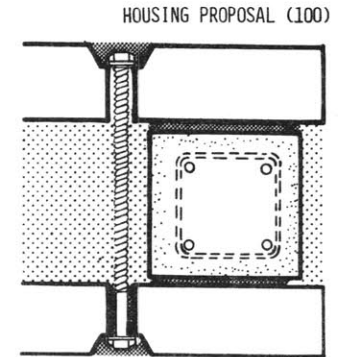
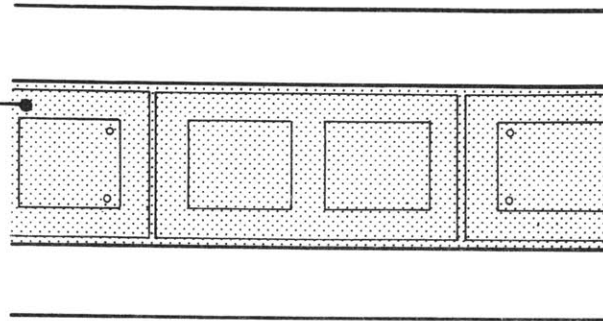
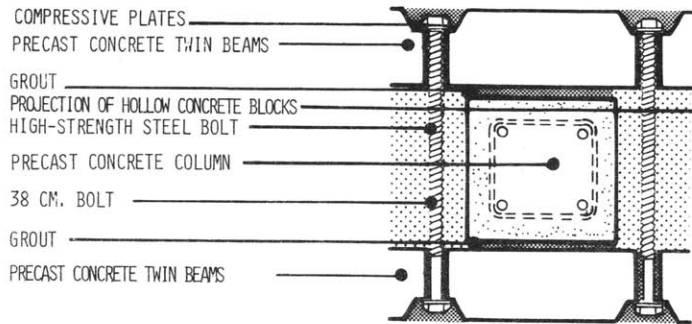


INTERIOR SECTION AT JOISTS/INTERMEDIATE CONSTRUCTION DETAILS

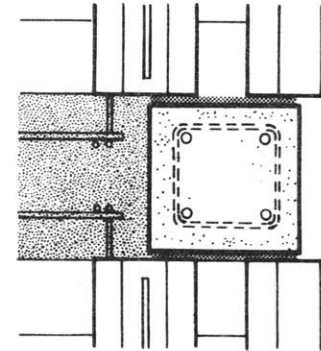
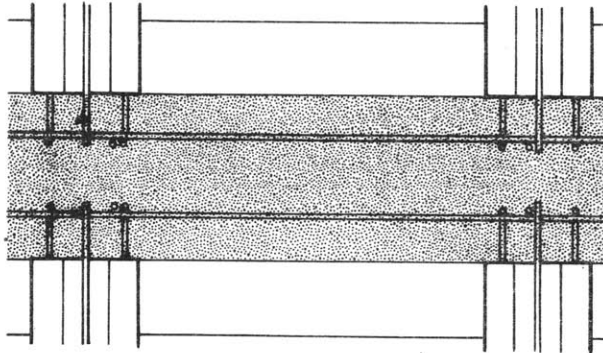
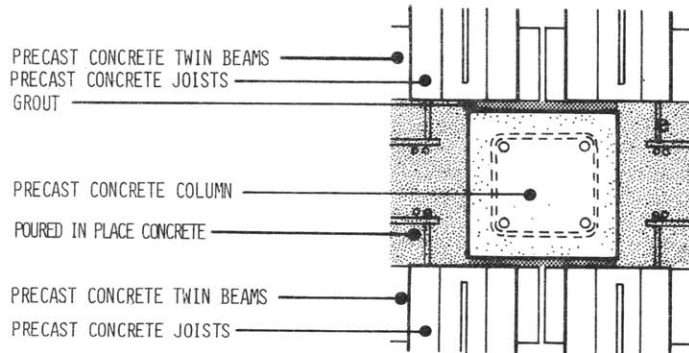


EXTERIOR SECTION AT JOISTS/INTERMEDIATE

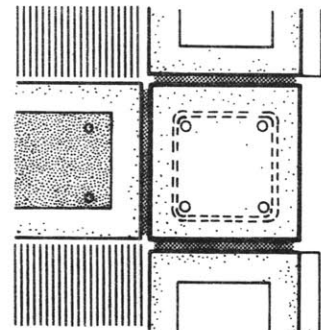
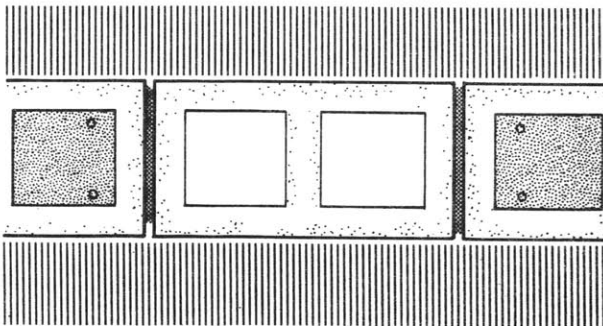
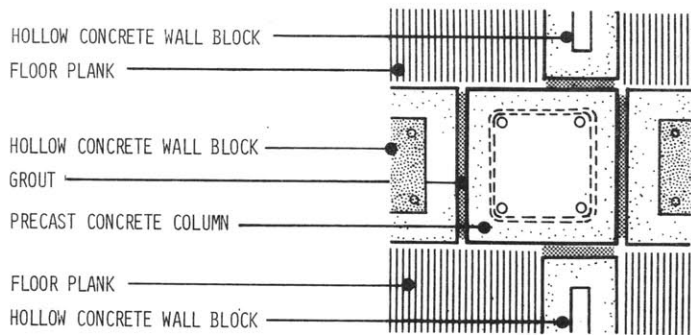




PLAN AT COLUMNS WITH TWIN BEAMS CONNECTIONS

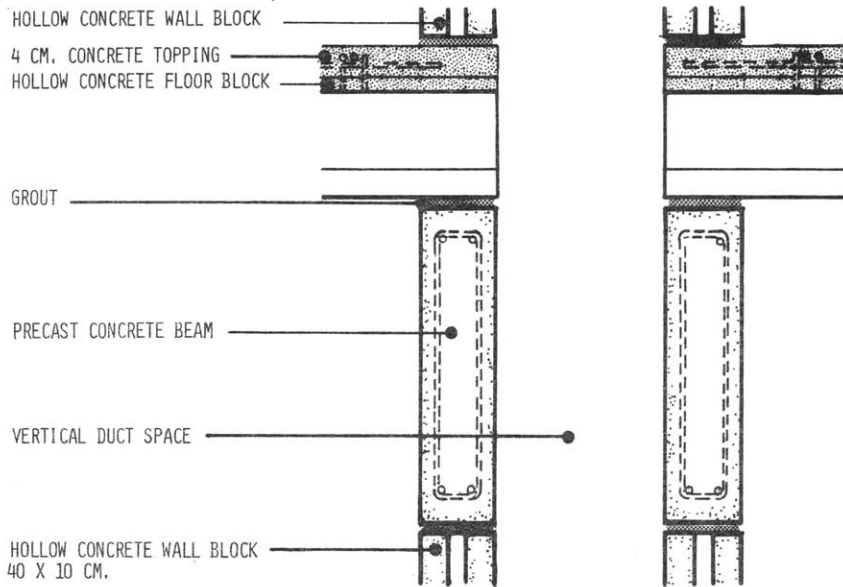


PLAN AT COLUMNS WITH CONCRETE JOISTS

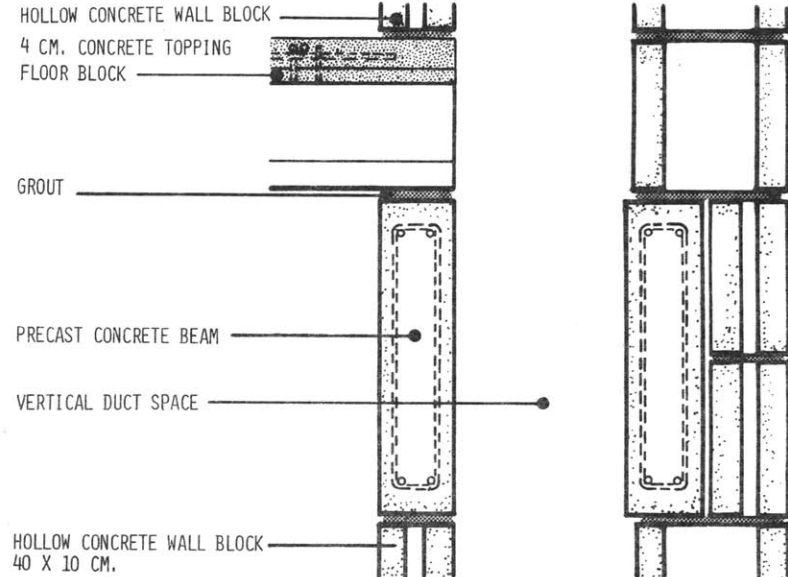


**PLAN AT COLUMNS WITH FLOOR PLANKS
CONSTRUCTION DETAILS**

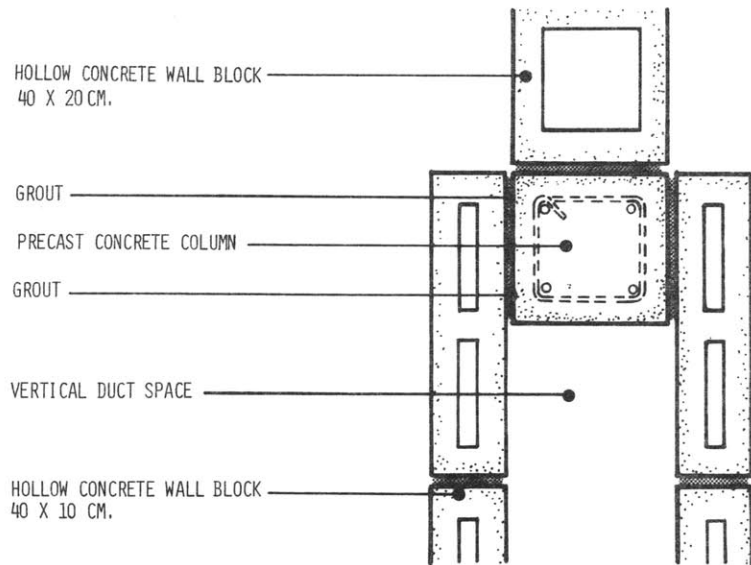




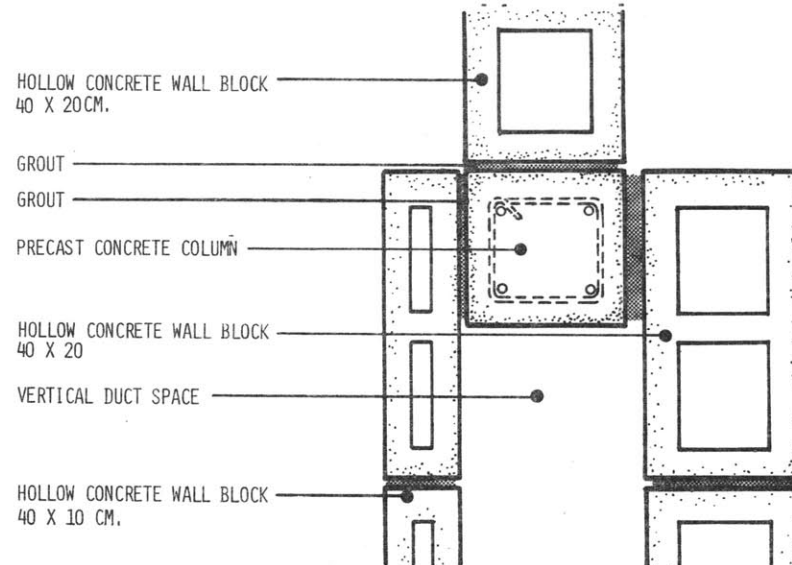
SECTION AT INTERIOR VERTICAL DUCT SPACE



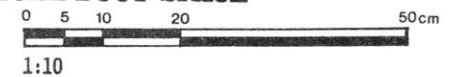
SECTION AT EXTERIOR VERTICAL DUCT SPACE

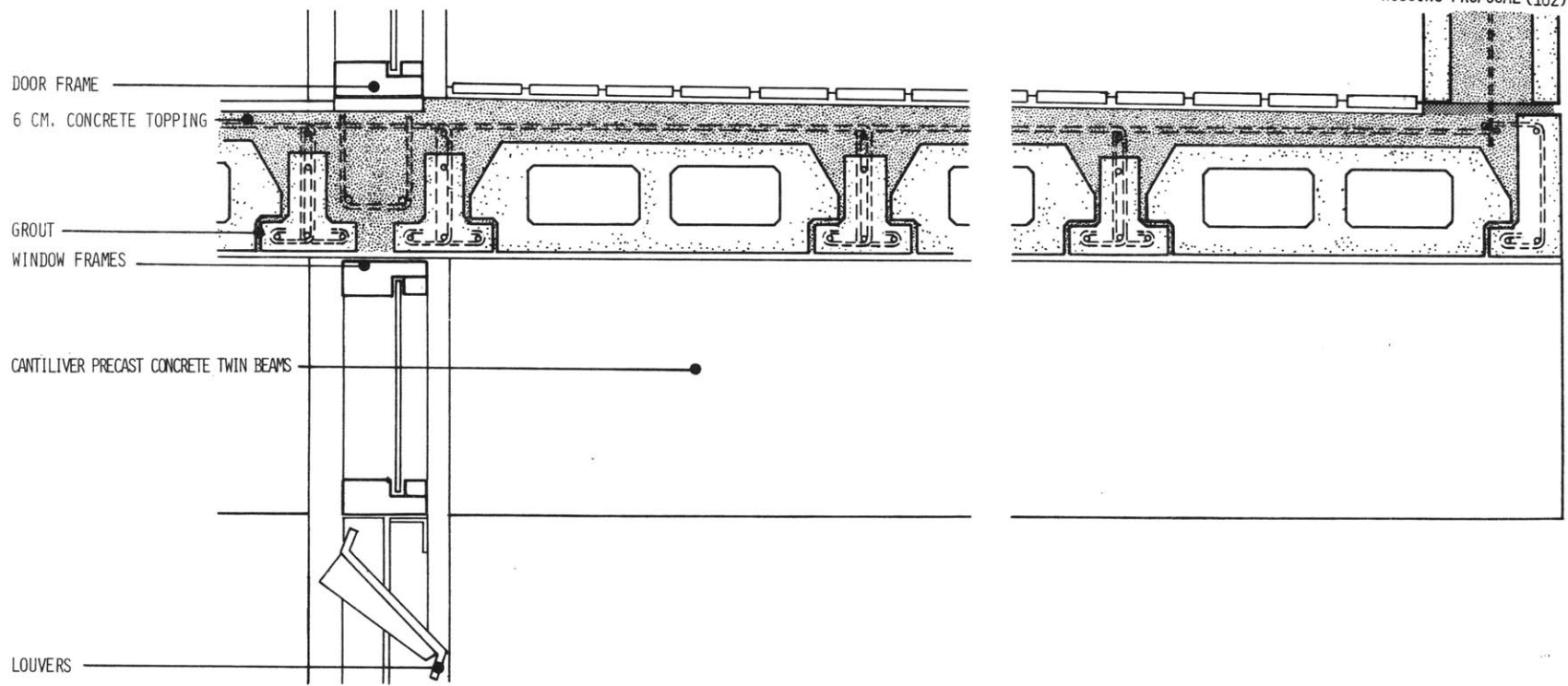


**PLAN OF INTERIOR VERTICAL DUCT SPACE
CONSTRUCTION DETAILS**

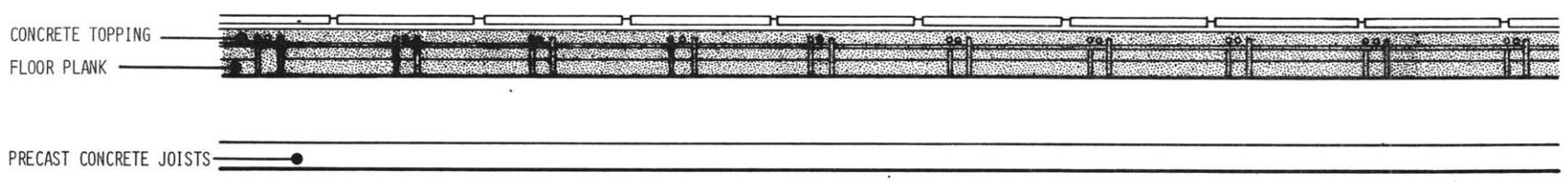


PLAN OF EXTERIOR VERTICAL DUCT SPACE



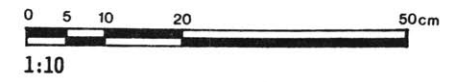


PARALLEL SECTION TO TERRACE



PERPENDICULAR SECTION TO TERRACE

CONSTRUCTION DETAILS



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