Table of Contents.

Cambridge, January 18, 1945.

166 Beacon Street
Boston, Massachusetts
November 20, 1944

Dean William W. Wurster
School of Architecture
Massachusetts Institute of Technology
Cambridge 39, Massachusetts.

Dear Sir:

I hereby submit the topic of my thesis, " Considerations on Apartment Design ", as partial requirement for the degree of Bachelor of Architecture.

I hope that this subject will meet with your approval.

Sincerely yours,

Diego C. Carbonell

DCP:ehs

ACKNOWLEDGMENT

The author takes this occasion to render his thanks to the undersigned for their cooperation and assistance.

Dean William W. Wurster

Professor L. B. Anderson

Professor Bridge

Professor Kennedy

Professor Gellotte

Librarians of the Rotch Library

All others who in any way offered assistance have my sincerest gratitude.

INTRODUCTION:

In this thesis, the author has attempted to give a comprehensive study of factors influencing the design of shelter, specially from the economic point of view. From this analysis, a program will be drawn, the design for which will be presented.

Venezuela has been selected for the purpose of interpolating a method of analysis. Although the data and figures used have been assumed on a sound basis, they are by no means exact, but, are of value in formulating such a program.

GENERALITIES.

Some of the factors affecting the economic development of housing, have been the direct consequence of land economics, namely, its location, its area and its use. On the other hand, there are other social and economic factors which have had basically the same results. Both these controls, that is, land economics and social and economic factors, can be shaped in the function of time, but results can be achieved more quickly and probably more efficiently through the former, since a change in the latter, would mean a change of basic or longer stablished conditions of society.

Let us examine, in short, these "other social and economic factors" and try to find the best conditions presented by possible changes and proper analysis of land. These factors constitute the economic conditions stablished by the social structure of society which in turn, is ultimately molded by the people's idiosincrasies and the conflicting interests arising from the relations between themselves. Both economic and social conditions therefore, have the same source. Yet, economies become of prime importance because of the subordinate role social considerations play in our money-class society.

In a perfectly competitive market, as pictured by economists, the price machine would theoretically bring to an equilibrium all resources, and with it prices. Unfortunately, the existance of a perfectly competitive market, especially in the field of housing, is a human impossibility. The factors responsible for such conditions, are the effects of unbalanced economic forces that rise from the deficiencies of free capitalistic systems, of legislati° acts, of conflicting individual interests, etc,.The sharp inequality of income distribution, and the often resulting unbalanced standard of living as well as prices, the overvaluation of certain necessary commodities to the profits of an organized minority, all prove the existance of these economic evils.

Bemis (1), points out, after studing the statistics of the average percentages of family budget used for shelter in various countries that"... it appears, then, that the cost of shelter represents 10 per cent or even less of the family budget in countries of a comparatively primitive status and ranges from that up to 15 or 20 per cent in the case of the developed, industrial countries with a somewhat higher percentage in the case of a few countries which, though modern in their civilization have not yet reached their full development. "

(1) " The Evolving House ",.- Bemis. page 33.

Venezuela falls in the last of these groups. Though, little developed, it has achieved its present modern standards because of the mild inflation created by the oil exports and government exchange regulations. Actually, Venezuelan economy is largely based on its outflow of black gold. Unfortunately, it is not returned to the national economy in the form of basic commodities or industrial developments, but, instead is exchanged in a large proportion for luxuries from foreign markets.

This has a direct effect on the exchange rates of currency. A depreciation of dollars in terms of bolivares results. Thus, the exporting American market is greatly favored and Venezuelan industry is shut off because of the interior prices it has to bear. These being the conditions, as compared to more industrially mature countries in which prices and foreign trade possess a greater degree of balance, it is easily seen that basic commodities such as shelter, which are controlled by interior prices as against imported commodities, will have a larger percentage of the family budget than usual.

It is up to the polititian and the economist to overcome these problems. Their solution is entangled with so many things that the changes needed would be numerous and unrelated, despite most of

probably being necessary. These changes could be made if proper time is allowed for them to take form and would undoubtedly be directed towards a protective frame for the industrilation of the country. This policy could be acheived by proper use of the tremendous national income derived from petroleum exports, by protective tariffs, by special banking credit rates for industry, etc,.

Nevertheless, when the businessman or the philanthropist as individuals get involved in housing projects, they do not and can not deal with these major problems. It is a task for a group, and not anindividual. They are faced with the effects of these major problems, the so called "land economics".

LOCATION.

Land is valuable because people thinks it is worth a certain amount of wealth, since land has a property or quality which in the people's judgement is valuable or necessary to them. This quality is the location of land with respect to other centers of interest for the people.

The valuation when established is more or less inelastic. The immobility of land and therefore its inflexibility to change according to differences

inthe preference, likings or interest of people, naturally causes land value to fluctuate. The location of land, therefore, may bring to the owner more profits if, for example, it is near the working areas of the people buying or renting it. Suitable utilities, agreeable surroundings, nearness to schools, play grounds, amusement centers, etc, are considerations in regards to location. Of these factors, the most important is probably the distance between the piece of land and the working areas of the people using such land, this being particularly true in the case of the working classes. It is worthwhile to notice that, taking the cost of land and the cost of building into account, that of land is the more flexible of the two, when it comes to adjusting the total cost.

Land cost depends on the location required in regards to the values of land in such location. This is particularly true when land is used for business and entertaining purposes, because of the importance, location plays in these particular cases. For residence in cities, buildable land may be defined as "land which is suitable for living purposes and is near enough to industrial plants and centers of economic activity to permit residents to reach

their place of employment in a reasonable length of time." (1). A reasonable length of time, naturally, varies with habit and local circumstances, but, it may be considered as not exceeding thirty five minutes for each of two daily journeys. It is interesting to note the effect of modern transportation on buildable land.

Before, when transportation was not available, a town of 180,000 inhabitants, covered an area of 9 square miles,(density= 16,000 per sq. mile.) Now, the same town could have an area of 144 square miles, 2,304,000 could be housed (at a reduced density of 16,000 per square mile.) (1)

LAND COSTS.

The total cost of shelter, includes the total cost of land, and the cost of the building. The total cost of land may be determined as pointed out before, by the location of the land, which is the main determining factor of the cost of the raw land, and other costs connected with improvements of land. The cost of the building is self explanatory.

In the United States, the average total cost of shelter, represents roughly, 20% of the fa-

(1).- The design of Residential Areas.- Thomas Adams page 26

mily's yearly income. The total land cost is aproximately 20% of the total cost of shelter, while the cost of raw land varies from 5 to 7% (of total cost of shelter) making therefore the cost of land improvements between 12 and 14%.

Thus, for average U.S. conditions, the average ratio between total land cost and the total cost of shelter, may be expressed as 1 to 5. This implies that one dollar of land is worth under average conditions, four dollars of building. It is possible to assume therefore, that under average conditions, this proportion will yield maximum profits.

The "real value of land" signifies the degree of land crowding as determined by existing local social and economic conditions.

The "real land cost" (location, its cost, and intrinsic and man-made improved housing conditions of land) in dictating land density is a main factor in considering the type of housing to be used. Next, we will review the effects of the real value of land on (a) density, (b) housing types.

DENSITY:

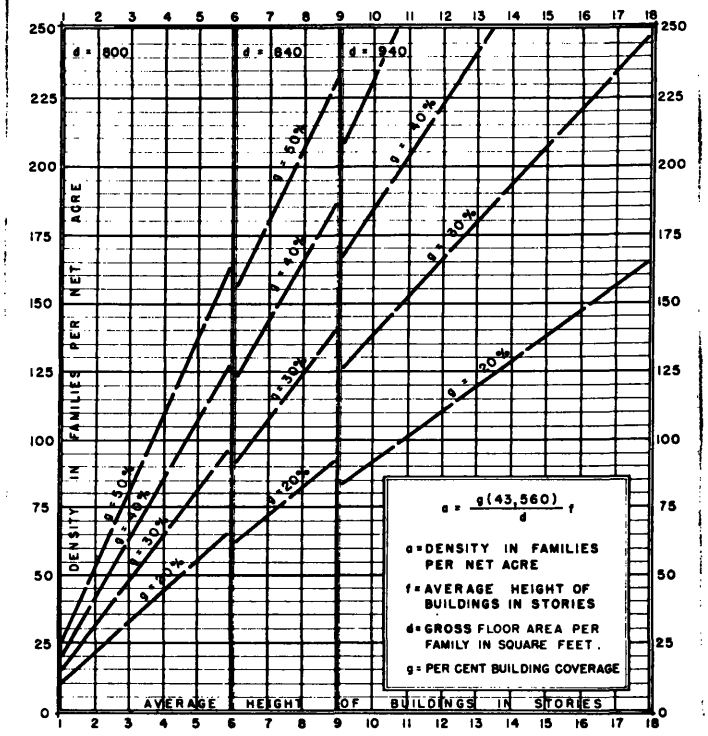
Let us examine density under the two concepts of gross and net density.

By Frederick J. Adams
From the Technology Revue
Number 7, May 1943

DENSITY STANDARDS FOR MULTI-FAMILY RESIDENTIAL AREAS

C H A R T I

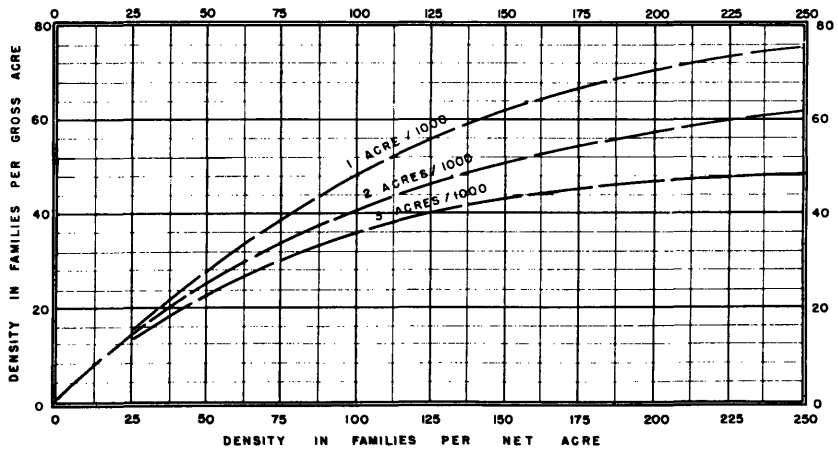
DENSITIES PER NET ACRE
IN RELATION TO HEIGHT AND COVERAGE OF BUILDINGS



DENSITY STANDARDS FOR MULTI-FAMILY RESIDENTIAL AREAS

C H A R T II

GROSS DENSITY IN RELATION TO NET DENSITY
VARYING WITH ADOPTED STANDARD OF PUBLIC RECREATIONAL AREA PER 1000 PERSONS



The gross density represents the density of population per specified unit of area, this area being the total of building coverages, neighborhood shopping, streets, parks and playgrounds, and additional street area for parking. The accompanying chart No. 3 gives the spatial requirements per family for various net densities. Note on the right-hand set of conditions (percentage distribution) the increase of areas of parks and playgrounds as gross densities arises, as compared to the decrease of both building coverage and balance of net areas. LeCorbusier's proposal of gigantic apartment buildings, deals with very high net densities and more or less normal gross densities. This arrangement eliminates, therefore, both building coverage and balance of net area (private grounds) and going still further, by elevating and simplfying highways he further eliminates street areas leaving a balance of practically one hundred percent area for parks and playgrounds.

Table 2 shows the decrease of street area as net densities increase. Approximately the same proportional reductions could be achieved in the cost of services, such as water, sewerage, and gas at increasing net densities. This is one of the substantial claims made by LeCorbusier.

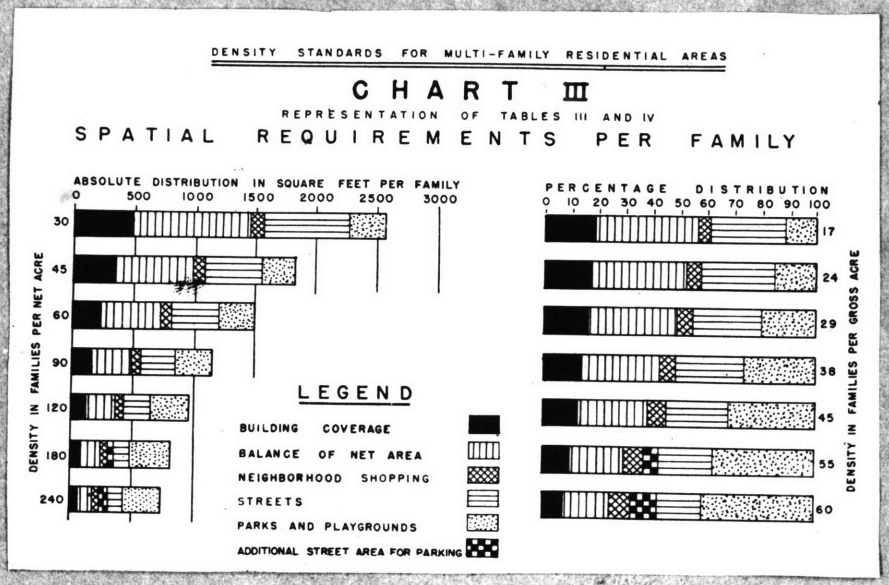


TABLE 1

Densities Per Net Acre in Relation to Height and Coverage of Buildings

(*a*) Density in families per net acre	30	45	60	90	120	180	240
(*b*) Density in persons per net acre at 3.5 persons per family	105	158	210	315	420	630	840
(*c*) Net area of lot per family in square feet	1,450	970	725	485	360	240	180
(*d*) Gross floor area per family in square feet	800	800	800	840	940	940	940
(*e*) Ratio of average gross floor area to net area of lot; $\frac{(d)}{(c)}$	0.55	0.82	1.10	1.73	2.60	3.90	5.22
(*f*) Average height of buildings in stories, assuming average building coverage of approximately 30 per cent; $\frac{100(e)}{30}$	2	3	4	6	9	13	17

TABLE 2

Minimum Street and Parking Area per Room in Relation to Density per Net Acre

(*a*) Density in families per net acre	30	45	60	90	120	180	240
(*b*) Average building coverage	30%	30%	30%	30%	30%	30%	30%
(*c*) Net area per family in square feet (From Table 1)	1,450	970	725	485	360	240	180
(*d*) Area of lot not covered by buildings; 70 per cent of (*c*)	1,015	680	508	340	252	168	126
(*e*) Average street area per family	700	480	380	280	220	150	120
(*f*) Available parking space per family; 50 per cent of (*d*) plus 20 per cent of (*e*)	648	436	330	226	170	114	87
(*g*) Area to be added to street area (*e*) in order to bring minimum parking space per family up to 160 square feet	0	0	0	0	0	46	73
(*h*) Total street area per family in square feet; (*e*) plus (*g*)	700	480	380	280	220	196	193

TABLE 3

Maximum Density per Gross Acre Obtainable at Various Densities per Net Acre

(*a*) Density in families per net acre	30	45	60	90	120	180	240
(*b*) Net area per family in square feet; item (*c*), Table 2. Additional allowance for local shopping facilities	1,450 105	970 90	725 90	485 70	360 70	240 60	180 5
(*c*) Total net area	1,555	1,060	815	555	430	300	23
(*d*) Area of parks and playgrounds per family at 2 acres per 1,000 persons	305	305	305	305	305	305	30
(*e*) Total street area per family; item (*h*), Table 2	700	480	380	280	220	196	19
(*f*) Gross area per family in square feet; (*c*) plus (*d*) plus (*e*)	2,560	1,845	1,500	1,140	955	801	73
(*g*) Density in families per gross acre (approximate)	17	24	29	38	45	55	6

TABLE 4

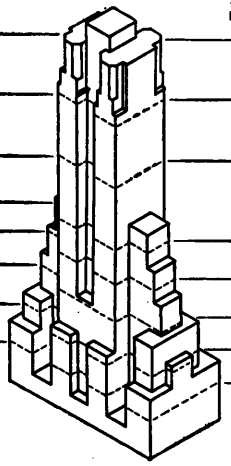
Proportionate Land Uses at Various Densities per Gross Acre
(Derived from Table 3)

Density in families per gross acre		17	24	29	38	45	55	6
Per cent of gross area in:								
Net area	Residential	57.0	52.5	48.5	42.5	37.5	30.0	24.
	Commercial	4.0	5.0	6.0	6.0	7.5	7.5	7.
Parks		12.0	16.5	20.5	27.0	32.0	38.0	41.
Streets		27.0	26.0	25.0	24.5	23.0	24.5	26.

By Frederick J. Adams
From the Technology Revue
Number 7, May 1943

ECONOMIC HEIGHT OF AN OFFICE BUILDING*

STORIES	HEIGHT	NET RENTABLE SPACE	COST	ANNUAL NET INCOME	RETURN ON TOTAL INVESTMENT
NUMBER	FEET	THOUSAND SQ. FEET	MILLION DOLLARS	MILLION DOLLARS	PER CENT
75	890	1792	43	4.3	10.06
63	753	1653	39	4.0	10.25
50	599	1491	36	3.5	9.87
37	446	1313	33	2.9	9.07
30	365	1186	30	2.5	8.50
22	269	984	27	2.1	7.73
15	181	803	25	1.6	6.44
8	101	513	22	0.9	4.22



STORIES	INCREMENT		
	NET RENTABLE SPACE	COST	NET INCOME
NUMBER	THOUSAND SQ. FEET	MILLION DOLLARS	THOUSAND DOLLARS
75			
	129	3.7	301
63			
	162	3.3	476
50			
	178	3.2	574
37			
	147	2.4	390
30			
	182	2.8	456
22			
	181	2.3	503
15			
	290	2.9	687
8			

*Based on Clark and Kingston – The Skyscraper

As net densities rise, whatever the changes in gross densities, there is a practically direct proportional increase in the height of the building and a proportional decrease of the balance of net area as a result of the proportional increase of building coverage. (See Table 1, Chart 1, and Chart 2) Nevertheless the vertical growth of buildings or increase in height mentioned before presents economic restrictions. These forces which work against the proportional decrease of cost of land per unit of floor area, are the increasing areas for circulation, services and structure, as well as the increasing cost of the structure itself and of the mechanical equipment.[1] These conditions acting against the economic vertical growth of buildings are inevitable and even in the best designed buildings of this type the effects of high cost of land are present in the 20 to 25 per cent higher rents for equivalent rooms to those of a one-family detached house. The private builder or promoter knows that in order to get a satisfactory return on his investment he must maintain a reasonable relationship between the total rentable floor space of his building and the cost of the site. In other words, as it was seen before, the land value is allowed to dictate the so-called economic height and coverage of a building.

[1] For data on this subject refer to the "Land Economids" by Ely and Werwheim page 128.

LeCorbusier affirms nevertheless, that his project would very easily cover these extra costs from the resulting economies of simplification of the urban residential housing, but the real problem is whether people, would like to live under so standardized and communal housing condition. This last point, though, will be discussed later.

Density is a direct consequence of land cost in the case of the profit-seeking enterpreneur. In this case it is land cost and, therefore, density which determine the housing type used. These factors are dependent in relation to each other, but since land cost is inflexible in land supply in most cases, it is always assumed that housing types are results of land cost.

HOUSING TYPES:

We can divide types of housing into three broad categories as follows: [1]

(A) The detached single-family house has social advantages over all other types. It is especially successful in small towns and cheap land. If coupled to these conditions the cost of local improvement, construction and materials, can be kept low, this type is the best. The great fault is the insufficiency of sanitary improvements, large front width etc.

The bungalow is the variation of the detached single family house. It has one advantage and one disadvantage in its one-level feature. It makes domestic work

[1] "The Design of Residential Houses" by Thomas Adams, pg.91.

easier and probably its structure is lighter, but this is offsetbecause the more expensive developement of land and higher roof proportion to cubic capacity.

(B) Group housing because of bad design has been relation in the public mind to crowded structures on small, awkwardly-shaped lots. Because of the lessened sense of ownership they are better for rental. Its monetary advantages are many and enables it to meet highe r land costs. The land improvements are cheaper, the frontage is very much decreased, the number of exterior walls are substantially reduced.

(C) Multiple, or apartment, housing. This type of housing has been created to meet the restrictions of high land cost on housing. These restrictions of land cost are overcome by increasing the density of tenants without change of land area by means of multiple-story buildings. Their popularity is based on (a) the absence of capital to buy, (b) unwillingness to be tied to a house for any lengthy period due to uncertainty of local improvement or monetary status, (c) uncertain liabilities for local improvement costs and taxes that go with ownership, (d) the fact that apartments usually provide more labor-saving appliances than houses.

NOTE: If we consider on business and social bases the problems of shelter, it may or may not have residual claims

d

depending on whom it's meant for and, therefore, who undertakes the job (private enterprise, low interest or non-profit capital, i.e. government, business, or philanthropy.) This again, depends on the standard of living, comparative distribution of income, purchasing power, social conditions, etc. of the people for whom shelter is to be provided.

In the case of the business man, he has to solve, after consideration of the preceding, and before stating a program whether his buildings are going to be for rent or for sale and if the latter, what policy he should follow.

The factors effecting this decision are results of both social and economic conditions of the group under consideration. "To buy a house," says the proverb, "is to settle down." In order to make this decision, the individual as well as the group has to be of non-migratory characteristics, he must have a steady job and in general up to a near future he expects his income to be steady or increasing. If he is uncertain of his future, and is a reasonable and thoughtful person, he probably will not take a chance.

These conditions may be traced down to a group through the same questions, though of a larger scope, and define it in a more general sense. This tendency to buy or rent is obviously due to what kind of jobs are offered,

their permanent or transitory characteristics, the agreeableness of the surroundings, facilities, etc. On the other hand, people are willing to rent the shelter because they may expect in the future to change their economic status for better or worde, because in the short run, renting is cheaper than buying etc. [1] This last statement is due mainly to two reasons:

(a) The percentage of repayment of complete costs consists of savings.

(b) People are ready to lessen their expenditures in another direction in order to purchase a home.

DEPRECIATION RATES.

In the case the tenant favors buying rather than renting, the building as a general rule should be built under such standards as to have a longer useful life. If, on the other hand, the tendency were towards renting, the "probable useful life" of buildings would be influenced by the desirable effects of the subsequent rate of depreciation would have on the economic rent of the building, possibility that social obsolescence occurs before physical obsolescence, total cost of project caused by standards necessary to insure a certain useful life etc.

The estimates of the probable useful life and of rates of depreciation of certain types of residential

[1] "Design of Residential Areas" by Thomas Adams, page 81.

buildings are reproduced below[1].

(2)	FRAME		MASONRY (interior frame.)		MASONRY (slow burning)		MASONRY (fireproof)	
	P.U.L.	D.R.	P.U.L.	D.R.	P.U.L.	D.R.	P.U.L.	D.R.
Single-family Dwelling	33	3	50	2	50	2	50	2
2-3 or 4 family Dwelling	30	$3\frac{1}{3}$	33	3	40	$2\frac{1}{2}$	45	$2\frac{1}{4}$
Row-housing	30	$3\frac{1}{3}$	35	$2\frac{6}{7}$	40	$2\frac{1}{2}$	45	$2\frac{1}{4}$
Aptms and flats without elevat.	25	4	30	$3\frac{1}{3}$	35	$2\frac{6}{7}$	40	$2\frac{1}{2}$
Hotel and elevat. aptms.	22	$4\frac{1}{2}$	25	4	30	$3\frac{1}{3}$	35	$2\frac{6}{7}$

The economic rent represents a fixed amount to cover maintenance costs plus the interest the owner charges for the use of his property.

The rate of interest gives, therefore, directly the amount of time in which the building will have paid its own cost to the owner. It is then important to check the rate of interest of a building, against its materials, construction et., which define its probable useful life.

[1] From a pamphlet of the United States Treasury Department, Bureau of Internal Revenue, "Depreciation Studies, Preliminary Report" (G:O:P:, Washington, D.C. 1931) page 3.

(2) P.U.L. = Probable Useful Life in years.
D.R. = Depreciation Rate (percentage)

ECONOMIC RENT.

The economic rent has been defined "The sum of annual charges expressed as percentages of the cost of shelter unit," the cost of shelter unit being, "the capital cost of the land and building at the time of occupancy, regardless of whether the unit is old or new, to be occupied by owner or tenant." [1]

The annual charges mentioned before as the elements of the economic rent are: [1]

Interest	5.0 %
Taxes	2.5 %
Maintenance	2.0 %
Depreciation	0.7 %
Administration))- Vacancies)	0.7 %
Insurance	0.2 %
Total	11.1 %

Slight variations may be due to: more or less efficient landlord, more or less migratory tenants, higher and lower demands in services, allowances for vacancies and bad debts, allowance for depreciation comes from physical as well social obsolescence. For lower rates of interest good construction is necessary since it requires less annual repairs.

[1] "A Method for Analizing the Economic Distribution of Shelter." by the Albert Farwell Bemis Foundation, M.I.T.

The cost of what the future tenant can pay for, is controlled by his income, the economic rent yielded by the project and which has to be met by the tenant's income, is the factor defining the rent at which the services of shelter will be offered to the public (in our case showing a profit to the investor.) The formula expressing this relationship between income and rent may thus be stated as follows:

$$I \times S = P \times R$$ in which

I = Income

S = Percentage of I for shelter

P = Capital value of shelter

R = Economic rent

FAMILY BUDGET:

The most inflexible factor in the economic planning of housing is income. All other conditions, cost of land, of labor, of materials, type of building etc., have to meet this condition, and in very few cases is income not considered to be the controlling factor. Such cases, when present, occur only in the high income groups.

Housing costs as related to total expenditures in other items in 1928 in the United States were as follows:

Housing	22.2 %
Food	24.7 %
Automobiles	11.2 %
Other luxuries	11.2 %
Clothing	9.6 %
Savings	7.6 %
Sickness	3.4 %
Others	7.8 %

From year to year these percentages vary but as an average we can take for the United States a housing-to-income ration of 1 to 5 or 20% of income for housing.

Nevertheless this ratio probably cannot be maintained in Venezuela as explained before. Furthermore, of this quantity the percentages dedicated to shelter and land under Venezuelan conditions tend to be different from those in the United States. Because of climatic conditions in the United States, the tendency is to consider the structure as the real shelter. The favorable climate of Venezuela makes outdoor living conditions much more desirable and it can be assumed, therefore, that the percentage dedicated to land will be higher than its U. S. reciprocal. Another reason will be for our particular case in Caracas will be the higher cost of land, which has been artificially inflated.

INCOME.

I have chosen Caracas for the site of this work. It is a city of about 380,000 inhabitants, all of which may be divided into three groups. Social, cultural, and economic conditions in each of these groups are homogeneous.

(A) High income group. This group forms the smaller percentage of the total population (5 to 7%) They live in the best residential areas of the largest cities and their social status is largely effected by the occupation of the head of the family which may be:

Investor or owner of large property
Successful professional
Managerial staff of industry or business
High government employees

This group is the one that approaches the best modern standards of comfort.

(B) Middle income group. This group forms the 15 to 18% of the total population. Their income is derived from the working elements of the family. Social status in this group because of its homogenity does not present the sharp contrast of the high income group. They are:

Less successful professional
Government official
Skilled workers
Clerical staff

(C) Low income group. It is the largest group (75 to 78%) and problem of Venezuela. Their very low purchasing power as compared to other groups, their education, sanitary conditions, etc. makes their housing problem the hardest. To this group belongs the farmer as well as the low-paid unskilled laborer and the unemployed.

It is obvious that the high-income group does not need either protection or help. The problem is in the middle and low income groups.

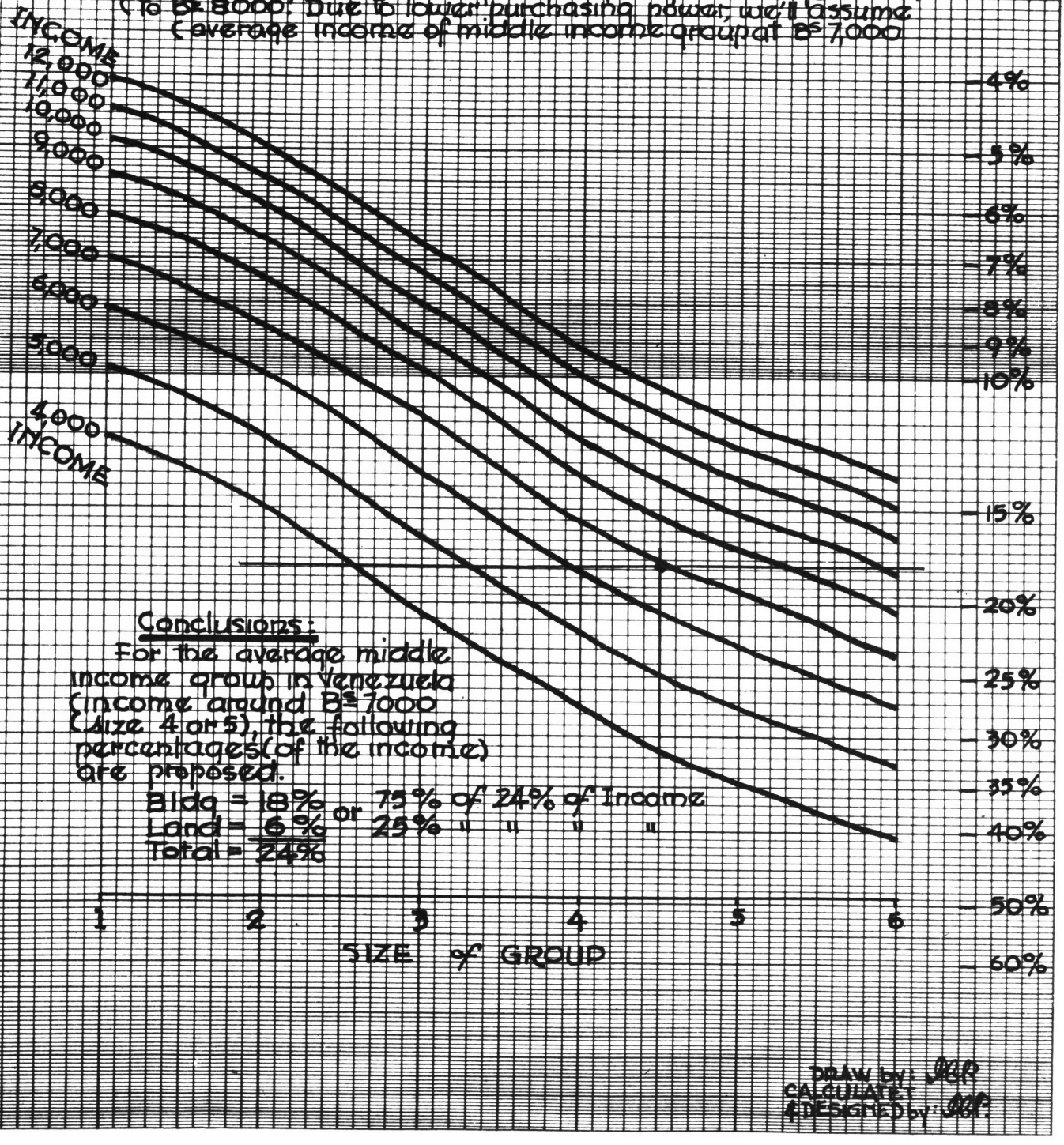
It is easy to see that the latter does not appeal to the profit-seeking enterpreneur, and that its solution lies, therefore, on government subsidy, or at least in the use of long-term repayment non-profit capital.

On the other hand if private capital were to invest it would be in the middle income because of the high demand and up to now limited supply. This, as explained more extensively in the thesis of J. A. Vegas (December, 1944, M:I:T:) is due to the increasing population of Caracas in the last ten years, which has roughly triplicated. Nevertheless, either because of the absence of private capital, or investors' initiative the supply did not meet the demand with the natural effect of valorization of both nearby open land and existing buildings.

THE PERCENTAGES THE INCOME-SIZE GROUPS WOULD HAVE TO PAY FOR THE "MINIMUM STANDARD COMFORT AREAS"

- (Land cost not included
- (The above mentioned %'s (are income pertentages
- (Assume Venezuelan aver. (family size of middle income (group to be = 4.5 persons.
- (Assuming aver. income of U.S. middle income group at ($2000 = a year, it corresponds in foreign exchange market (to Bs 8000. Due to lower purchasing power, we'll assume (average income of middle income group at Bs 7,000

if:
cost/sq. mt of floor area = Bs 150 sq (aver. const. cost in Caracas)



Conclusions:
For the average middle income group in Venezuela (income around Bs 7000 (Size 4 or 5), the following percentages (of the income) are proposed.

Bldg = 18% or 75% of 24% of Income
Land = 6% or 25% " " " "
Total = 24%

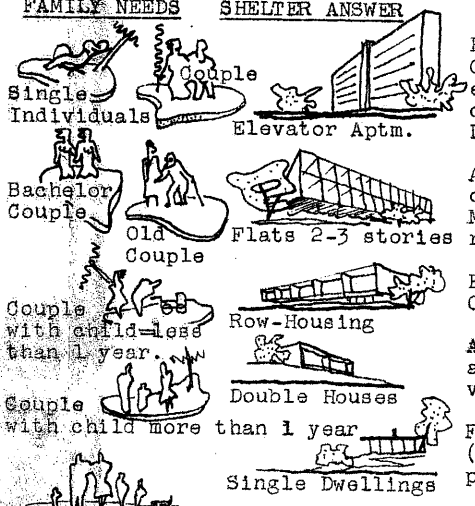
DRAW by: JCR
CALCULATED by: JCR
DESIGNED by: JCR

Size	Minim. Confort Areas.+	House Rent.	Land[2] Rent.	Total[3] Rent.	6000 Rent H. 76% =1120 Rent L. 24% = 350 Total R.24.5%=1470			7000 * Rent H.= 75% = 1260 Rent L.= 25% = 420 Total R= 24% of I.= 1680					8000 Rent H.= 74% = 1390 Rent L.= 26% = 490 Total R= 23.5%= 1880				
					Rent H.	Rent L.	Total R.	Equival. H.	Equival. L.	Rent H.	Rent L.	Total R.	Equival. H.	Equival. L.	Rent H.	Rent L.	Total R.	Equival. H.	Equival. L.
1	38.3	478	159	637	+742	+191	+933	41	80	+782	+261	+1043	43	108	+912	+341	+1253	505	142
2	47.1	589	196	785	+531	+154	+685	30	64	+671	+224	+895	37	93.5	+801	+294	+1095	445	125
3	64.1	800	256	1056	+320	+ 94	+414	18	39	+460	+164	+ 624	26	68	+590	+234	+ 824	330	97
4	87.05	1085	361	1446	+ 35	- 11	+ 24	2	-4	+175	+ 59	+ 234	9	24	+305	+129	+ 434	169	54
5	111.4	1422	475	1897	-302	-125	-427	-17	-62	-162	- 55	- 217	-9	-23	-32	+ 15	- 17	-17	6.2
6	130.8	1730	580	2310	-610	-180	-790	-34	-75	-470	-160	- 630	-26	-66	-340	- 90	-430	-189	--37

Minimum Standard Confort Areas.
(From the recomendations of the New York Housing Committee.)

Size of group.	1	2	3	4	5	6
Living Area	15.50	15.50	17.80	20.40	25.90	25.90
Dining Area	L.R.	2.80	4.20	5.60	12.10	13,25
Kitchen	6.50	6.50	7.40	10.00	10.00	11.10
Sleep. Area	11.10	16.70	27.70	33.50	44.60	55.60
Bathing Facilit.	3.60	3.60	3.60	4.10	4.10	7.40
Closet Space.	1.60	2.00	2.30	3.25	4.20	5.00
Laundry Facilit.	Kitch	Kitch	Kitch	5.60	5.60	5.60
Storage Space	Cl.Sp.	Cl.Sp.	1.10	4.60	5.00	7.00

FAMILY NEEDS — SHELTER ANSWER



YES.....	BUT
Fine view-Max. services Opp. to sociability. Most economic use of all kinds of mechanical equipment. Lots of space around.	Lack of privacy Getting along with neighbors. No children wanted.
Access to ground. Little or no stair climbing. Most shelter for your rent.	Lack of privacy. No good if you don't like children.
Economic. Private garden. Own 4 walls and roof.	Narrow garden. Diff. of thru access Too close to neighbor
Added exterior oppeness adds to pretense of privacy. More flexible plan.	Same degree of privacy. No good if want to be alone.
For the individualist (with plenty of land, peace and quiet.)	You have got to pay for IT.

From the " Architectural Forum".

[2]. Land Rent. It has been taken as being the 25% of the total cost of shelter: ratio of bldg to land = 3 to 1

[3]. Total Rent. It represents the amount that has to be paid to rent the above mentioned areas if: a) cost of construction is Bs 150/ sq.mt, and b) economic rent is 12%

*. 7000= Income. Rent H (House)= Amount Income should pay to rent minim. stand. confort areas.(% does not refer to income directly, but to % of income dedicated to shelter.). Rent L.(Land)=same meaning as before. Total Rent= % income should pay to rent shelter. Equival. H ϕ L represent the equivalent floor area and land that can be rented with the residue left after rent has been paid. (The residuals and equivalents are tabulated

ANALYSIS OF VENEZUELAN CONDITIONS.

For this thesis we will undertake the middle income group. In the analysis of a group, searching for such answers as a balanced percentage for shelter and the proportion of it dedicated to land and building, the most reasonable quality standards of construction for the different income groups etc., the best method to arrive at such answers are statistics. Since I haven't got such statistics, they will be assumed on the basis of United States statistics, by comparing United States and Venezuelan conditions.

With this in mind, the following chart was made. It shows the percentages, the different income-size relations have to pay in order to get what has been specified as the "minimum comfort areas". The percentage ordinates, emphasize the income size relations. When considering specific groups it is essential to know what income-size relations characterize such group. It is obvious that a family of two of the Bs 6,000 group, will have a larger purchasing power per capita, than a family of six of the same income. The standard of living of the former in housing considerations, will be the same as that of a group of three of the Bs 8,000 income and of four in the Bs 11,000 income. (See chart.)

This chart is framed by the following conditions:

(A) Living areas are based on specifications by the New York Housing Committee as "minimum standard comfort areas."

(B) The physical quality of shelter has been set up at Bs 150 per square (average in Caracas.) [1]

The figures resulting from these calculations, are compared to United States averages, The average "family" of 3.5 persons spending 20% of their income in shelter of which 20% goes to land and 80% to building. Assuming the average income of the United States middle income group to be at 2,ooo dollars a year it would correspond in the foreign exchange market to an income of Bs 8,000 but due to the inequality of distribution of income and other factors explained before, as compared to United States conditions, the real purchasing income in Venezuela corresponding to the $2,000 would be around Bs 7,000.

Being a fact, that the average Venezuelan family islarger (say 4.5) we could set our average percentage at 18% for building and 6% for land or 24% of income for shelter.

The proportion of land to building, 1 to 3, is justified to having in mind the high price of land and the possibility of use of outdoor living areas.

[1] This figure was chosen after consultation with several Venezuelan students at M.I.T.

Economic aspects of housing and their analyses are very diversified and limitless, and obviously out of the scope of this world. Furthermore to continue without statistics would be foolish and this thesis is at the point, if not beyond it, where precise data is necessary.

DESIGN CONSIDERATIONS FOR APARTMENTS.

First, it is taken for granted that the most economic solution is the fundamental consideration.

We have then to try to find a solution, in the midst of economic restrictions, that will pay in services its cost, a solution which will attract tenants as well as satisfy them. It is then of prime importance to fulfill as much as restrictions permit the tenants' reauirements. These requirements vary of course, depending on the ideology of particular societies.

LeCorbusier's proposal of gigantic apartments supposes a highly developed tendency towards communal activities. His project was, nevertheless directed towards simplification, economic efficiency and "openness" of city housing. Undoubtedly, it presentsmany advantages, but it is doubtful whether it would fit the requirementsof even a large homogeneous group of a particular society.

The traditional family spirit would be largely broken because of the partial diasapearance of the sense of land ownership. Children would have to be separated from

parents with the only advantages of common nurseries and probably better facilities.in this field. The concept of home as cente r of as center of family activities, would largely dissappear. In a society of primitive industrial status, where family activities are not likely to be carried on communal basis, and tne sense of land and home ownership are still strong, the ideas of Le Corbusier, even in smaller scalle would probably fail. Furthermore, it is probable that the conditions of a society of primitive industrial status would not require a scheme of the size and ideology of that proposed by LeCorbusier.

On the other hand and under certain circumstances, apartments may be much more desirable than private housing. Some of the economic advantages of apartments were explained before.

The type of apartments used, therefore, is dictated by land cost and necessity of location of such land with respect to other centers of interest of people on the one hand, and as much as economic restrictions permit by preference of the people on the other. If the conflicts between economies and people ideology is too great, the project should not go further than the project stage.

Let us classify apartments under the two controlling design considerations.

(a) Type of circulation.

(b) Design of apartment units.

CIRCULATION.

Vertical Circulation.

When using only vertical circulation, elevators do not seem to be justified if only two apartments per floor are used, and of course, still less if two apartments of several levels. (These cases are only justified in the case of high land cost and restricted supply.) This, of course, leads to four apartments per floor for maximum use of circulation area, and in general undesirable orientation has to be accepted. We will assume that a desirable maximum for a walk-up apartment in Caracas will be three floors.

Prevailingly Horizontal Circulation.

If we are to consider row housing of multi-family or apartment housing, it would be the simpler example of horizontal circulation. The more usual case, nevertheless, is that of the multistory building. In such cases, corridors may be used depending on circumstances. In their use, several effects should be taken into consideration.

(a) Corridors cut outside exposure and cross ventilation. This effect is at its worse in the design of walk-up apartments. This condition is even desirable when undesirable orientation has to be met, or where climate conditions are such that too much exposed area would mean extra loss of heat.

(b) Its desirability with respect to climate. It may either be extra volume to heat, and made of protective and expensive construction, or just an open corridor of low cost construction, which may provide cross ventilation to apartments.

(c) Its cost relation to elevators (vertical growth) or to extra piping, wiring, roofing, foundations etc., (horizontal growth)

TYPE OF APARTMENT UNIT.

It is obvious that the design of the units depends almost entirely on the conslusions reached on the circulations patterns of the particular case under consideration.

If land cost is fairly low, but not low enough to allow single-family or row housing developments, the natural result is the walk-up apartment. Its circulation pattern should be vertical, and several-level apartments in this case do not have justification, unless inaa few cases.

Vertical circulation is not only advisable but necessary when land cost is high, the lot relatively small and land supply restricted.

The resulting cases of undesirable orientation may be overcome by design. Some recently designed and built apartments in New York illustrate the point. In the case of still higher land costs and severally restricted supply of land, lies a possible explanation of the use of several-levels apartments with this circulation pattern.

Of course, at this point it is debatable whether land of such conditions should be used for housing at all.

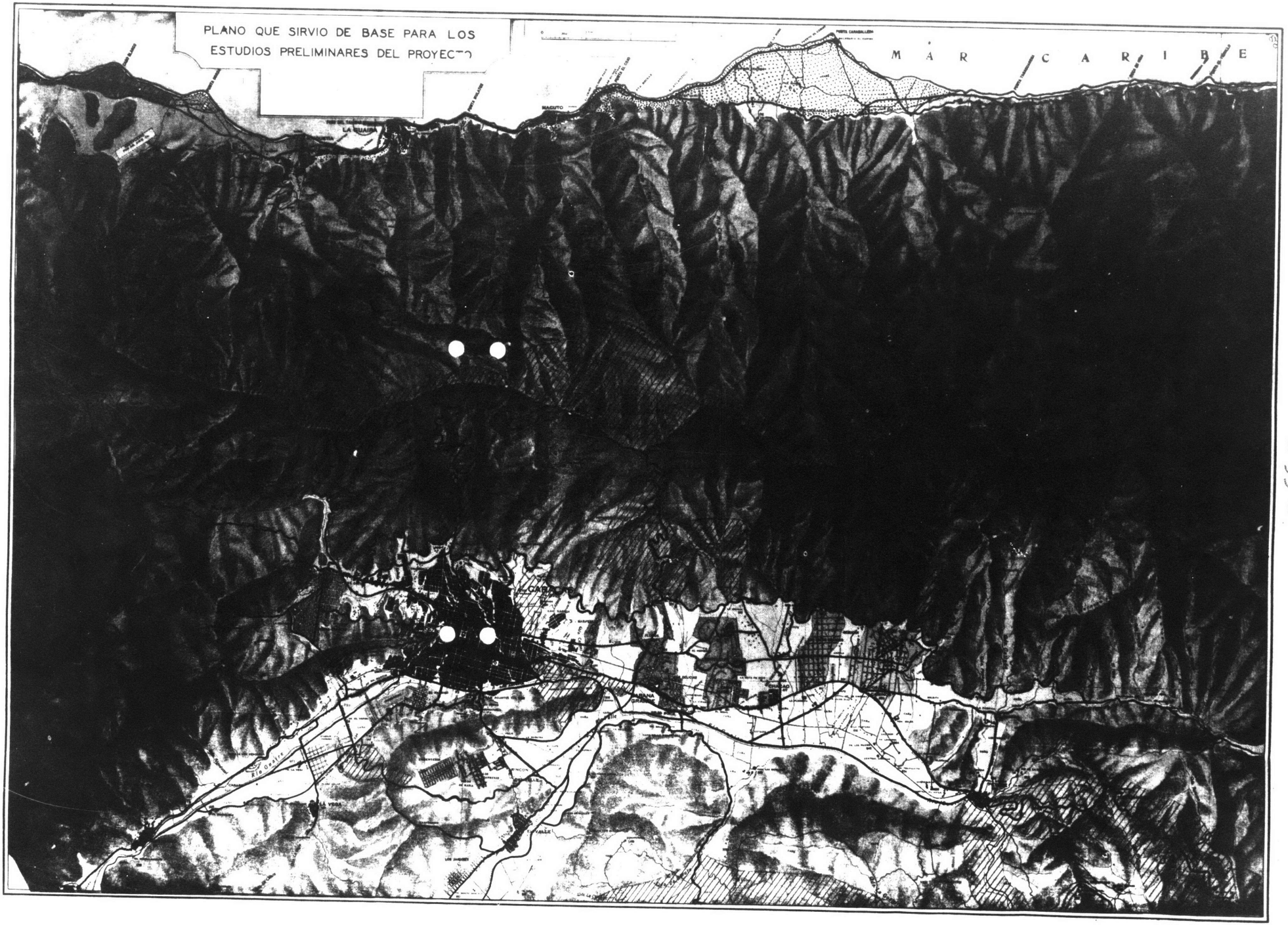
This case is the probable result of a cost of land higher than the one justifying walk-up apartments, but equal or lower han that of the former case. Another probable factor which differentiates this case from the elevator apartments, is a less restricted supply of land.

In order to diminish circulation area as much as possible, and increase outside exposure without having the building grow horizontally, the two and three level apartments has been produced. This type furthermore, gives a sense of larger than actual volumes by using higher ceilings in living areas and by letting one volume flow into the other.

The first design of this kind was produced by LeCorbusier. His design presents some deffects in shapes of areas, as he tried to design the unit as narrow as possible in order to economize corridor.

Several projects of this kind have appeared since. The works of Well Coats in London with this type of design, have proven to be very successful.

One of the best studies of this kind and for the particular conditions under consideration is the design presented by the Hovemeyeff group under the title of "Park Apartments" (The Architectural Forum Magazine.)


PLANO QUE SIRVIO DE BASE PARA LOS
ESTUDIOS PRELIMINARES DEL PROYECTO
M A R C A R I B E
LA GUAIRA
MACUTO
CARACAS
Río Guaire

BIBLIOGRAPHY

"Land Economics"
Eli and Werwheim

"Design of Residential Areas"
Thomas Adams.

"The Evolving House". Vol. 2
Bemis.

"A method for analyzing the economic distribution of shelter"
Albert Farwell Bemis Foundation, M.I.T.

The Architectural Forum Magazine

FHA Housing Reports

20th Century Fund

"Shall We Ration Crowding?"
Frederick J. Adams

AMEN.