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Site and Unit Design Handbook

Office of Housing and Urban Programs

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International Development

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SITE AND UNIT DESIGN HANDBOOK

Office of Housing and Urban Programs
Agency for International Development
Washington, DC 20523

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Prepared by

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This Site and Unite Design Handbook was developed at the request of Fred Hansen, Assistant Director of East and Southern Africa for the Office of Housing and Urban Programs. It was commissioned to serve as a reference manual for Regional Housing and Urban Development Offices and host country counterparts on new project design financed under the Housing Guaranty Program.

The handbook was prepared jointly by the Planning and Development Collaborative International (PADCO) and the Office of Housing and Urban Programs. The principal author was Richard Woods of PADCO with the assistance of Duane Kissick and Robert Olsen. Office of Housing and Urban Programs personnel who worked closely with this project and made special contributions were Jack Howley and Dean Swerdlin.

The views and interpretations expressed in this report are those of the authors and should not be interpreted as the official position of the Agency for International Development.

SITE AND UNIT DESIGN HANDBOOK

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FOREWORD

The Office of Housing and Urban Programs is pleased to make available this Handbook. The document is intended to serve as a reference manual for use by the Regional Housing and Urban Development Offices (RHUDO), the Office of Housing and Urban staff, AID consultants and Host-Country counterparts in planning and reviewing site and unit designs for projects targeted to low-income beneficiaries. Examples of site design, unit design, expandable units (horizontal and vertical) and related infrastructure are included in the manual, which is highly illustrated with text being in bullet and short summary form. We intend to evaluate the handbook's usefulness over the course of the next year and would welcome suggestions as to its content and presentation.

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Director
Office of Housing
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Chapter I
Introduction

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Chapter I
Introduction

The Site and Unit Design Handbook is to be used primarily by the Regional Housing and Urban Development Offices (RHUDOs) of the Office of Housing and Urban Programs. The handbook is designed to assist the RHUDOs in orienting the preparation of sites and services and core house programs for Housing Guaranty (HG) financing. As most HG projects are prepared by host country institutions or local consulting firms, it is anticipated that the handbook will be provided to these groups to assist in project preparation. In general, the handbook will be extremely useful for all technicians and practitioners. The formulation of a handbook which is applicable world wide has necessarily required that the guidelines be restricted to general design principles. To provide a regional perspective, examples from Latin America, Africa, North Africa, and Asia have been provided in the text and annexes.

Because of the potentially broad nature of the Site and Unit Design Handbook, it has been necessary to restrict the scope of the handbook to sites and services and core houses for AID's target group. Upgrading, for example, is an entirely different subject matter and is not treated here. Furthermore, because of affordability considerations, design options for site and core house development must also be restricted. Expandable core houses have been limited primarily to horizontal and vertical expansion to two storeys. Other design options, such as the use of alternative dwelling unit construction materials are subject matters in themselves and have only been treated lightly.

On the other hand, because site and unit design cannot be divorced from the project development process, general guidelines for housing policy, data collection,

programming, and site selection have been provided. As project development is a joint AID/host country process, it is important to clearly define AID's special concerns from the outset to avoid misunderstandings and delays.

The handbook is concerned with site and dwelling unit design. Therefore, no guidelines have been provided for **evaluating** completed projects. However, it is believed that the fundamental elements which will result in a positive evaluation have been incorporated in the report. In addition, a separate document was prepared for PRE/H in 1977 for this purpose: "Evaluating Successful Low-Income Housing Projects in Less Developed Countries", PRE/H, Consultant, 1977.

A. Shelter Policy Guidelines

Site and dwelling unit design is governed by overall shelter policy. In general, when AID and host countries elect to undertake a shelter project, it is to achieve several policy objectives. AID has been involved in urban shelter programs since the early 1960's. In 1973, with the Congressional mandate to focus AID resources on the poor majority, AID's Office of Housing, now Office of Housing and Urban Programs (PRE/H), defined its major policy as the fostering of national policy and institutional development in LDCs, with the ultimate aim of assisting in the development of a self-reliant shelter sector capable of providing affordable unsubsidized shelter to even its poorest citizens. Within this policy framework, the major objectives of PRE/H are as follows:

1. Basic Objectives

a. **Affordable solutions.** To ensure that low-income families have access to secure land tenure, basic services and housing which they can afford; AID's target group is defined as those households below the median urban household income.

b. **Sustainable delivery systems.** To assist LDCs to develop institutions capable of sustaining a level of shelter production commensurate with the needs of the population, with special emphasis on meeting the shelter needs of the urban poor.

c. **Financial self-sufficiency.** To develop systems for financing shelter and urban development with minimum subsidy requirements.

d. **Private sector participation.** To encourage and facilitate an increased role for the private sector in the production of low-cost shelter for the low-income population. This includes both a greater role for the households themselves as well as private developers and entrepreneurs.

e. **Rational housing policy.** To encourage the preparation and implementation of national housing policies that reflect the four preceding objectives and that provide a comprehensive, internally consistent framework for future housing activities.

2. Program Activities

PRE/H's major instrument for achieving its policy objectives is the Housing Guaranty (HG) program which has authorized more than $1.7 billion in HG assistance for 167 projects in 44 countries. These projects primarily include sites and services, core houses and upgrading projects. As this project is concerned with the former a brief description of these programs is provided.

a. **Sites and services.** The preparation of vacant land for productive shelter use through lot division and installation of water lines, sewage disposal systems, electricity, roads, and drainage. In a typical situation, this is followed by self-help or owner managed home construction.

b. **Core housing.** The construction of a rudimentary dwelling unit usually including a cooking area, toilet and washing area, and a small multi-purpose living and sleeping area. The latter usually consists of one or two rooms. In many cases, readily available indigenous materials are used to reduce the costs of construction.

c. **Community facilities and services.** Primary schools, health clinics, and basic local markets are generally components of HG financed projects. However, other elements might include small-scale industrial and commercial plots, manpower training centers, etc.

The Site and Unit Design Handbook provides guidelines for project development within the above framework. At the end of the handbook a bibliography is provided as well as a list of references of documents with subject matter beyond the scope of this handbook.

B. Shelter Programming

It is the premise of this handbook that shelter programming concerning host country resources and potential HG programs will have been carried out prior to specific project development. Host countries and AID will be concerned with shelter programming in a variety of cities and locations. In addition, host countries are preoccupied with shelter programming for a variety of beneficiary groups including but not limited to AID's low-income target group. PRE/H programming of shelter projects by city is a concern of regional offices during the formulation of its country strategy. In general, the larger, most rapidly growing urban centers are selected for PRE/H projects because they:

- Shelter and must accommodate increasing numbers of the urban poor where needs are largely unmet
- Require assistance in managing massive urban development
- Are generally the most economically productive urban centers requiring shelter support
- Provide a "forum" for low-cost shelter options which may be replicated in other urban centers

PRE/H programming of shelter projects in secondary cities is also common. PRE/H is concerned with national urban policy issues and the national settlement system as a whole. Therefore, in addition to addressing basic needs and often long-standing deficits, these projects aim at supporting the economic growth potential of secondary settlements through provision of housing and infrastructure. As the Site and Unit Design Handbook is concerned with guidelines for development of specific projects, programmatic considerations will primarily concern:

- The national scale of the project
- The appropriate project scale on each site
- The potential mix of income groups on each project site
- The mix of shelter options including plot and dwelling unit types

1. The National Project Scale

HG projects tend to range between $10 and $25 million dollars and usually include a host country contribution of up to 33 percent of total project funding. In project terms, between 2,500 and 6,000 plots and core houses could be financed with these funds. The impact and desirability of this range will depend upon the country and urban setting envisaged.

A typical settlement of one million population that is growing at an annual rate of 6 percent per annum must accommodate an average of 64,000 persons per year over a three-year period. This translates into roughly 12,700 households. If AID's target group is considered as those households between the 20th and 50th percentiles on the settlement's income distribution, about 3,800 households would fit into this group. Thus, if $10 million finances about 2,500 plots and core houses, such a project could finance about 70 percent of one year's requirements for this group. However, since projects usually require at least three years to complete, a $10 million project would satisfy about 22 percent of the average annual requirements over three years.

If one considers that many countries have primary settlements with populations over one million and several secondary cities of 100,000 population or more, it is clear that HG projects can have a substantial impact on meeting shelter needs in a given country, but that they are, except in rare cases, not large enough to fully satisfy demand. Therefore, HG projects are fundamentally aimed at providing prototype shelter programs that can be replicated on a larger scale in diverse locations by host countries while having a substantial impact in addressing shelter needs.

The amount of HG financing, though directly related to need, is governed by other factors. These include the sum that PRE/H can authorize on an annual basis ($150 million for all countries), the economic and debt situation prevailing in a given country, and host country commitment to low-income shelter.

2. Appropriate Project Scale by Site

The choice of an appropriate project scale by site is an important project consideration. Generally, single projects of several thousand plots must incorporate major improvements in service capacities. This usually involves the provision of off-site infrastructure and facilities at a community scale (secondary schools, hospitals, etc.) Though economies of scale might come into play, such large-scale projects are generally more costly on a per capita basis and implementation is slow. When heavy investments in several sectors are required, coordination for investment planning and contracts is a time-consuming process. Large single projects are also more risky due to potentially poor choices in location, contractors and marketing analysis.

In a major urban setting the choice of two or three sites involving 1,000-2,000 plots is recommended. Generally, these can constitute urban extension projects which do not require upgrading of infrastructure capacity in the project area. They also may rely temporarily on community facilities in surrounding areas while those on the project site are being constructed. (As construction of these elements is dependent upon other Ministries they are usually the last to be completed.) Smaller urban extension projects also have the distinct advantage of relative proximity to existing commerce, services, and other activities which are very slow in maturing in large-scale projects. Smaller projects, in addition, will likely involve several contractors and spread the risk of contracting difficulties. In general, these projects will result in better delivery, better supervision and better cost control.

The choice of two or three project sites will reduce the risk of poor marketing analysis and management. On the other hand, it is important to avoid more than four sites in the same city since these become difficult to manage

and coordinate and may result in some loss in economy of scale.

The same principle is true in secondary cities. Secondary cities projects usually involve a single implementing agency but a multitude of contractors and subcontractors; thus, they are difficult to manage and implementation is slow. As secondary cities are smaller, one or two project sites are recommended. In these cases, the risk of poor locational choices is less great.

3. Appropriate Mix of Income Groups

AID's target group will actually consist of a number of subgroups which are generally found in existing low income communities. Thus, by providing a range of shelter options according to income, some mix will take place. The desirability of mixing income groups will depend on cultural considerations in a given country. As a rule most countries prefer to avoid large concentrations of strictly low income shelter. Furthermore, in existing communities low and middle income groups tend to reside in close proximity to one another due to limited shelter options for these groups. The association of low and middle income groups in projects also provides an opportunity for cross subsidy which will assist in making shelter affordable for the lowest income subgroups (i.e., 20th to 30th income percentiles).

Incorporating middle and high income groups in projects has the disadvantage of consuming a larger share of resources per plot than for low income shelter. Thus, care must be taken to avoid the excessive deployment of resources for these groups. As a rule in keeping with shelter policy objectives, limited public resources should be concentrated on lower income groups and should not be used for shelter involving households above the 75th percentile of household income.

4. Appropriate Mix of Shelter Options

Mix of income groups and shelter options on a project site must reflect the differences in levels of service for each group. Provision of different levels of service is generally not economical if the mix is too thorough (i.e., at the plot level). Rather, it is advisable to mix

pockets (or blocks) of different shelter options/income groups in order to vary levels of service and plot size.

These elements are discussed more fully in Chapter II in the section dealing with site planning and design. Annex D shows examples of site development modules in which consideration of appropriate mix has been given.

5. Case Examples of Urban Shelter Programming

In Table I-1, an illustrative annual shelter program (between 1983-1986) for Abidjan, Ivory Coast is presented. The table was prepared during a Shelter Sector Assessment for the Ivory Coast.

Shelter sector assessments provide an opportunity for broad based programming which can be further elaborated by the host country. It is noteworthy that the table includes distinctions by income group including:

- Shelter needs
- Monthly payments/financial terms
- Site development costs
- Standards (land and units)
- Investment requirements

The table demonstrates that shelter solutions can be developed for a wide range of household income at full cost recovery. In the table, it is assumed that households with incomes of 40,000 FCFA[1] and up will be provided with credit for plot acquisition and housing construction. The table also indicates that if current loan terms could be extended from 10 to 15-year duration, larger plots and core houses would be affordable. No downpayment is considered in the program as it is assumed that household savings would be required for utility connections, installation of septic tanks or cesspools and various taxes.

---

[1]US$1 equals FCFA 406.85 on November 17, 1983.

TABLE I-1

ANNUAL SHELTER NEEDS, AND AFFORDABLE PLOT AND DWELLING UNIT STANDARDS FOR ABIDJAN (1983-1986)

Average Annual Population Growth 1983-1986 180,000		Income Group Share Population		Monthly Income FCFA	Affordable Monthly Payment		Possible Loan Amount At 13 Percent Over 10 Years FCFA	(I) Affordable Monthly Payment				(II) Possible Loan Amount At 13 Percent Over 15 Years	(III) Affordable Physical Standards				(III) Annual Investment To Meet Needs By Income Group Billion FCFA	Annual Number Of Dwelling Unit Needed By Income Group
Population By Income Group	Households By Income Group	Share %	CUM %		Percent of Income	Amount Month FCFA		Plot Size M²	Land DEVMT Cost/HA MFCFA	D.U. Size M²	Constr. Cost Per M² FCFA	FCFA	Plot Size M²	DEVMT Cost/HA MFCFA	Dwelling Unit Size M²	Constr. Cost Per M²	Billion FCFA	
57,600 (H.S. = 4.2)	13,714	32	16	40,000	20	8,000	535,795	100	12	20	20,000	632,290	160	12	20	20,000	5.4	6,850
			32	58,000	20	11,900	797,000	160	12	20	25,000	940,531	175	12	30	25,000		
57,600 (H.S. = 5.2)	11,077	32	48	73,000	20	14,650	981,000	160	12	30	25,000	1,157,723	200	12	35	25,000	6.8	5,884
			64	85,000	20	17,000	1,138,570	180	12	35	25,000	1,343,616	200	12	42	25,000	7.0	5,192
37,800 (H.S. = 7.8)	4,846	21	70	100,000	20	20,000	1,333,000	160	23	35	25,000	1,572,840	200	23	40	25,000	2.2	1,384
			78	130,000	25	32,900	2,202,000	300	23	45	30,000	2,600,292	300	23	50	35,000	4.8	1,846
			85	150,000	27	45,000	3,013,900	300	30	54	35,000	3,556,631	360	30	64	35,000	6.8	1,938
18,000 (H.S. = 6.5)	2,769	10	-	175,000	29	50,000	3,348,000	310	30	70	35,000	3,951,812	350	30	70	35,000	4.4	1,110
			-	200,000	30	60,000	4,018,500	325	30	80	35,000	4,742,175	375	30	95	35,000	3.9	830
			95	250,000	30	75,000	5,023,000	400	30	100	35,000	5,927,718	475	35	110	35,000	3.2	553
9,000 (H.S. = 5)	1,800	5	100	250,000										TOTAL			40.5	25,587

(H.S. = Household Size)

(U.S. $1 equals FCFA 408.85 on November 17, 1983)

Source: PADCO Analysis based on PDA Income Update (1982) and Current Financial Conditions.

To finance the schematic program indicated, an annual investment on the order of FCFA 25.6 billion would be required. This would exceed the public investment in housing and urban development that is likely to be made available for Abidjan. Thus, private investment would be required to complete the program. Generally, it was suggested that public funds be used to finance plot acquisition and housing construction for households earning between FCFA 40,000 and 130,000 that are least likely to be eligible for credit by private banks. Higher income households, including civil servants, would thus rely on private banks for financing.

C. Data Elements

There are two principal areas of concern regarding data requirements: (1) urban and (2) shelter specific. PRE/H is now conducting Urban Development Assessments (UDAs) in countries which could be eligible for HG financing. The UDAs provide an overview of the urban sector, including relevant institutional actors, policy issues and an analysis of the settlement system. Data collected during this exercise is helpful in determining which settlements require priority support. With respect to identification of shelter projects, key concerns would include:

- Growth policies or potential for settlements
- Physical development constraints in settlements
- Requirements for urban facilities

Further information on UDAs and data requirements can be obtained from PRE/H (UDA Guidelines). Also see Appendix C, Table 1.

Shelter Sector Assessments will provide most data required for an understanding of the sector as a whole and the full spectrum of income groups. This Handbook will be concerned with data which will be essential for project design. As AID's target group is defined as households below the median urban household income in each project location, data requirements will be limited to this group. On the other hand, projects should be designed with a range of solutions that are affordable by AID low income target groups. Experience has shown that

households which can realistically afford sites and services plots and dwelling unit financing will range be the 20th and 50th percentiles on income distribution. Where possible, data should be collected that will permit alternative plot and dwelling unit types for subgroups such as between the 20th and 30th, 30th and 40th, and 40th and 50th percentiles. Data distinctions should also be made by tenure status. Generally, data regarding renters and owners is quite different. A data checklist to be used for designing low income housing projects follows:

1. Household Data (by subgroup and tenure status)

- Size
- Head of household age:
  - .. percent of households in 25-30, 31-40, 41-50 age groups
- Income:
  - .. average household income
  - .. head of household income
  - .. household head's share of household income
  - .. share of income of head and household from regular employment
- Expenditures (share of monthly household income):
  - .. average share of income for shelter including:
    - -- rent, improvements and maintenance
    - -- taxes
    - -- utilities
  - .. transportation (note effects of shelter location on transport costs)
- Employment
  - .. stability or regularity (Percent of households in each subgroup. Denotes salaried employees or self-employed workers with regular income):
    - -- head of household
    - -- spouse
    - -- spouse and head of household
    - -- female heads of household
- Household savings
  - .. percent of income saved per month

2. Levels of Service

Service level data should be complemented with observations on the limitations and regularity of service provision. Costs of recent services should also be identified, including off-site extensions, where necessary.

- Water supply (in percent of households):
  - .. with individual water connections
  - .. with direct access to water supply (i.e. renters)
  - .. using public services (public water fountains)
  - .. using private services (vendors)
- Water consumption (liters per capita per day)
- Electricity (in percent of households):
  - .. with individual connections
  - .. with direct access to service
  - .. with secondary and tertiary street lighting
- Electricity consumption (kilowatt hours per capita per month)
- Sanitation (in percent of households):
  - .. with water borne sewer connections
  - .. with access to water borne sewer
  - .. with pit latrine or other alternative systems
  - .. households with private and communal facilities
  - .. households sharing facilities
- Circulation:
  - .. households with direct access to paved and unpaved roads
  - .. households with direct access to paved and unpaved pedestrian paths
  - .. area of circulation space in community
- Storm drainage:
  - .. access to drainage systems
  - .. subject to flooding
- Garbage disposal:
  - .. public service type (individual lot, community bin, etc.)

.. service (daily, weekly, etc.)
.. adequacy of service

- Public transportation
  .. areas served
  .. cost in distance from city center per trip
- Emergency services (with/without easy access):
  .. fire
  .. ambulance
  .. security

3. Dwelling Unit and Plot

- Plot size (housing type or community average)
- Number of persons per plot
- Area per person per plot
- Number of dwelling units per plot (assume one household per dwelling unit)
- Size (area of units and rooms per household, number of rooms per household)
- Dwelling unit area per person
- Construction material (percent by type and estimated replacement cost per square meter)
- Construction (percent with full or partial self-help construction)

4. Community or Housing Type Standards

- Land use areas (percent of total area):
  .. residential area
  .. public facilities
  .. private commerce (independent of housing)
  .. circulation
  .. open space
  .. vehicular parking
- Health:
  .. average areas of dispensaries and clinics
  .. service ratios (population per unit)
- Education:
  .. average areas of primary and secondary schools
  .. service ratios (population per unit)
  .. inventory of classrooms

.. existing absorption capacity
.. hours of utilization

- Market:
  .. average size
  .. paved or unpaved
  .. service ratio (population per unit)

5. Household Priorities

- Infrastructure:
  .. order of importance: water supply, electrical supply, street lighting, paved roads and pedestrian paths, storm sewers, garbage disposal
- Community contribution:
  .. willingness to contribute in-kind
- Social infrastructure:
  .. order of importance: schools, health facilities, market, commerce, security
- Dwelling unit:
  .. preferences: option for ownership renting, subletting, etc.
  .. type: single storey (common wall, etc.), walk-up, etc.
  .. construction material (quality, uniformity, regularity in supply)
  .. private or communal use of sanitation facilities
  .. private or communal use of kitchens
  .. household sharing of dwelling units
  .. degree of privacy

6. Physical Data from Measured House Plans in Existing Neighborhoods. (See Figure I.1 and Annex A)

In Annex A methodologies for target group identification and data collection are presented. **The thrust of these methodologies is that good project design must grow from a full understanding of the existing nature and conditions prevailing in target group communities.**

Figure I.1 shows measured house plans in Port-Au-Prince, Haiti. In each case, a small site plan, house plan and section are provided along with a basic data set on households and construction.

D. Site Selection

Site selection is a crucial element in the development of sites and services projects. Poorly chosen sites can result in: (1) considerable project delays (i.e. due to long acquisition process); (2) poor marketability (i.e. due to undesirable location); and (3) unanticipated development cost (i.e. due to unstable soil conditions or uneven topography).

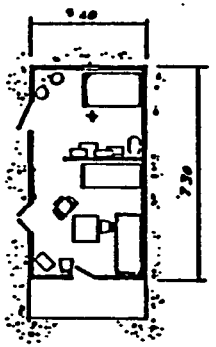
In Figure I.2 a matrix for evaluating sites is presented. Completion of the matrix will involve repeated site visits, an inventory of existing services, and research on soil conditions.

In Figure I.3 a modified matrix is presented which was used in the evaluation of potential project sites in Abidjan, Ivory Coast. The selected sites are noted in order of preference.

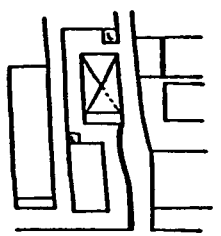
FIGURE I-1

MEASURED HOUSE PLANS IN EXISTING NEIGHBORHOODS

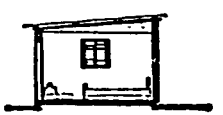
CAS 9 BEL.AIR . TYPE B



PLAN



PLAN MASSE



COUPE

Quartier : Bel-Air

Type Tissu : B

Description du Site : Montueux, Accessible à l'Infrastructure.

Matériaux de Construction : Toit - Toit Ondulée; Structure - Béton Armé; Mure - Blocs; Plancher - Planches; Sol - Ciment.

Valeur de Remplacement : $ 4.475.00

Etat de la Structure : Nouveau

Equipements : Sanitaire - Latrine; Energie - Electricité (Lumière), Charbon (Cuisine)

M² Couverts : A) 31.5 B) 20.2

M²/Personne : A) 3.9; B) 2.9

Loyer/Mois : A) 10; B) 10

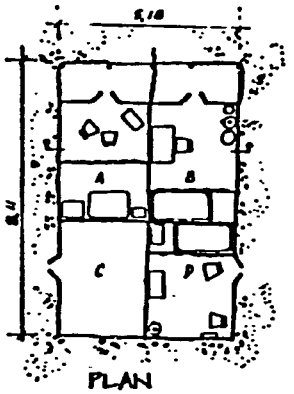
Résident Depuis : A) 7 Ans; B) 4 Ans

Origine Familiale : A) Léogâne; Port-à-Coline; B) PAP

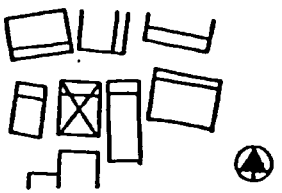
Profession : A) Commerce B) Maître d'Ecole

Besoins Prioritaires Exprimés :

CAS 10 BEL.AIR . TYPE B

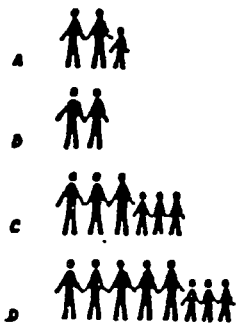


PLAN



PLAN MASSE

COUPE



Quartier : Bel-Air

Type Tissu : B

Description du Site : Montueux, Difficilement Accessible à l'Infrastructure.

Matériaux de Construction : Toit - Tôle Ondée; Ifc; Structure - Bâtons Bondé $.07; Mure - Planches; Sol - Ciment.

Valeur de Remplacement : $ 1.185.00

Etat de la Structure : Moyen

Equipements : Sanitaire - Latrine; Energie - Charbon (Cuisine), Kérosène (Lumière).

M² Couverts : A) 9.09; B) 9.09; C) 8.15; D) 8.15

M²/Personne : A) 3; B) 4.5; C) 1.4; D) 1

Loyer/Mois : A) 8; B) 8; C) 8.C.; D) 5

Résident Depuis : A) 2 Ans; B) 1 An, C) 8.C.; D) 1 An

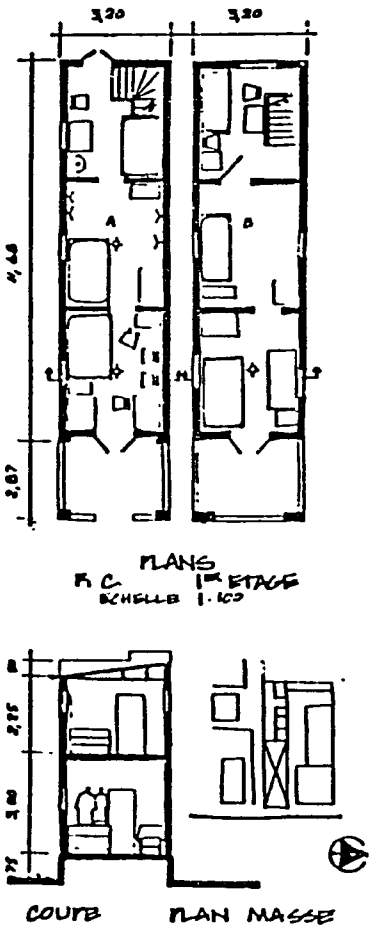
Profession : A) Ebéniste; B) Vente Barlette C) 8.C.; D) Usine

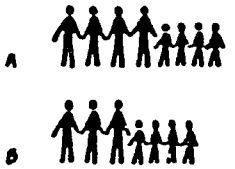
Origine Familiale : A) B) Dominicaine C) D)

Besoins Prioritaires Exprimés :

FIGURE I-1 (continued)

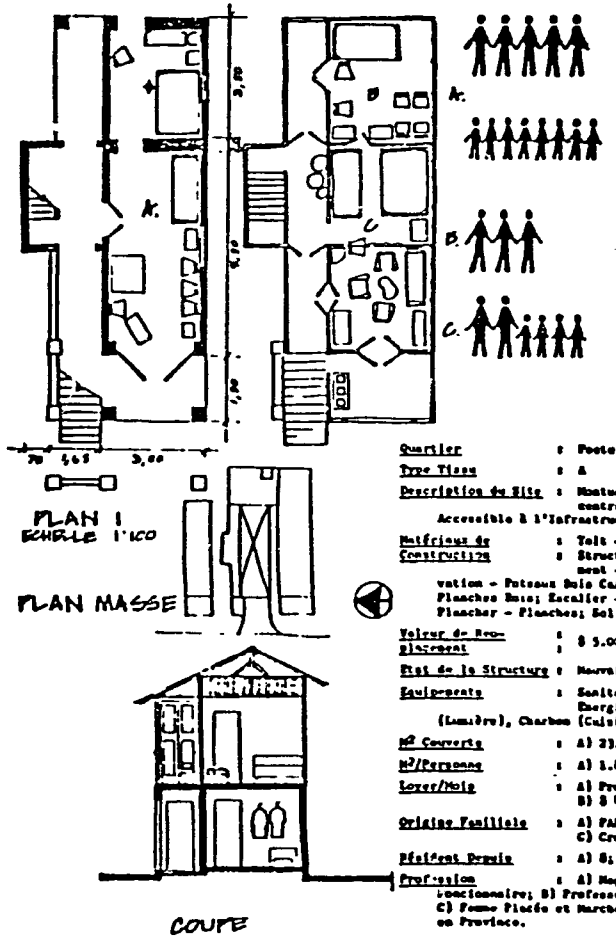
CAS 11 BEL.AIR . TYPE B





Quartier	: Bel-Air
Type Tissu	: B
Description du Site	: Montueux, Ayant Accès à l'Infra Structure
Matériaux de Construction	: Toit-Tôle Ondulée; Structure - Blocs; Murs - Bahareque; Sol - Ciment.
Valeur de Remplacement	: $ 1,360.00
Etat de la Structure	: Bon
Equipements	: Sanitaire - Latrine; Energie (Lumière, Musique), Charbon (Cuisine).
M^2 Couverts	: 19.2
M^2/Personne	: 2.4
Loyer/Mois	: Forfaitaire : $ 13
Origine Familiale	: Duo Marajoe PAP
Résident Depuis	: 3 Ans
Activité	: Electricien

CAS 12 POSTE MARCHAND . TYPE A



Quartier	: Poste Marchand
Type Tissu	: A
Description du Site	: Montueux, Sommet sur centre de Commerce. Accessible à l'Infrastructure.
Matériaux de Construction	: Toit - Tôle Ondulée; Structure Sous-Bassement - Pierre; En Elevation - Poteaux Bois Carrés; Murs - Planches Bois; Escalier - Béton Armé; Plancher - Planches; Sol - Ciment.
Valeur de Remplacement	: $ 5.000.00
Etat de la Structure	: Moyenne
Equipements	: Sanitaire - Latrine, Energie - Electricité (Lumière), Charbon (Cuisine).
M^2 Couverts	: A) 23.3; B) 10; C) 16.4
M^2/Personne	: A) 1.8; B) 1.1; C) 2.7
Loyer/Mois	: A) Propriétaire; B) $ 4.00; C) 12.50
Origine Familiale	: A) PAP; B) PAP; C) Croix-des-Bouquets
Résident Depuis	: A) 8; B) 1; C) 4
Profession	: A) Maçon (Porte-Bleue); Fonctionnaire; B) Professeur, Artiste; C) Femme Placée et Marchande de Tissus en Province.
Besoins Prioritaires Exprimés	: Collectifs : Eau; Personnels : Milieu Social

FIGURE I-2

SITE SELECTION MATRIX

*SELECTION CRITERIA	SITES 1	2	3	4
1) **Acquisition status** (i.e. expropriated) • land • crop • buildings • tenancy status		(yes or no)		
2) **Land Cost**		(cost/m^2)		
3) **Proximity to existing infrastructure** (w/adequate capacity • water • electricity • sanitary sewer • storm sewer • transport services • primary access road		(distance)		
4) **Proximity to social services** (w/adequate capacity) • schools (primary) • market and basic commerce • dispensary/health unit • clinic or hospital		(distance)		
5) **Ease of development** • slope less than 5 percent • direct access to site • site unoccupied • adequate area • no need of extensive grading		(yes or no)		
6) **Soil conditions** • stability/ease construction • adequate depth • suitability for sanitation alternatives • no need foundations deeper than 1-2 meters		(yes or no)		
7) **Environmental concerns/natural hazards** • subject to flooding • wind and dust storms • earthquake		(yes or no)		
8) **Distance to employment centers** • city center • principal industrial zone • small-scale employment centers • port or other		(distance)		

*In selecting settlements additional criteria should be employed (i.e., growth rate in population and employment, tax basis for cost recovery, size of industrial base, etc.)

FIGURE I-3

ABIDJAN SUB-PROJECT SITE SELECTION CRITERIA

Sites Possible	Gonzague-ville	Niangnon Nord	Port Bouet	Abobo Nord-Ouest	Abobo Djihi	Abobo Derriere les Rails	Anyama Km.18	Akouedo Nord	Binger-ville Est
Rank: (Four Preferred Sites)		1	2	3	4				
Evaluation Criteria									
Degree of Expropriation									
- Land	N	Y	Y	N	N	N	N	N	N
- Plantation	N	Y	Y	N	N	N	N	N	N
- Building	-	-	N	N	-	N	N	-	-
Proximity to Infra-atructure Networks									
- Water	N	Y	Y	Y	N	N	N/Y	N	Y
- Electricity	N	Y	Y	N/Y	Y	N	N/Y	Y	Y
- Sewers	N	Y	N	N	N	N	N	N	N
- Transport	N	Y	Y	N/Y	N/Y	N	N/Y	N	N
Proximity to Services									
- Comerce	N	N/Y	Y	Y	N/Y	Y	N	N	Y
- Schools	N	Y	Y	N/Y	N/Y	-	N	N/Y	N/Y
- Health facilities	N	Y	Y	N/Y	N/Y	Y	N	N/Y	Y
Ease of Development									
- Easy	N/Y	Y	N/Y	N/Y	Y	N	Y	Y	Y
- Drainage networks in place	Y	N/Y	N/Y	Y	Y	Y	Y	Y	Y
- Unoccupied	Y	Y	N/Y	N/Y	Y	N	Y	Y	Y
- Sufficient area	Y	Y	N/Y	N/Y	Y	N/Y	Y	Y	Y
Distance to Employment Zones* (kms.)									
- Plateau	25	14	15	16	15	14	22	14	19
- Youpougon	39	5	29	20	19	18	15	17	22
- Port	17	19	7	21	20	19	27	20	25
- Industrial zone	19	21	9	24	23	22	30	22	27
- Port Banco Project	39	8	29	21	29	19	27	17	22

N = No; Y = Yes

*Note: Physical configuration of city and lack of available sites result in higher than generally desired distance to employment centers.

Chapter II
Site Planning and Subdivision

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Chapter II
Site Planning and Subdivision

A. Introduction

Site planning and subdivision follows the programming steps, target group identification and site selection outlined in Chapter I (and Annexes). It represents the important task of first reflecting how people live and establishes a physical framework for all activities on the site.

The following gives the sequence of decisions which leads to the preliminary design options:

- Site selection (area, attractiveness: see I.E)
- Identification of existing access points to be kept in the design, such as access to main roads and the city center and access to adjacent settlements
- Identification of infrastructure connection points for sewers, water, drainage, and electricity
- Subdivisions of site into zones of homogenous topography (slope, natural drainage zones)
- Determination of the range of preferential direction for streets and network in each topographical zone
- Design of main circulation and infrastructure lines
- Selection of types of circulation pattern based on performance
- Design of layout

B. Land Use Standards and Guidelines

1. Functional Categories

Land use is generally broken into broad functional categories or into specific types:

Broad	Specific
Private	Residential Commercial Small industry
Public	Circulation Open Space
Semi-public	Schools Health Community faciltiities Religious
Semi-private	Land held in condominium

Plans usually distinguish between land uses in specific terms whereas graphs and tables give broad categories. Not only must all land in a project site be given a designated use (Figure II.1) but proper controls should be established to define its territorial extent, encourage its intended function and allow for its maintenance. These controls can take legal, social or physical forms in identifying users and responsible agents.

2. Land Use Standards

Determination of percentages for land use may be derived from existing urban norms, official regulations or recommended figures.

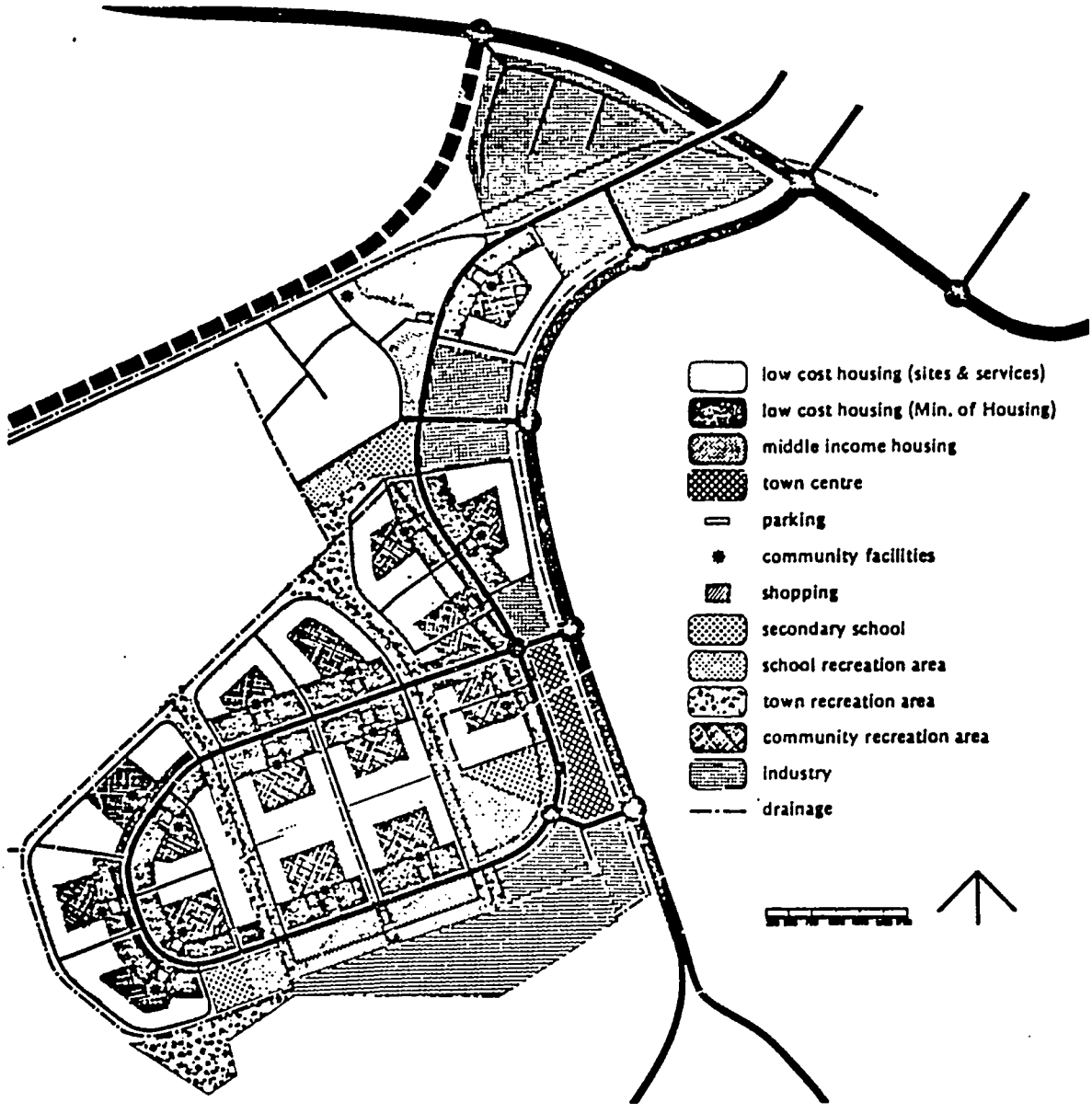
a. **Land use percentages in existing communities** will reflect local customs which deserve strong consideration but may vary in their applicability to sites and services/core housing projects since these have experienced encroachment and densification or disregard official regulations. For example, an average percentage for eight squatter settlements in El Salvador shows that residential land use has been maximized at the expense of space needed for public facilities.

Land use	El Salvador†
Residential	81.2%
Circulation	18.5%
Schools	0.3%

Source: †PADCO, et al. "A Program for the Integrated Improvement of Critical Metropolitan Areas in El Salvador. 1978. p.VI-10.

FIGURE II-1

LAND USE PLAN



Source: Building Research Establishment, Department of the Environment. Third World Urban Housing: Aspirations, Resources, Programs, Projects. London. 1977. p.241.

b. **Official regulations** often establish standards which are unaffordable by low-income households since they derive from Western or developed nation conditions (i.e. less land use for private amortization and more for public) or to the overall urban area rather than to primarily residential extensions such as are sites and services and core housing projects. Nonetheless, official regulations on land use may establish irrevocable standards which must be followed, or in some cases, changed through legislative processes. Below are examples of official standards which result in a high percentage of public space and high development costs:

Land use	El Salvador† DUA R8	Egypt†† GOPP
Residential	39.7%	41.7%
Circulation	32.5%	33.3%
Community facilities	7.9%	16.6%
Commercial	6.6%	1.3%
Recreation/open space	10.0%	7.1%

Source: †PADCO, et al. "A Program for the Integrated Improvement of Critical Metropolitan Areas in El Salvador. 1978. p.VI-10.

††PADCO, et al. "National Urban Policy Study", Final Report-Appendices, Volume 2. Cairo. 1982. p.135.

It would appear that residential land use in both these official standards is not suitable for LDC sites and services projects. Circulation and combined other public and semi-public land use result in more suitable Europe and USA standards.

c. **Recommended or preferred land use percentages** vary depending on geographical area, project size and location, level of existing community facilities, population density and the levels of affordability and cost recovery to be attained. The following are recommended standards from two studies and a general range of standards for project review:

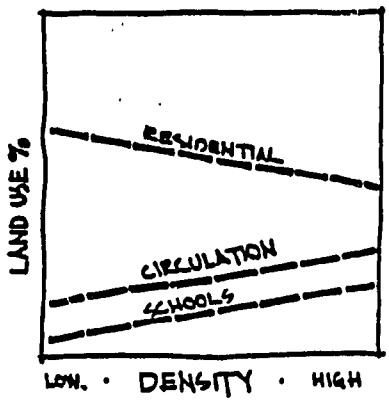
Land use	Pakistan† Metroville	Egypt†† NUPS	General
Residential	50%	57%	50-60%
Circulation	15-30%	20%	15-30%
Community facilities	10%	15%	5-15%
Commercial	8-12%	8%	3-5%
Recreation/open space	5-7%	-	5-10%

Source: †PADCO, et al. "METROVILLE: Low-income Settlement in KARACHI." Final Report Karachi. 1977. p.134.

††PADCO et al. "NUPS", Volume 2. Cairo. 1982, p.135.

3. Public vs. Private Land

The provision and maintenance of public land involves costs during development and operation which must be amortized either by the private landholders or through public subsidies and as funds for such lands are scarce, a rule of thumb should be minimization of public land and maximization of private land.



Population density has an effect on land use percentages. Generally, as densities increase there is a low but positive correlation with land used for circulation due to a greater frequency of accessway provision to the decreasing sized plots.

Since residential land use is usually determined by the subtraction of all other uses from the total land area, this increase of circulation land use means a decrease in residential land use. A recent study of a wide range of physical layouts shows that as gross densities increase from 50 persons/ha to 1,000 persons/ha, residential land use decreases from 60% to 50%, and circulation land use increases from 20% to 30%.[2] Also, as densities increase through the use of smaller plots, publicly provided open space becomes increasingly necessary to substitute for the on-site losses, and more schools and other community facilities are needed to service the increased population.

[2]USAID Office of Housing. Squatter Settlements and Housing Policy: Experiences with Sites and Services in Colombia. Washington, DC. 1980. p.134.

4. Recommended Gross Densities for Sites and Services Projects

There are significant regional variations in recommended densities. Projects in sub-Saharan Africa usually fall in the least dense ranges while those in Latin America, North Africa and especially South Asia will fall in the higher ranges. These variations reflect the availability and costs of land, local customs (especially regarding privacy), and the economic level of the target population.

The following recommended densities are derived from various planning studies:

Source	Densities
USAID	250-300 p/ha
MIT	200-600 p/ha
OAS	600 p/ha
NUPS (Egypt)	140-280 p/ha
DUA (El Sal.)	384 p/ha

The tradeoffs involved in variations of gross densities are:

- At lower densities, more private land is available for development and maintenance amortization but for a higher income target population
- At higher densities, less private land is available for amortization but for lower income target population
- Also at higher densities, land used for circulation increases but plot servicing and infrastructure becomes more efficient

Although the above density standards are indicative for sites and services projects, it is important to adjust them in consideration of host country density data in existing communities. In Port-Au-Prince, Haiti, for example, a sites and services project used a density of 800 persons per hectare while densities ranging between 1,500-2,000 persons per hectare were common in already developed communities.

5. Project Size

Project size also has an effect on land use percentages. The smaller the project, the fewer public facilities will be needed to service the site. In a small project, it may

be possible to use off-site commercial, educational, health, open space and other community facilities rather than providing them as a project cost. Likewise in a small project, the additional burden on existing infrastructure may be negligible. The advantages of urban infill and extension projects were discussed in I.C.2. Of these, the likelihood of smaller sites being available with access to existing services is an important consideration.

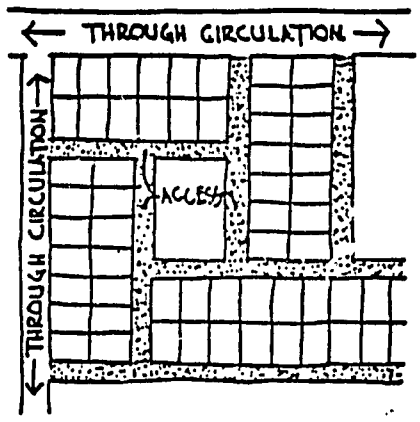
Conversely, in smaller projects, it may be desirable to include community facilities and infrastructure designed to service a larger population if the surrounding neighborhood and community are lacking in these facilities and the appropriate financial instruments can be devised. For this reason, it is necessary to survey the level of public facilities and infrastructure available to the project site and to take into consideration the impact that additional project population will have on the larger urban area.

6. Components of Land Use

Listed below are the main components of land use applicable to sites and services projects.

a. Residential

- Planning considerations:
  - .. higher residential land use percentages equate with lower densities and larger plot sizes
  - .. small project scale enables a higher percent of residential land as fewer public facilities and land uses are necessitated
- Economic considerations:
  - .. produces revenue through plot charges and direct taxation and is primary instrument for development cost recovery
  - .. higher residential land use percentages mean lower public costs overall; however, at low densities less efficient utilities and service delivery will act to diminish advantages in cost recovery
- Development control:
  - .. development regulated by land use codes, building codes and tenure arrangements

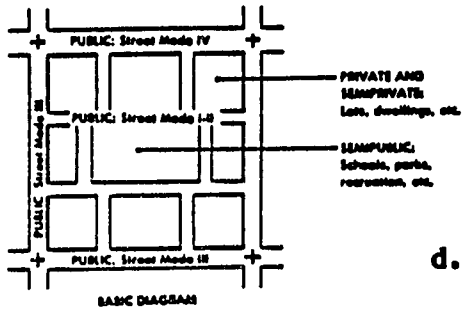


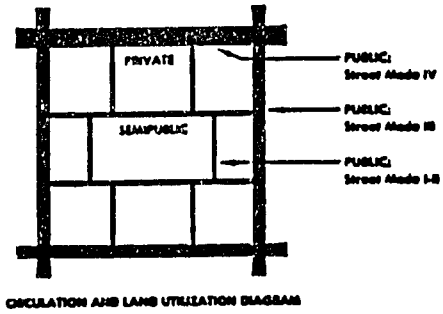
b. Circulation

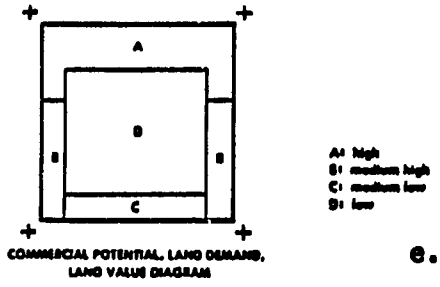
- Planning considerations:
  - .. includes both vehicular and pedestrian
  - .. higher circulation land use percentages equate with higher densities and smaller residential plot sizes as frequency of access increases; thus, rights-of-ways in residential areas for vehicular and pedestrian access should be held to a minimum
  - .. with some designs such as cluster blocks, distinction is made between through-circulation and access-circulation:
    - -- through-circulation: streets for vehicles or vehicles and pedestrians that primarily serve a large number of people going from one part of the city to another and secondarily provide access to plots on their sides; they are usually long and connected at both ends with other circulation lines, and should be on public land
    - -- access-circulation: dead-end (150m maximum length) or loop streets (200m maximum length) or walkways serving a limited number of people as access to the abutting plots; they are usually short, connect to other lines of access circulation and should be on private or semi-private land, if at all possible
- Economic considerations:
  - .. costs of secondary and tertiary circulation are generally recovered through plot charges while part or all of primary circulation is frequently supported by public subsidy
- Development control:
  - .. public control over design and regulation

c. Commercial and small industry

- Planning considerations:
  - .. formally provided, usually in central locations or along primary access routes at neighborhood and larger scale
  - .. at plot and block scale, development will usually be spontaneous and informal







Source:
Caminos, H. & R. Goethert.
Urbanization Primer.
Cambridge, MA. 1978. p.101.

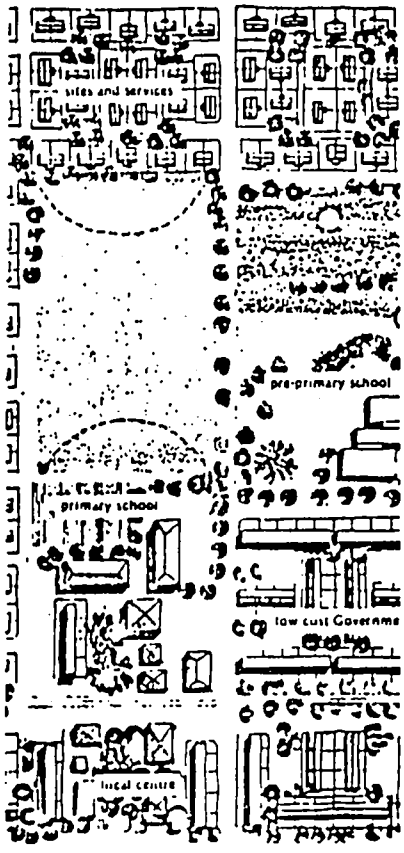
- Economic considerations:
  - .. project plan should facilitate non-polluting cottage industries in residential areas as they are a potential source of income generation that may assist in cost recovery
- Development control:
  - .. development regulated by building codes and tenure arrangements

d. Open space and recreation

- Planning considerations:
  - .. frequently proximate to schools and included in overall school or community facilities land use percentages
  - .. higher densities require greater overall land use percentage to substitute for lack of on-plot open space
  - .. poor location and sizing, misunderstanding of eventual users and function, and lack of effective controls over maintenance and operation can generate land waste or misuse (i.e. open spaces turning into garbage dumps or squatter developments)
- Economic considerations:
  - .. may be charged to beneficiaries as plot cost
- Development control:
  - .. public control over design and regulation

e. Schools

- Planning considerations:
  - .. higher densities require a greater frequency of schools
  - .. average of 5,000 people requires one primary school
  - .. average of 20,000 people requires four primary schools and one secondary school
  - .. averages will vary depending on rates of school attendance, age composition of service population, birth rates and density of project
- Economic considerations:
  - .. development and operations costs are generally borne by government agency in charge of education but may be recovered in plot and user charges



Source:
Building Research Establishment, Department of the Environment. "Third World Urban Housing: Aspirations, Resources, Programs, Projects". London. 1977. p.242.

- Development control:
  .. public control over design and regulation

f. Health facilities

- Planning considerations:
  .. includes clinics, first aid centers and the like
  .. may be combined with general-use community facility (i.e. meeting hall, social club, school)
  .. when facilities are planned, maintenance and operation responsibilities must clearly be established, as well
- Economic considerations:
  .. development and operations costs are generally borne by government agency in charge of health, but beneficiaries may support land and infrastructure costs
- Development control:
  .. public control over design and regulation

g. Other community facilities

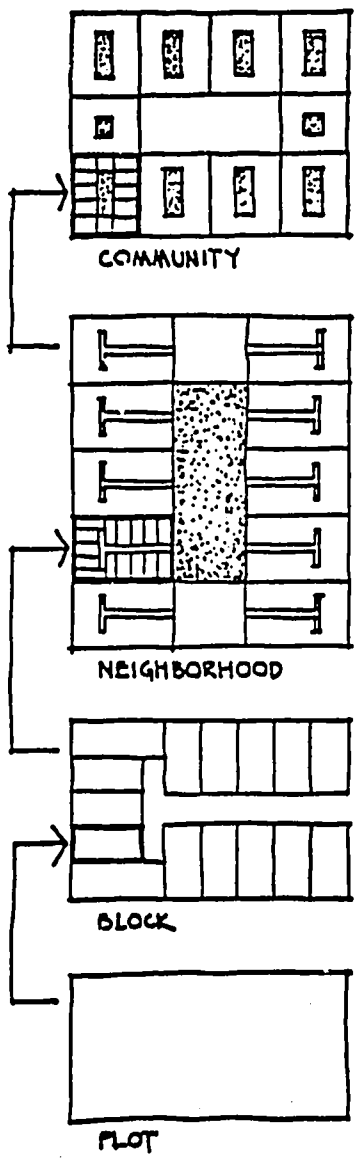
- Planning considerations:
  .. Community centers, project administration, meeting halls and other government facilities may be included in large scale projects depending on need and potential for cost recovery
  .. includes markets, especially at neighborhood and larger scales
- Economic considerations:
  .. development and maintenance costs are usually covered by public agencies and partially recovered through user fees
- Development control:
  .. public control over design and regulation

C. Site Development Modules

1. Module Hierarchy

For planning purposes, urban areas can be broken down into discrete modules which can be repeated to form a site plan. These modules are generally defined by planned population size, school requirements, geographical area, or elements of a social or administrative nature. Below is a table showing the hierarchy of modules and a brief description of each type of module.

Module	Planned Population Size	School Requirements	Geographical Area
Community	20,000	1 secondary	50-150 ha.
Neighborhood	5,000	1 primary	10-25 ha.
Block	250	—	.5-5 ha.
Plot	10	—	20-400 m.



a. **Community.** A grouping of neighborhoods proximate to each other, under the same sort of governmental structure, and of a sufficient size to warrant large-scale common facilities serving daily and weekly needs for a potentially extra-community population.

b. **Neighborhood.** A grouping of blocks bounded by natural, social, or administrative boundaries, containing a sufficient number of people to warrant common facilities serving daily needs.

c. **Block.** A grouping of individual plots bounded and served by public roads and walkways.

d. **Plot.** A measured parcel of land having fixed boundaries and direct access to public roads or walkways, and usually tenanted or owned by one family.

2. Relevance of Design Modules in the Design Process

- Modules provide an organizational structure which clarifies functions and relationships between different land uses
- Modules provide for unit replication and consequent reduction of effort in the planning and design process

3. Community Module

a. General observations

- Recommended HG project scale by site is limited to that of neighborhoods (Section I.C.1) although extenuating circumstances may occasionally require projects of community scale
- Extenuating circumstances include:
  - .. lack of availability of smaller sites for a project

.. lack of existing facilities and infrastructure essential to the project and cost efficient only at a larger scale (e.g. hospital, water supply system, large open spaces)

.. availability of a site with proximity to poorly serviced large-scale employment centers

.. the opportunity to use existing community scale facilities which are being underutilized and can be incorporated into the project

b. Physical components usually not provided at less than a community scale:

- Religious center, requiring both enclosed and open space
- Health facility, for both outpatient and inpatient care, the latter of a noncritical nature
- Secondary school, including classrooms, attendant enclosed and open space
- Major commercial facilities, for weekly shopping
- Major market, with rental stalls and open market space
- Post office, fire and police stations
- Small-scale light manufacturing workshops (domestic goods)
- Entertainment facilities such as cinemas, clubs, etc.
- Community park and playing fields (if not provided for general public use by school facilities)
- Administrative facilities, such as outreach centers and project field offices
- Solid waste collection centers, electrical transformer stations, water supply tanks/wells/pumping stations (all highly dependent on design of infrastructure systems)

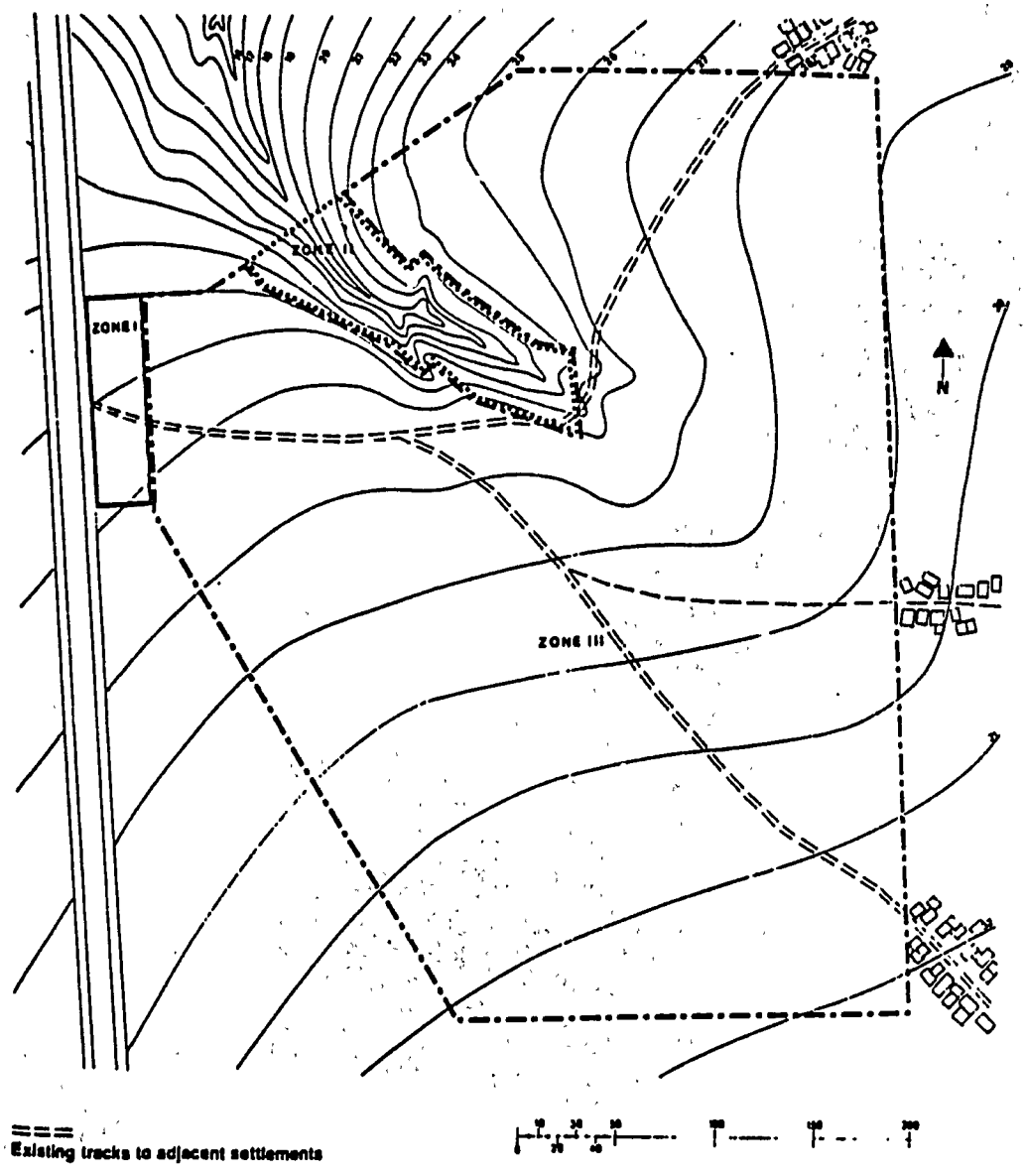
c. Design principles

- Overall organization:

  .. layout should be the servant of the people and the place; a rectangular grid of straight lines across an undulating, gully-crossed site, by failing to respond to the topography, generates extra costs for roads and utilities; Figures II.2-4 show how one site plan responded to these conditions

FIGURE II-2

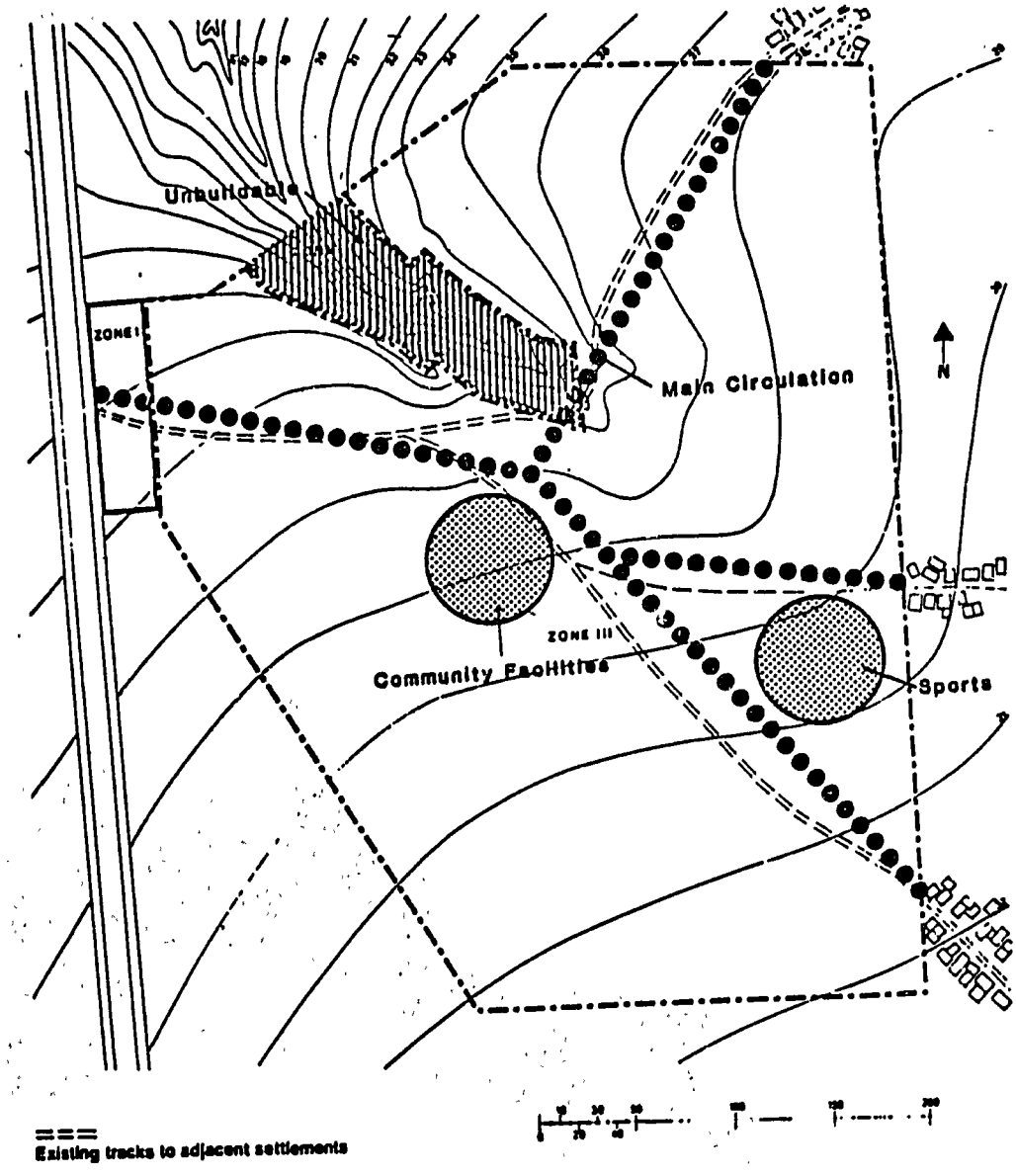
UNDEVELOPED SITE



Source: CITRUD. A Model for Analyzing Alternatives in Urban Project Design. Washington, DC. 1978. p.45.

FIGURE II-3

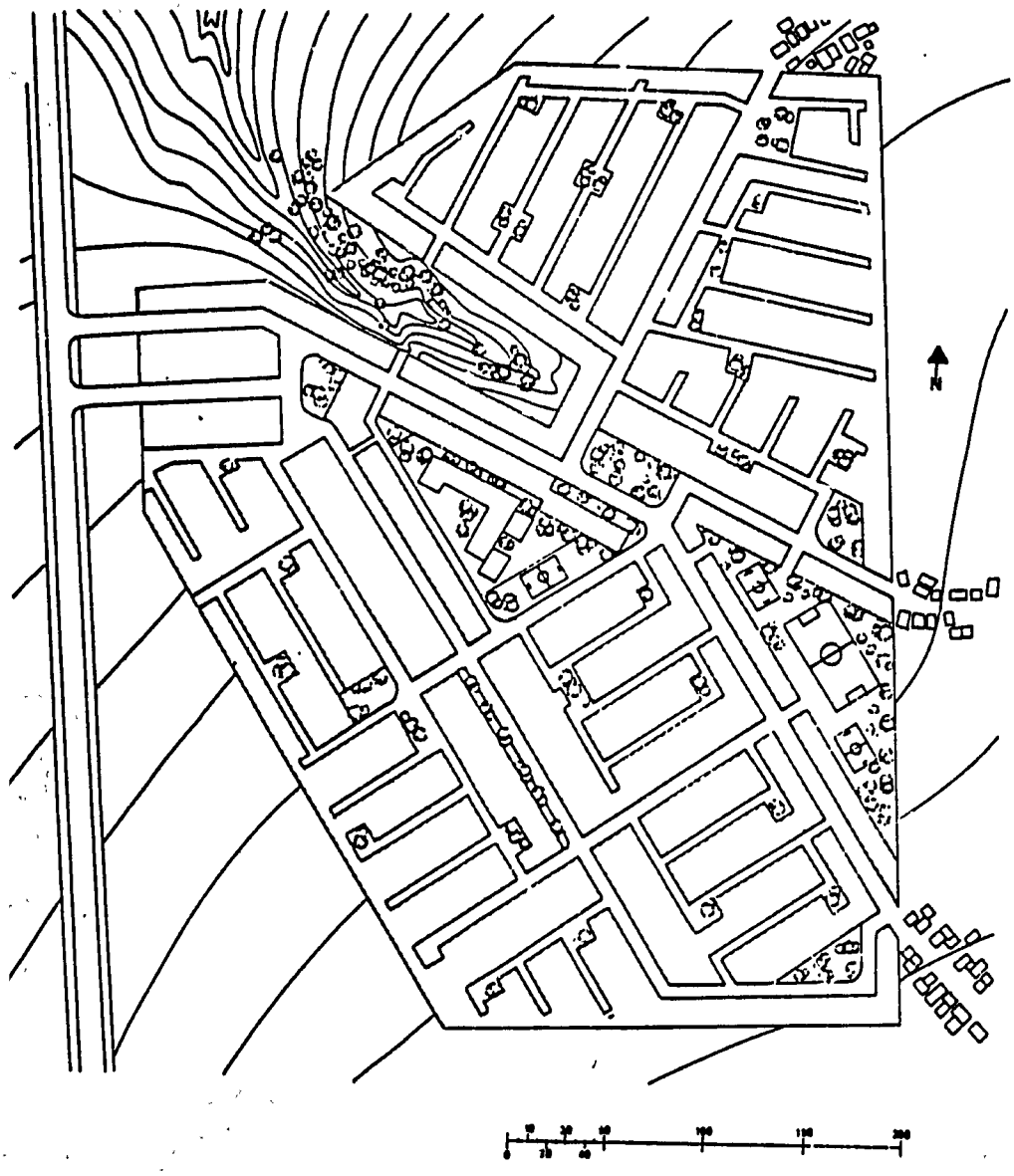
DESIGN PRINCIPLES



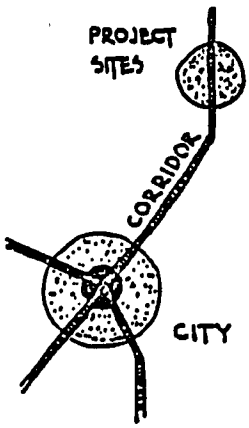
Source: CITRUD. A Model for Analyzing Alternatives in Urban Project Desig Washington, DC. 1978.

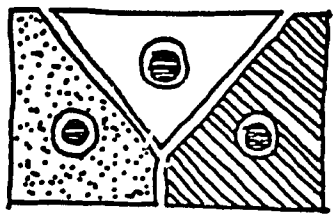
FIGURE II-4

FINAL LAYOUT

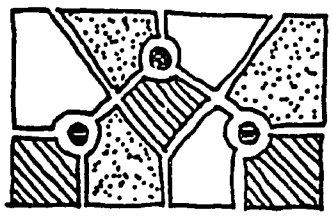


Source: CITRUD. A Model for Analyzing Alternatives in Urban Project Design. Washington, DC. 1978. p.55.





NO



YES
REINFORCE
FOCAL POINTS

.. the road and footpath pattern should reflect the need to move directly between clusters of plots, community facilities and commercial areas

.. by planning a community around a public transportation corridor providing through access to the larger urban area, a direct relationship between the site and the larger community can be established and necessary social/economic interchanges facilitated

.. the circulation network should reinforce the focal points of the plan such as community or commercial facilities and open space

.. loop roads provide additional access points to residential areas and public transportation stops, as well as delimit the community and neighborhood modules themselves

.. a diminishing hierarchy of access ways should be planned to restrict through traffic in residential and local facilities areas (Figure II.5)

.. since access to many of the nonresidential components within the community module is often by vehicle, it is recommended that they be directly oriented to the through access corridor; exceptions may include secondary schools and open spaces

.. walking distances within the community do not exceed comfortable limits; pedestrian paths should be planned to connect community facilities and focal areas

.. the circulation and infrastructure network should correspond to off-site networks, both existing and planned; Figures II.2-8 illustrate a good response to existing circulation patterns

- Response to the natural environment:

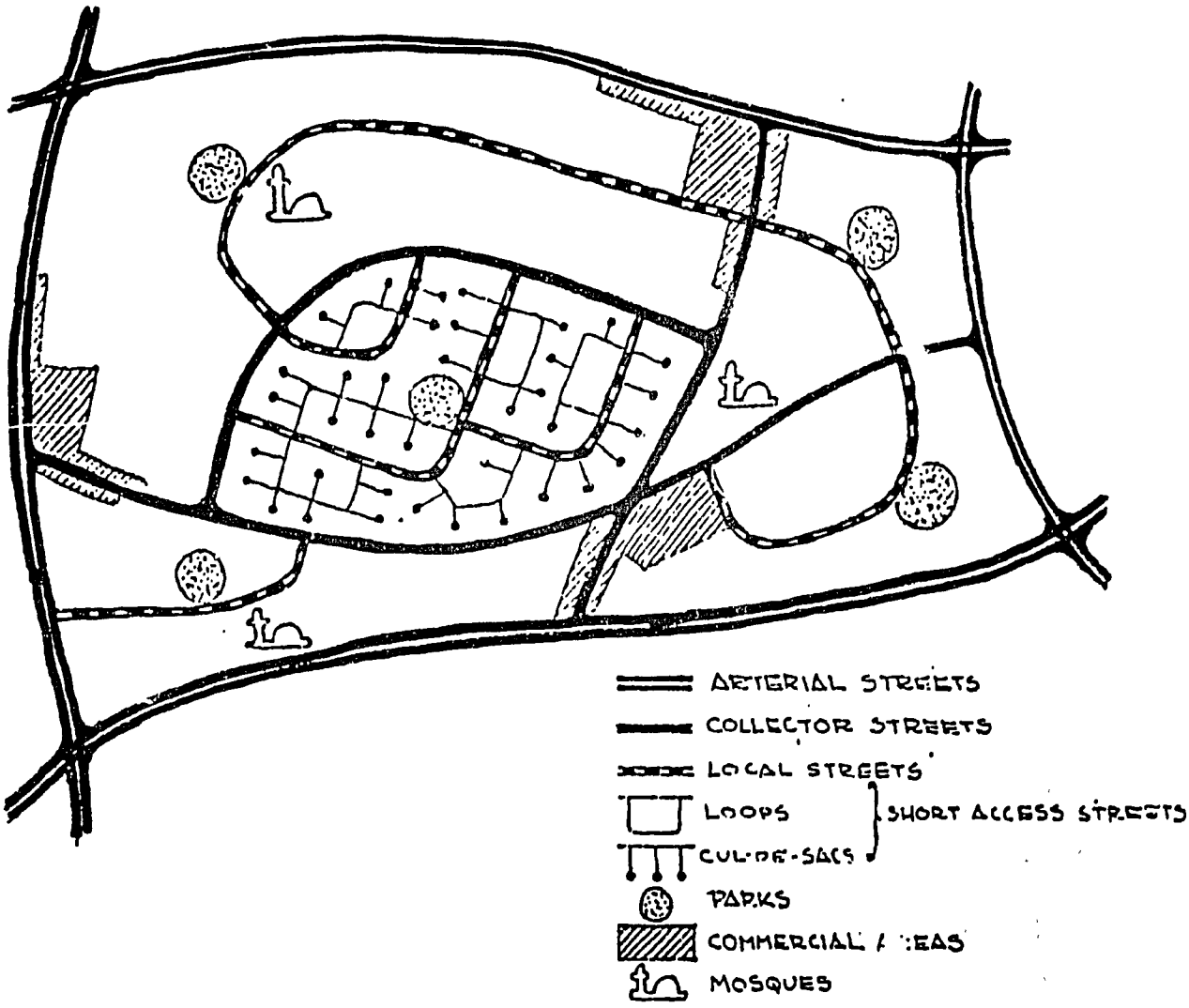
.. steeply sloped areas (over 20%), such as ravines and mountainsides should be left intact as part of the open space requirements and to lessen development costs and drainage complications (Figure II.2)

.. unique natural features (rock formations, mature trees, streams or lakes, etc.) should be left untouched

.. in hot climates, consideration should be given to a shade tree planting plan for public spaces, especially along pedestrian paths

FIGURE II-5

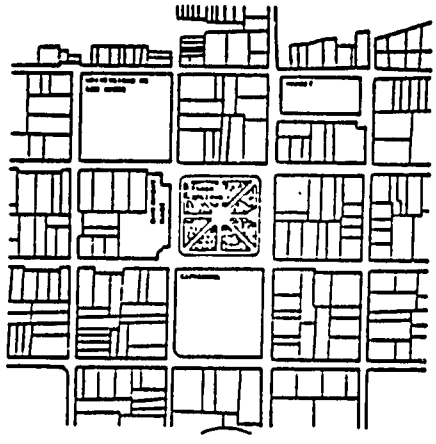
STREET HIERARCHY



Source: Technical Division of Planning and Housing, Ministry of Municipal Affairs. A Handbook of Physical Planning Standards. Sana'a, North Yemen. 1974. p.30.

.. where aridity is a factor and maintenance (irrigation) is not affordable or manageable, or in regions subject to heavy rain, consideration should be given to the provision of strategically located built shelters (bus stops, commercial areas, etc.)

- Response to the cultural environment:
  .. religious facilities may require specific orientations such a mosque orienting toward Mecca in Islamic countries, or a Catholic church facing the plaza in Latin America
  .. in all cultures and regions sensitivity must be observed in the planned placement of other land uses proximate to religious facilities in order not to violate local and general taboos; for example, in Pakistan it is frequently viewed as inappropriate to locate a cinema or bank next to a mosque; in other Islamic countries this would pose no problem
  .. focal points at the community scale vary between regions and cultures; in Latin America, it is frequently the formal plaza or zocalo, whereas in many other places it is the major commercial area or school open space facilities (Figure II.6); in any case the circulation network should emphasize the focal point
  .. in Latin America where secondary schools tend to be attended by a selective city-wide constituency, the provision of a school within a sites and services project will need be coordinated with overall needs and and transportation possibilities



Source:
Technical Division of Planning and Housing, Ministry of Municipal Affairs. A Handbook of Physical Planning Standards. Sana'a, North Yemen. 1974. p.156.

d. Cost implications

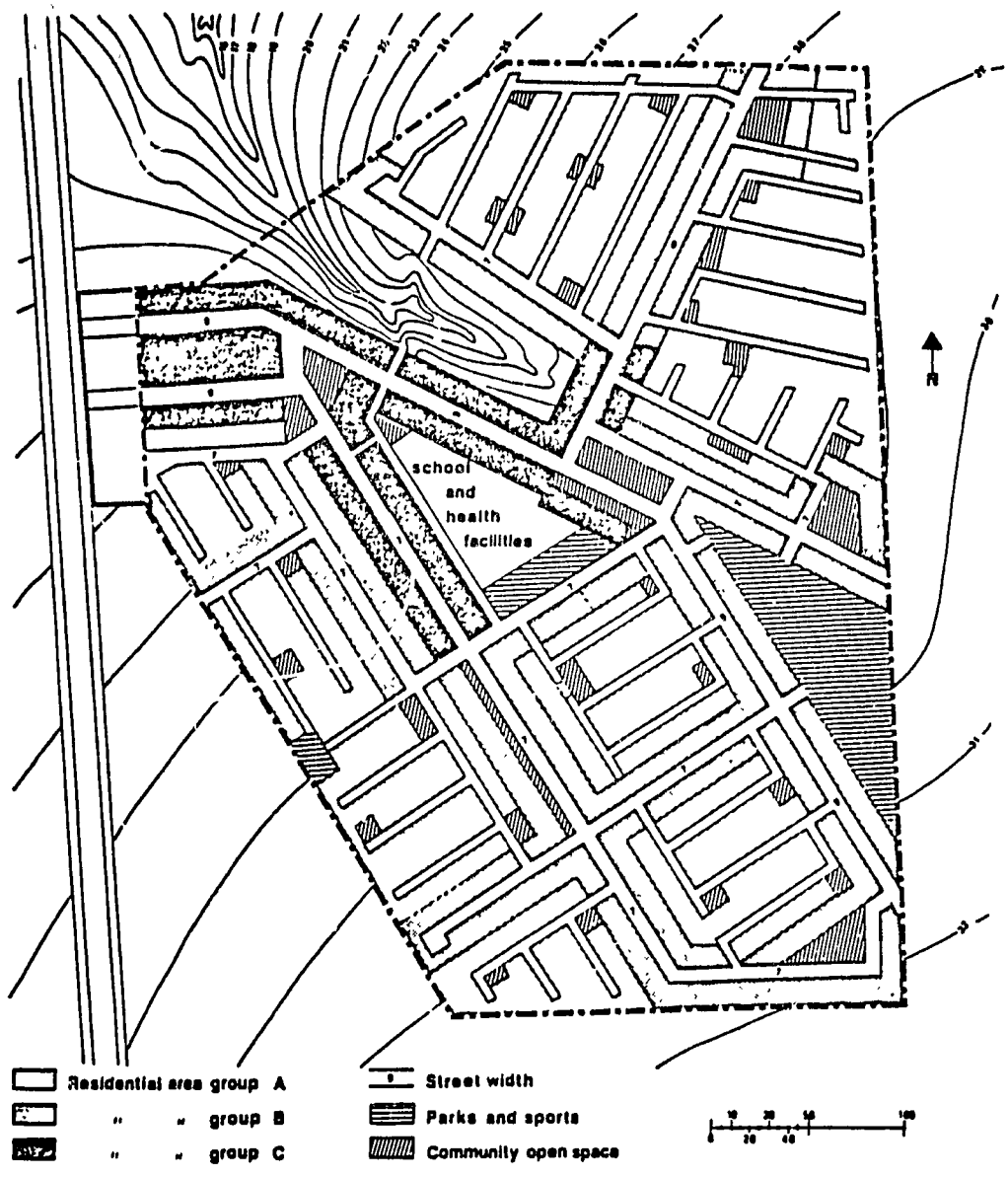
- At th. community scale there are increased project costs due to the need to accommodate citywide facilities. Studies by HUDCO in India[3] show that, as the site development module increases in size from 500 people to 1,500 people, development costs rise 17% to 21%

---

[3]HUDCO. Sector Model. New Delhi, 1983. p.21.

FIGURE II-6

LAND USE DISTRIBUTION



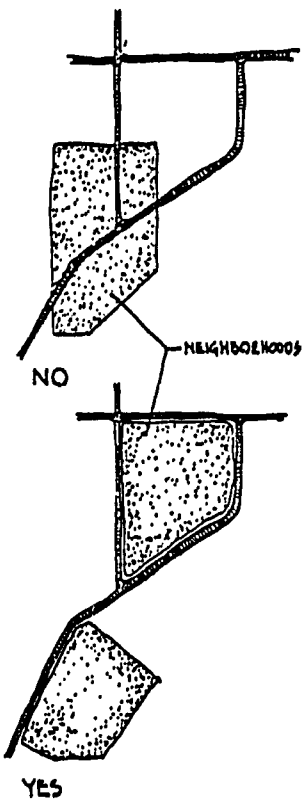
Source: CITRUD. A Model for Analyzing Alternatives in Urban Project Design. Washington, DC. 1978. p.46.

- A hierarchy of streets and pedestrian ways scaled to expected traffic/pedestrian volume is an efficient way to match public expenditure with expected use
- The increased costs (additional parking spaces and maintenance) of locating commercial facilities on accessible through routes is offset by the revenues from increased sales.

4. Neighborhood Module

a. General observations

- Recommended project scale by site (Section I.C.2)
- The neighborhood module represents a spatial unit which should take into consideration the socio-cultural, educational, recreational and commercial requirements of the people, on a daily basis
- The site should include a mix of differently sized, serviced and oriented plots to respond to the actual mix of economic levels within the target group, allowing for potential cross-subsidization to benefit the poorer levels of the population

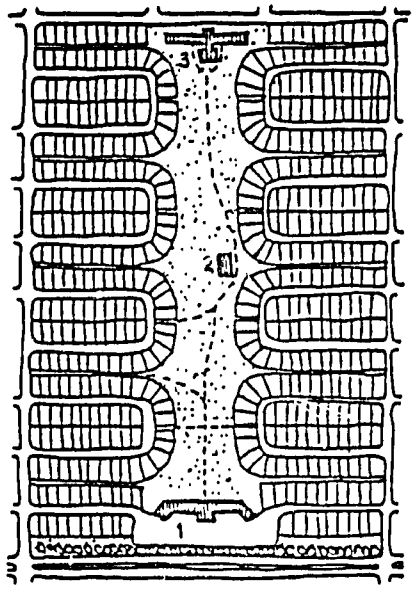


b. Physical components usually not provided at smaller than the neighborhood scale:

- primary school and nursery schools
- local commercial facilities for daily shopping
- local market facilities for daily needs
- neighborhood park or plaza
- local religious facility such as a small mosque or chapel
- public transportation stops
- solid waste collection depots
- multi-use community shelter
- neighborhood gardens

c. Design principles

- Overall organization:
  - .. through circulation should border the neighborhood unit as a corridor to one side or as a loop road
  - .. grouping non-residential components together on a spine or in a center establishes a focus and identifying element for the neighborhood



Source:
Technical Division of Planning and Housing, Ministry of Municipal Affairs. A Handbook of Physical Planning Standards. Sana'a, North Yemen. 1974. p.156.

.. non-residential components should be located so as to provide easy access both to through circulation and access circulation, although physical separation of the two should be maintained (Figure II.7)

.. vehicular parking and service access provided on the streets should be designed to present a discontinuous pattern to avoid through traffic

.. schools and open spaces should have a direct and proximate relationship

.. public transportation stops should be located on the periphery of the neighborhood, near non-residential uses if possible

.. walking distances should be minimized through the use of direct walkways in a concentric layout rather than linear

- Response to the natural environment:

.. neighborhood boundaries should be planned to encompass areas of uniform slope as much as possible

.. the street and pathway layout should be planned so as to channel surface runoff water across slopes, away from buildings and activity centres, and into natural or existing lines of drainage

.. if the neighborhood garden is a viable concept, its location should take into consideration soil fertility, irrigation possibilities and natural drainage, separation from potentially disruptive activities and its educational value to schools

.. in hot regions, consideration should be given to a planting plan for shade over pedestrian paths, along streets, around open spaces, and over markets and public transportation stops

.. in arid regions, it may be necessary to provide, at project cost, shelters against the sun and heat in selected locations where people congregate

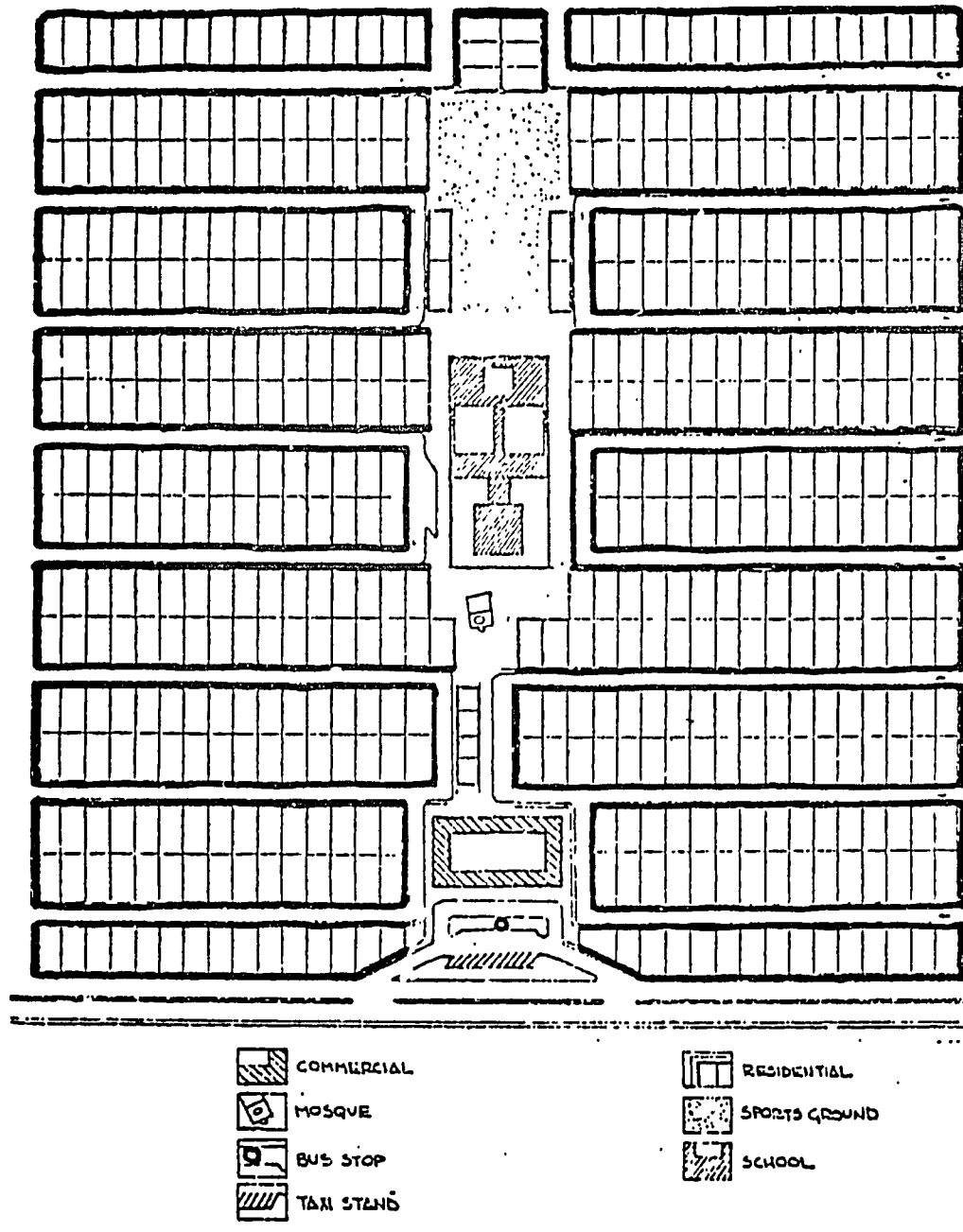
.. to facilitate a fast-tracking implementation process the land easiest to build on (least slope or fewest drainage problems) should be reserved for low-income residential land use

- Response to the cultural environment:

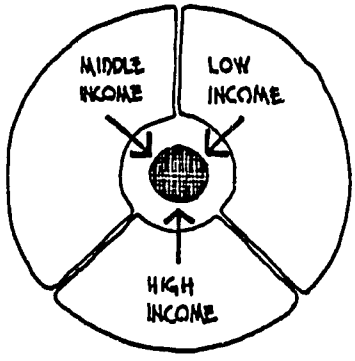
.. in regions such as the Middle East, where social extensions are more limited by observation of purdah and by strong privacy concerns, consideration should be given to dividing

FIGURE II-7

SEPARATION OF THROUGH AND ACCESS CIRCULATION



Source: Technical Division of Planning and Housing, Ministry of Municipal Affairs. A Handbook of Physical Planning Standards. Sana'a, North Yemen. 1974. p.158.



total open space requirements at the neighborhood unit level into smaller more local open spaces located throughout the project (Figure II.8)

.. likewise in regions where crime is a critical factor, large unsupervised open spaces should be omitted in favor of smaller more local, and thus better policed, open spaces located throughout the residential areas of the project

.. interaction between different economic groups should be facilitated by the nuclear location of social gathering places (open spaces, commercial facilities, schools, etc.)

d. Cost implications

- Requirements for the provision of open space should take into consideration that which is provided for schools and appropriate reductions for overall site needs should be made
- Smaller, more local, open spaces located throughout the project site may incur less public maintenance costs as the incidence of vandalism decreases and the degree of user care for the area increases
- Provision of neighborhood garden areas may necessitate public expenditures for water points and fencing
- An extended linear layout may be cost efficient by using already existing through circulation as its spine, but such a layout is often at the expense of neighborhood identity and comfortable walking distances
- Rectilinear layouts are generally most cost-efficient, whereas layouts in hexagonal groupings have been proven wasteful of open space and doubly expensive in infrastructure provision.[4] The same, to varying degrees, can be said of any non-rectilinear layouts

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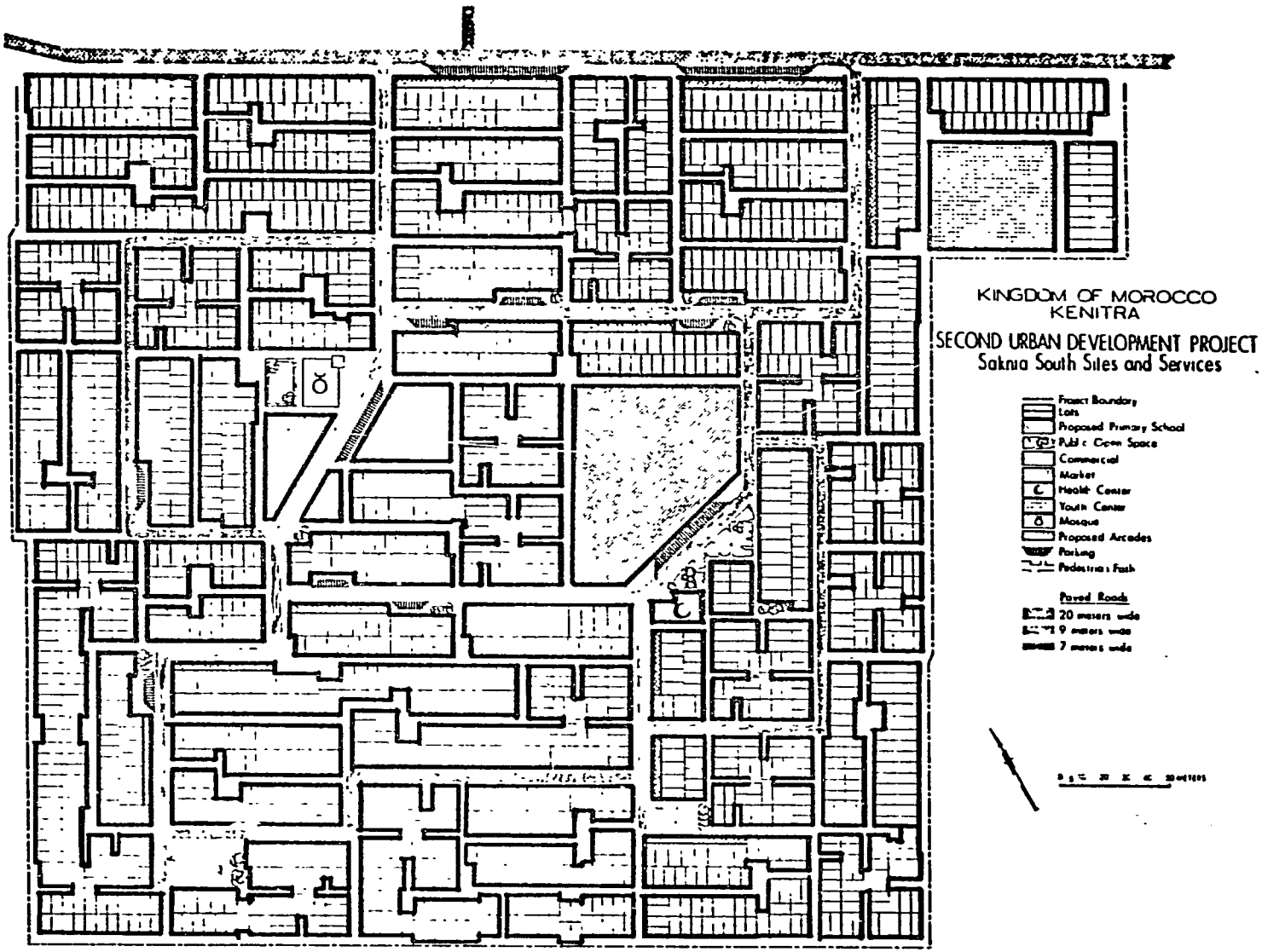
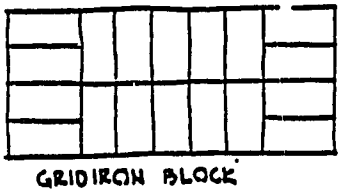
[4]USAID. Office of Housing. Squatter Settlements and Housing Policy: Experiences with Sites and Services in Colombia. Washington, DC. 1980. p.134.

FIGURE II-8

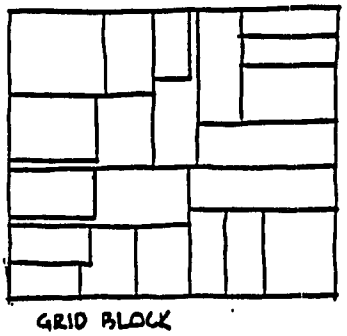
SITE PLAN



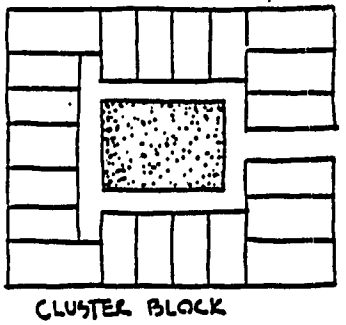
Source: IBRD Site Plan of Saknia South Sites and Services Project, Kenitra, Morocco (unpublished).



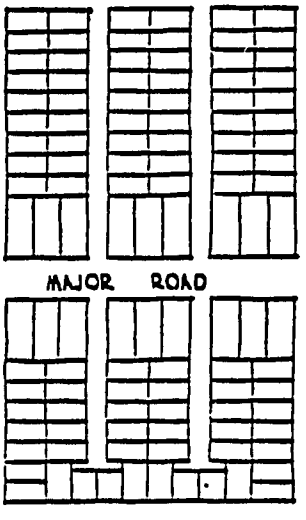
GRIDIRON BLOCK



GRID BLOCK



CLUSTER BLOCK



5. Block Module

a. General observations

- The block is the basic unit of residential subdivision
- At this scale, consideration must be given to provision of communal sanitary facilities
- Block dimensions are traditionally derived from the need to provide for pedestrian circulation and limited use of low-speed vehicles
- There are three basic block module types:
  - .. gridiron: dimensions determined by depth of plots and intervals between roads; generally includes only plots and lines of through circulation
  - .. grid: dimensions determined by intervals between roads; generally includes plots and lines of through and access circulation
  - .. cluster: dimensions determined by size and shape of central element, orientation of plots to the central element and layout of access circulation; generally includes plots, lines of through and access circulation, and open space or other central element

b. Physical components usually not provided at any smaller scale:

- Through and access circulation
- Street lighting
- Playlots and playgrounds
- Community Sanitary facilities (water taps, showers, laundry facilities, toilets), if not provided at the individual plot level

c. Design principles

- Overall organization:
  - .. longitudinal axis of the block should be laid out perpendicular to major roads of the neighborhood
  - .. in blocks located proximate to major roads, end plots should orient to the major road, thus increasing their commercial potential and land value
  - .. intervals between roads should be short enough to facilitate pedestrian circulation - 80m minimum

.. intervals between roads should be long enough to minimize public land use - 200m maximum (which also corresponds to the maximum distance fire equipment can usually pump water - a standard legislated in Colombia)

.. major roads must be wide enough to permit passage of fire trucks and solid waste collection vehicles

.. playlots, playgrounds and other community facilities should be located within easy view of the residents for better supervision and policing

.. generally, only one access point should be provided to each plot, thus negating the idea of alleys and blocks containing only two to four plots

- Response to the natural environment:

  .. longitudinal axis of the block should be laid out parallel to the contours of the land thus facilitating plot access and drainage of surface water (Figure II.9)

  .. longitudinal axis of the block should be laid out perpendicular to the direction of prevailing winds thus providing each plot the cooling effects of wind and breaking up a potential wind tunnel effect in the streets during strong winds

  .. in hot regions, consideration should be given to a tree planting plan around a cluster block's central element and along lines of through and access circulation

- Response to the cultural environment:

  .. the shorter the circulation interval, the more potential for social interaction and shared activities

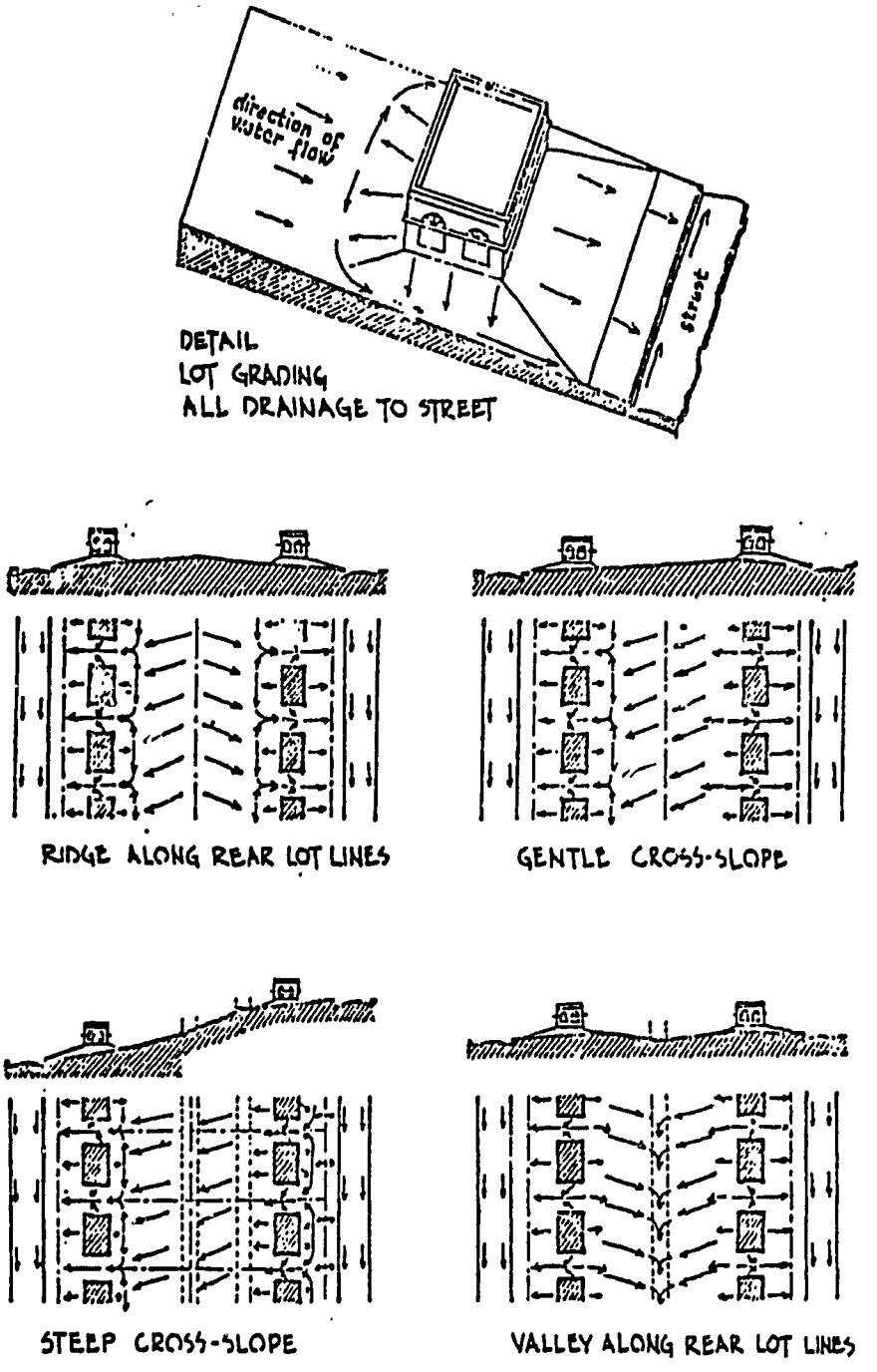
  .. cluster arrangements can help promote the social and cultural integration of the surrounding families, essential to mutual self-help, decision-making and maintenance activities

d. Cost implications

- Longer circulation intervals increase efficiency no matter what the plot area or proportion are, because they decrease circulation land use (Figure II.10)
- Only in grid blocks can absolute minimal circulation land use be achieved

FIGURE II-9

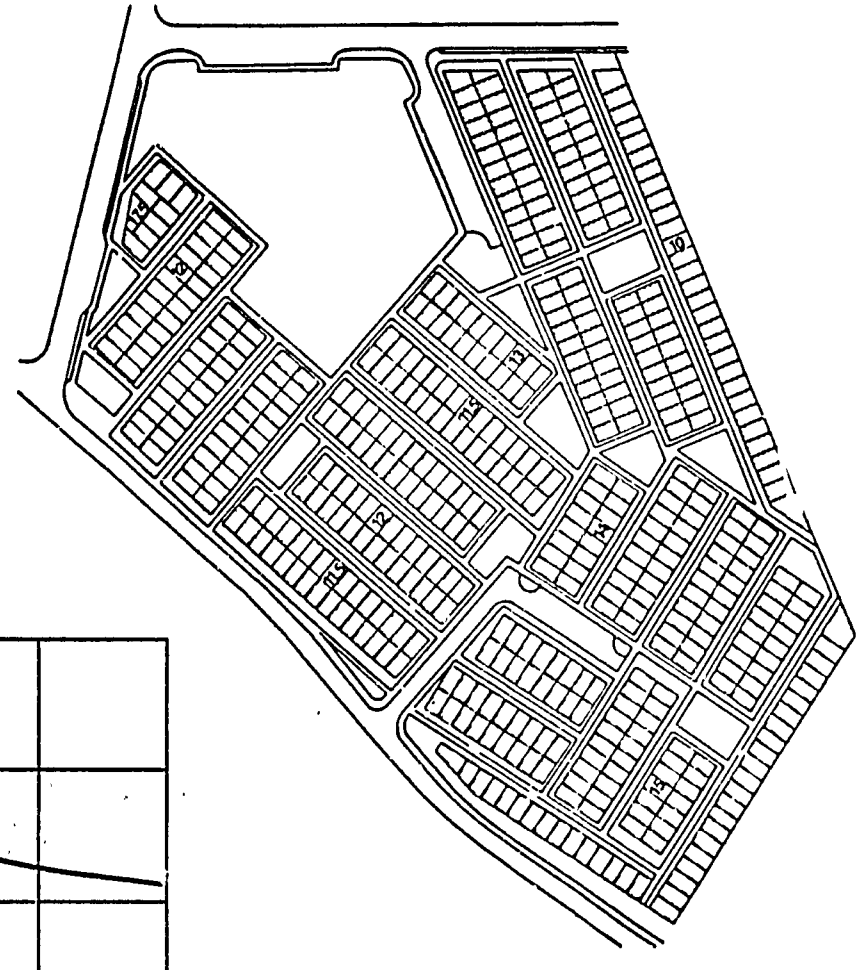
LAND GRADING FOR SITE DRAINAGE

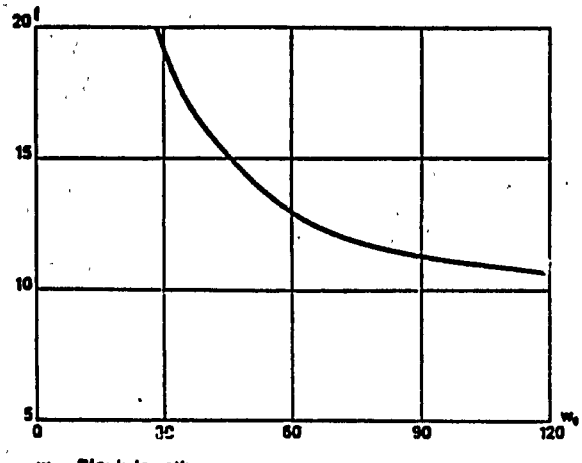


Source: Technical Division of Planning and Housing, Ministry of Municipal Affairs. A Handbook of Physical Planning Standards. Sana'a, North Yemen. 1974. p.114.

FIGURE II-10

MONTHLY PAYMENT PER PLOT
REFLECTING ACTUAL PERFORMANCE
(El Pepeto, San Salvador)





w_0 = Block length
f = Monthly payment

w_0	f
30	18.93
60	12.89
90	11.35
120	10.65

j = 60
u = 7
v = 7
k_3 = 114.6
k_4 = 4.56
e = 4.1

i = 5
m_1 = 20.8
h = 2.5
l = 6
n = 20

Monthly payment reflecting block performance

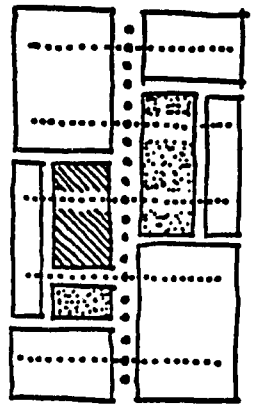
Source: CITRUD. A Model for Analyzing Alternatives in Urban Project Design. Washington, DC. 1978. p.46

- Favored block locations (such as frontage on major roads or community facilities, corner plots and those with better access) offer potential for cross-subsidization by charging more per square meter than for less favored locations

6. Plot Module

a. General observations

- The plot is the most important scale for the beneficiary as it determines costs to them, unit design possibilities and, on some sites, the type of construction possible
- Ownership of a plot is equated with a single or extended family, although in some regions (Latin America and North Africa) it is common to have three or more separate families occupying the plot, especially when vertical expansion is possible



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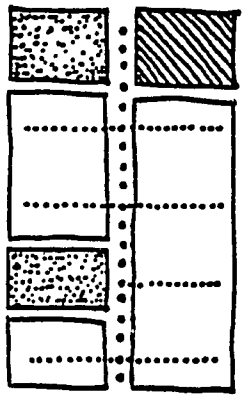
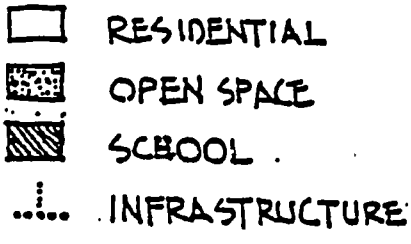


YES



b. Physical components usually not provided at any smaller scale:

- house
- sanitary core
- on-site open space
- boundary wall
- individual connection to infrastructure systems

c. Design principles

- Overall organization:
  - .. each plot should have direct, unencumbered access to lines of infrastructure systems even when immediate connection is not intended
  - .. plot proportions should minimize street frontage and maximize depth as this decreases circulation land use and costs, infrastructure and servicing costs. Generally, plots should have a width to depth ratio of 1:2 to 1:4
  - .. plot area should be 20 to 400m depending on regional customs, affordability levels and availability of land
  - .. generally, plot areas in sub-Saharan Africa are largest whereas they are smallest in the Middle East, North Africa and South Asia. Figure II-11 gives plot sizes for Sites and Services projects for selected countries

FIGURE II-11

SITES AND SERVICES PLOT SIZES

PLACE - PROJECT P: Proposed NDP: National Development Plan	AREA AND CONFIGURATION (m^2, m x m)
Burma	260
Colombia	140
(P) USAID	80
Chile: PAP - Plan 1	170
PAP - Plan 2	170
Ecuador (P) USAID-FCH Proposal	127 (8 x 16)
El Salvador ESDV	67
Guinea	96 (8 x 12)
India: Bombay (P)	14.5
Madras	91.4
New Delhi	25 (93% of plots) 80 (7% of plots)
Iraq: Baqdad and Barra	160
Kenya: Nairobi-Kariobangi	210 (15 x 13.3)
NDP 65-70	210
Korea: Pusan	60
Seoul	120
Malawi: Blantyre	530
NDP	610 (legal) 440 (recc.)
Morocco: Trama Sanitaire	35
Lot Evolutif	64 (8 x 8)
Lot Economique	64 (8 x 8)
(P) IBRD 1965	64
Pakistan: Lahore	120
Senegal: Dakar - Pikine Ancien	219 (12.5 x 17.5)
Pikine Extension	150 (10 x 15)
Sudan:	850
Thailand: Bangkok	73 145
Tunisia:	80
Zambia: Lusaka - New Kanyema	315
- Marrapodi	315
- Chainama Mills	335
- Kaunda Square	167
Second NDP	315

Source: IBRD/IDA Urban Projects Department. "Sites and Services: The Experience and Potential". Washington, DC. 1973. p.15.

.. sites located in high density and central city areas will be smaller than those in outlying areas

.. recommended plot sizes, dimensions and assumed family sizes:

Agency†	Plot Size	Plot Dimension w/Minimum Frontage	Assumed Household Size
United Nations Relief & Works Agency (UNRWA)	105 m^2	7.5mx14m	5
US Agency for International Development(USAID)	100 m^2	5mx16.7m	5
Organization of American States	40 m^2	5mx8m	6

†IBRD/IDA, Urban Projects Department. Sites and Services: The Experience and Potential. Washington, DC. 1973. p.16.

- Response to the natural environment:
  .. on slopes over 20 percent, consideration should be given to plot proportions and sizes conducive to multi-level access to house units
- Response to the cultural environment:
  .. where detached houses are traditional, a squarer proportioned plot may be more appropriate
  .. poorest households may require large plots due to the need to house a large extended family or doubling up of separate families on the same plot
  .. in Jamaica and the Caribbean, plots should be sized and proportioned to permit the traditional "walk around the house"
  .. in the Middle East, North Africa and South Asia, plots should be sized and proportioned to allow for common walls on both sides as custom encourages a courtyard arrangement for on-site open space
  .. in traditional Islamic, Latin American and South Asian cultures, a boundary wall (approximately 2m high) is a prerequisite for family occupation of the plot

.. in South Asia and sub-Saharan Africa, consideration must be given to the access and space required for the keeping of animals on-site

d. Cost implications

- The smaller the plot, the more serious are design flaws (i.e. wasted space)
- The smaller the plot, the greater are costs for foundations and building structure to support vertical expansion of the house
- The smaller the plot, less open space is provided on-site and more is needed off-site at public expense
- Large plots hold down development costs per hectare but raise the cost per plot
- The longer and narrower the plot, the less efficient and more problematic the house layout (i.e. long corridors and less expansion possibility)
- Cluster block layouts add potential for different tenure arrangements
- Costs for cut and fill increase with steeper slopes
- A higher plot ratio (less width to more length) translates to less public infrastructure costs
- One study by Doxiadis Associates in Zambia on the effect of plot size on costs demonstrated that an increase in frontage is more costly than an increase in total size:

COST INCREASES FOR SEVEN PLOT SIZES

Alternative Increases in Size of 30'x60' Plot	Increases in Size	Increase in Base Estimated Cost
1. 30'x70' = 2,100	16 percent	9.6 percent
2. 35'x60' = 2,100	16 percent	15.4 percent
3. 40'x60' = 2,400	33 percent	17.5 percent
4. 35'x70' = 2,450	36 percent	24.6 percent
5. 40'x70' = 2,800	55 percent	29.6 percent
6. 40'x80' = 3,200	77 percent	34.1 percent
7. 40'x90' = 3,600	100 percent	40.0 percent

Source: IBRD/IDA, Urban Projects Department. Sites and Services: The Experience and Potential. Washington, DC. 1973. p.16.

Chapter III
Unit Design

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Chapter III
Unit Design

A. Introduction

1. The Concept of Core Housing

The purpose of core housing is to provide a minimum shelter unit consistent with the occupant's ability to pay, while anticipating future improvements and additions as the occupant's income level improves. The concept applies to a wide range of income levels through varying the definition of what constitutes a minimum unit.

2. What Constitutes a Core House

Core houses should provide basic shelter from the elements, water and sanitary facilities, and privacy. The basic components of core houses generally include:

- **Sanitary block:**
  - privy
  - water tap
  - laundry and shower elements
- **Shelter:**
  - roofed area
  - one or more room shells
- **Boundary wall**

Provision of the sanitary block is the minimum core house unit, whereas shelter provision and its extent and finishing depend on affordability. The need for construction of boundary walls further depends on affordability and cultural concerns.

Precise determination of the core house elements to be provided in a given project should be facilitated through an affordability analysis, such as can be done with computer models and an analysis of housing and socio-economic survey data showing existing patterns and culturally acceptable standards.

B. Key Core Housing Programming Issues

1. Affordability

Affordability analysis establishes overall capital costs, their allocation and the method and degree of cost recovery. Models have been developed for both handheld calculators and micro-computers which rapidly calculate the effect of tradeoffs by varying one or more components, including core housing and on-site infrastructure costs. See Annex B for an example of affordability analysis in the Ivory Coast.

2. Minimum Standards

Standards have an enormous impact on housing and infrastructure costs and hence the income groups that can be reached. Low or minimum standards can reach a lower income group, reduce subsidies, and preserve flexibility for later upgrading. Established standards should be directed toward basic health and safety, and based on a realistic level of performance rather than on specific detailed sizes, methods and materials. One of the most significant problems encountered in planning sites and services projects is the applicability of existing regulations to minimum requirements.

3. Tenure/Ownership Restrictions

In providing secure and direct ownership of the plot, or a lease-purchase agreement, tenure enhances social and economic status and further provides the incentive to invest time and money in housing. Where permitted, it also encourages economic development through use of part of the house for small scale commerce and rental income. On the other hand, to avoid speculation many countries (i.e., Honduras) specify that the implementing agency should maintain a first right of purchase or refusal on lot resale.

4. Expansion and Upgrading

Initial design of core houses and infrastructure should take into consideration changes and additions that plot size and configuration, future income and life style make possible.

Figures III.1 through III.6 show the phased expansion (both horizontal and vertical) of various core houses, while Figure III.7 shows the expansion potential of various core house sizes on different sized plots.

5. Response to Cultural Environment

Should core housing and infrastructure not respond closely to the perceived needs and desires of the target group population, the project may suffer from lack of marketability or misuse of the finished product, and may constrain the traditional life style evolution of the occupants. Standards and actual design should thus reflect the observations made during socio-economic, urban services, and housing surveys. For example:

- Enclosed space ratios in many tropical countries should be abandoned in favor of open space ratios (m^2 per inhabitant) since much domestic activity occurs outside rather than inside
- The diversity of cultures within many single countries (i.e., India or Brazil) necessitates very flexible national, or even local, standards
- Development of non-traditional style shelter, while finding a ready market, may contrast with traditional development creating social conflict

6. Response to Natural Environment

Nature exerts its own set of conditions on housing and infrastructure design demanding consideration lest the occupant and structure suffer ill effects. Core housing should provide basic protection from the elements; the site should not subject beneficiaries to flooding and other environmental hazards.

C. Core House Components

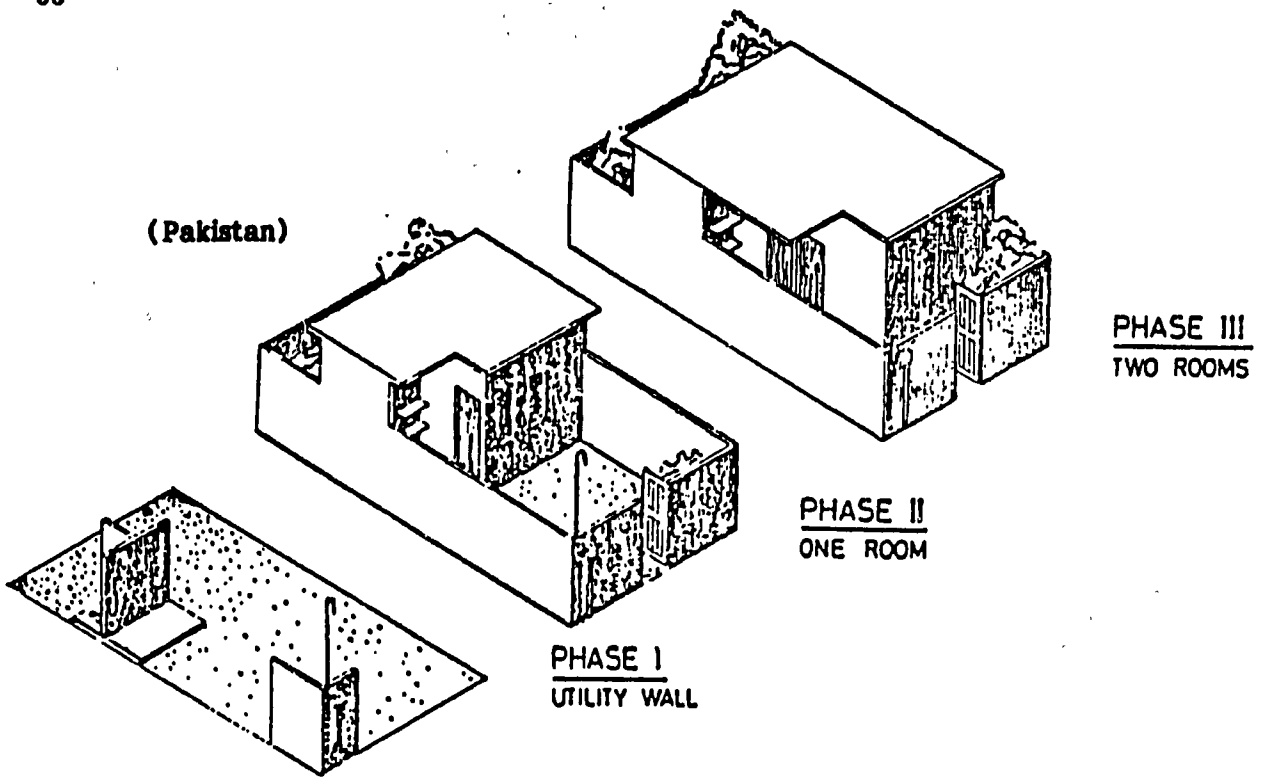
The following is a list of identifiable spatial and functional design components commonly included in core house designs. First, each is described. Second, spatial requirements are discussed. Third, specific design considerations are noted.

Spatial requirements for a design component as well as for all components together should derive from affordability analysis and observation of living patterns.

FIGURE III.1

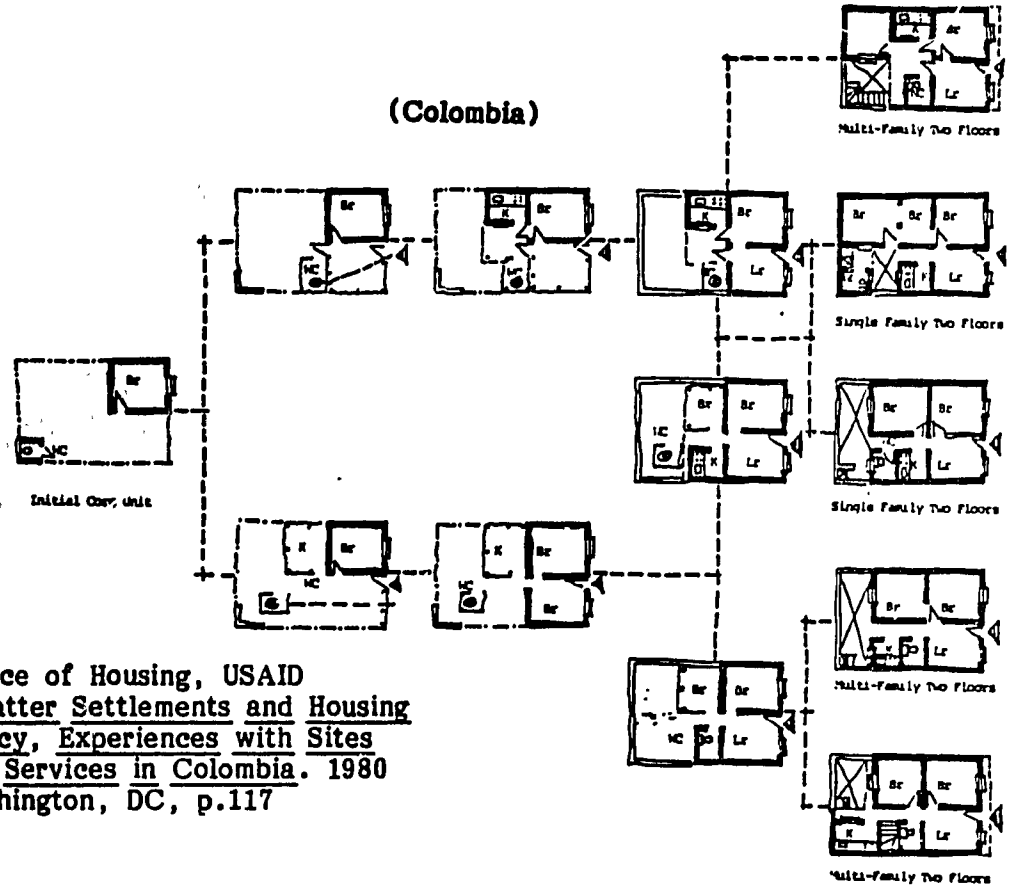
CORE HOUSE EXPANSION

(Pakistan)



SOURCE: Office of Housing, USAID. "Evaluating Successful Low-Income Housing Projects in Less Developed Countries: Criteria and Case Studies." 1977, Washington, DC, p.98

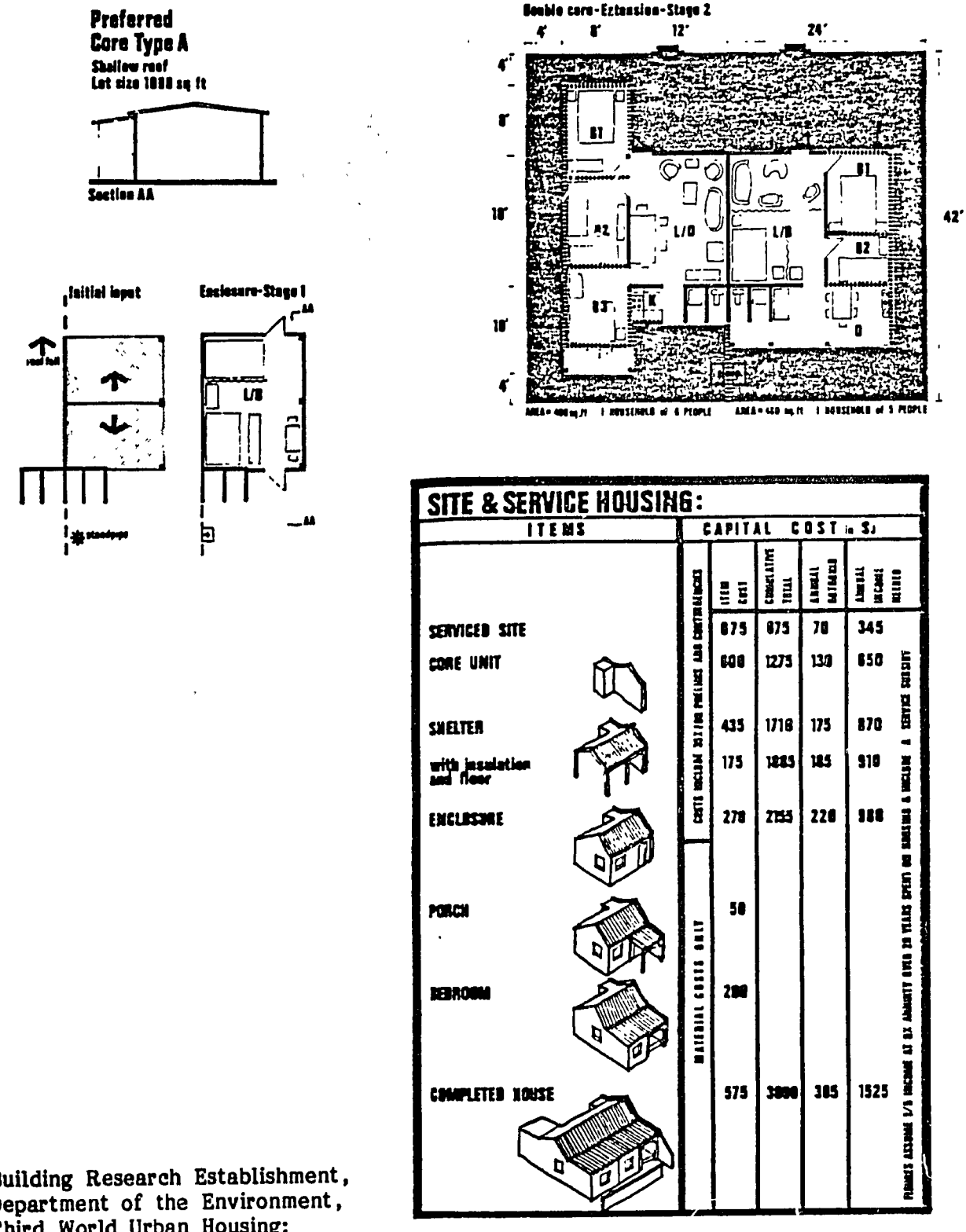
(Colombia)



SOURCE: Office of Housing, USAID
Squatter Settlements and Housing Policy, Experiences with Sites and Services in Colombia. 1980
Washington, DC, p.117

FIGURE III.2

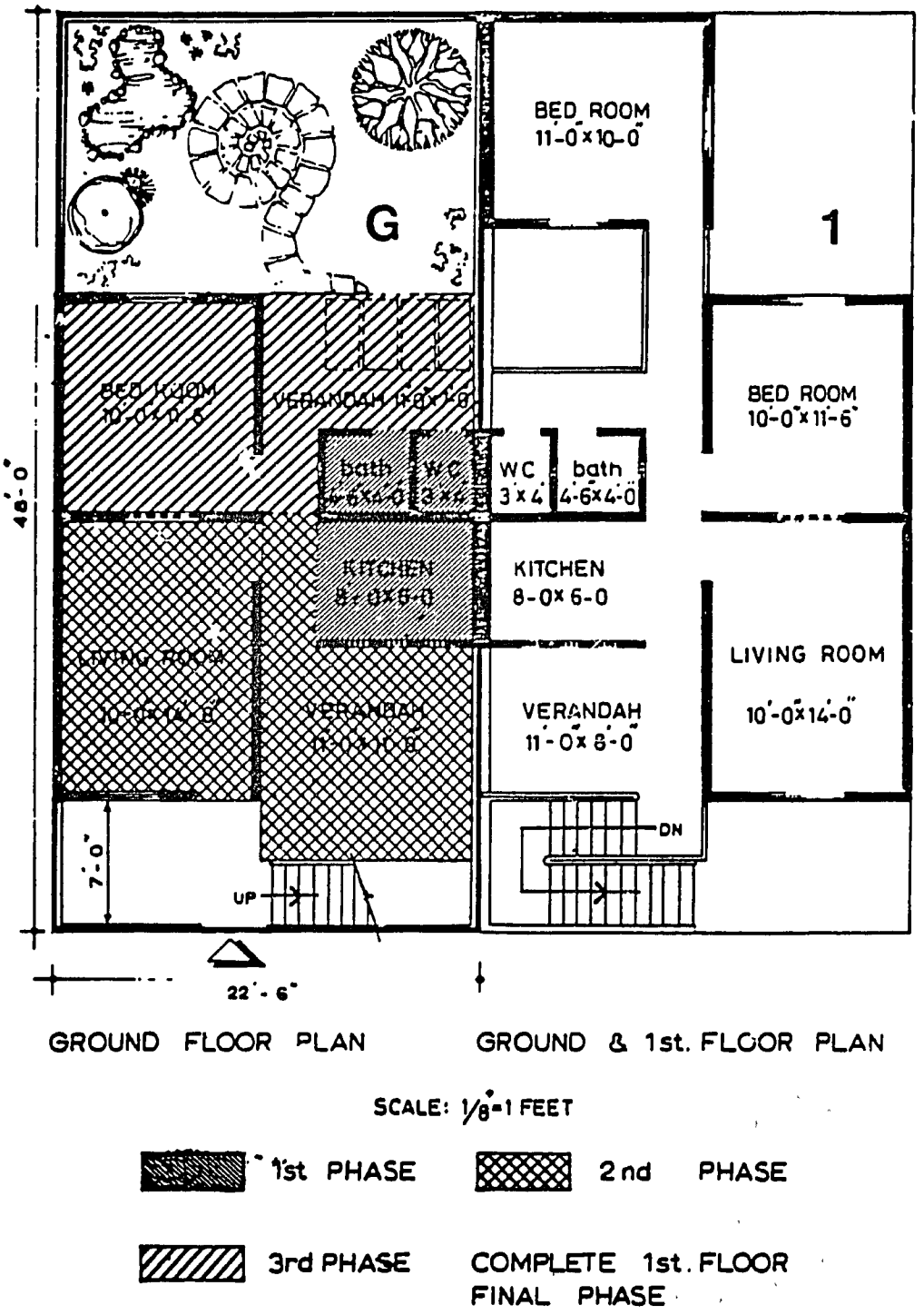
CORE HOUSE EXPANSION
(Jamaica)



SOURCE: Building Research Establishment, Department of the Environment, Third World Urban Housing: Aspirations, Resources, Programs, Prospects. 1977, London, p.195

FIGURE III.3

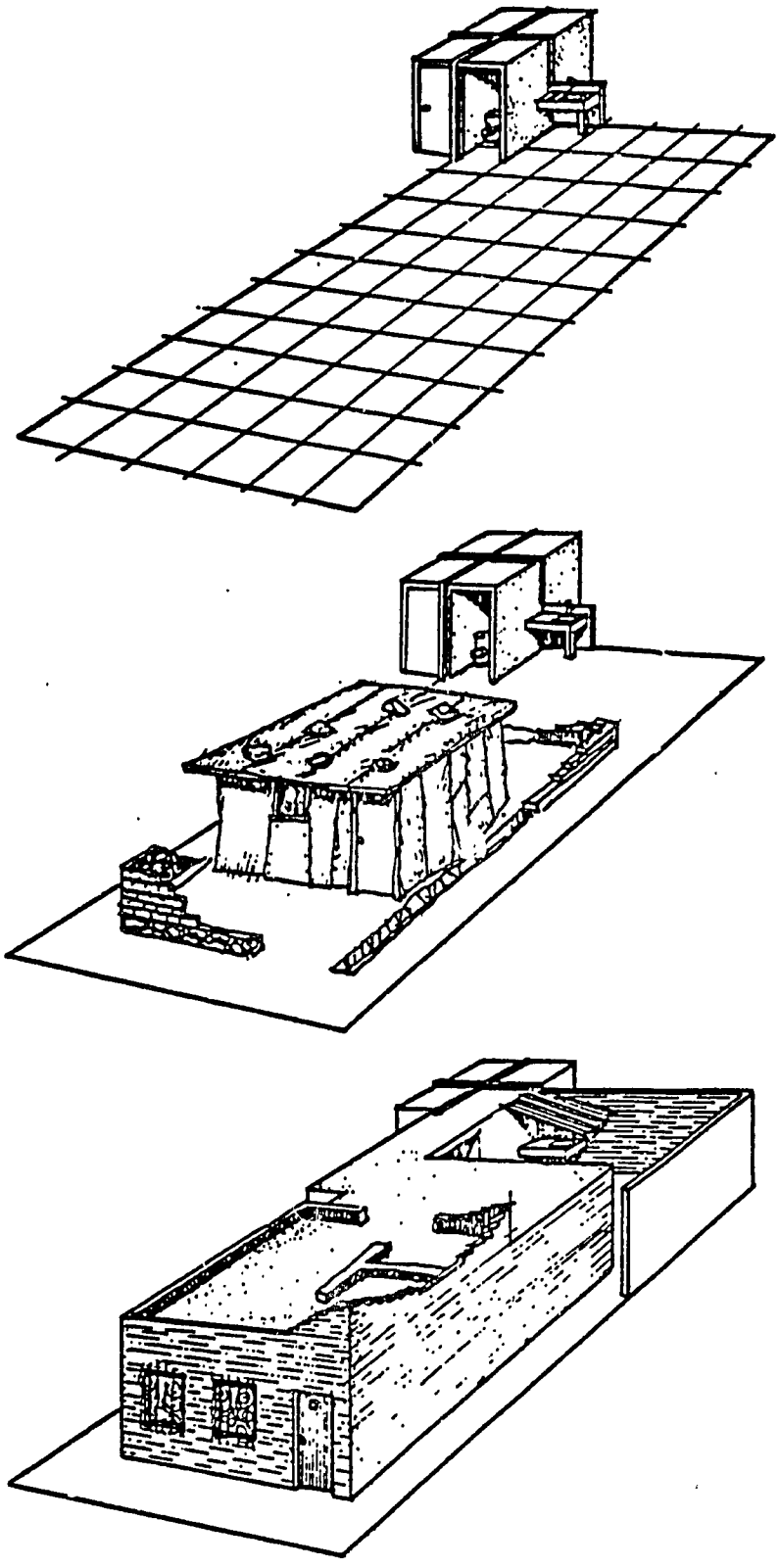
CORE HOUSE EXPANSION
(Indonesia)



SOURCE: PERUMNAS/PADCO. "Land Planning and Architectural Standards." (Vol. II of an 8-volume Working Paper Series) 1978, Jakarta, p.51

FIGURE III.4

CORE HOUSE EXPANSION
(Latin America)



STEP I - Family is provided with a lot in a planned community with minimum sanitary services. In this plan 4 sanitary units are joined at the intersection of 4 lots, minimizing costs.

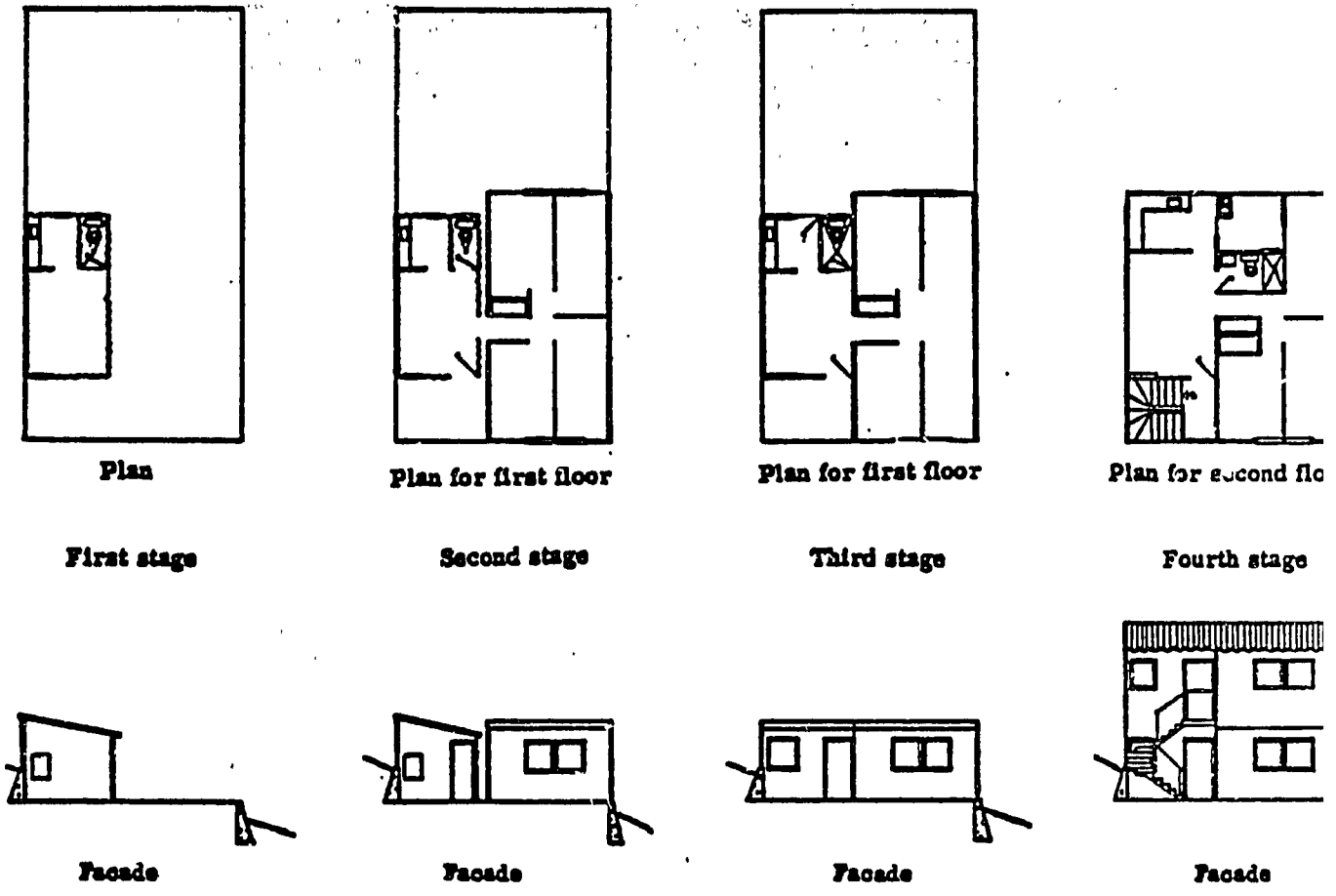
STEP II - Family may initially erect a shack from whatever materials are available.

STEP III - As family income permits a permanent house of better materials is constructed by unaided self help. The site and service alternative seeks to control and legalize what otherwise would occur in an uncontrolled settlement.

Source: USAID Bureau for Latin America, Housing and Urban Development Division. "Cooperative Housing and the Minimum Shelter Approach in Latin America." (Vol.1), 1972, Washington, DC, p.vii

FIGURE III.5

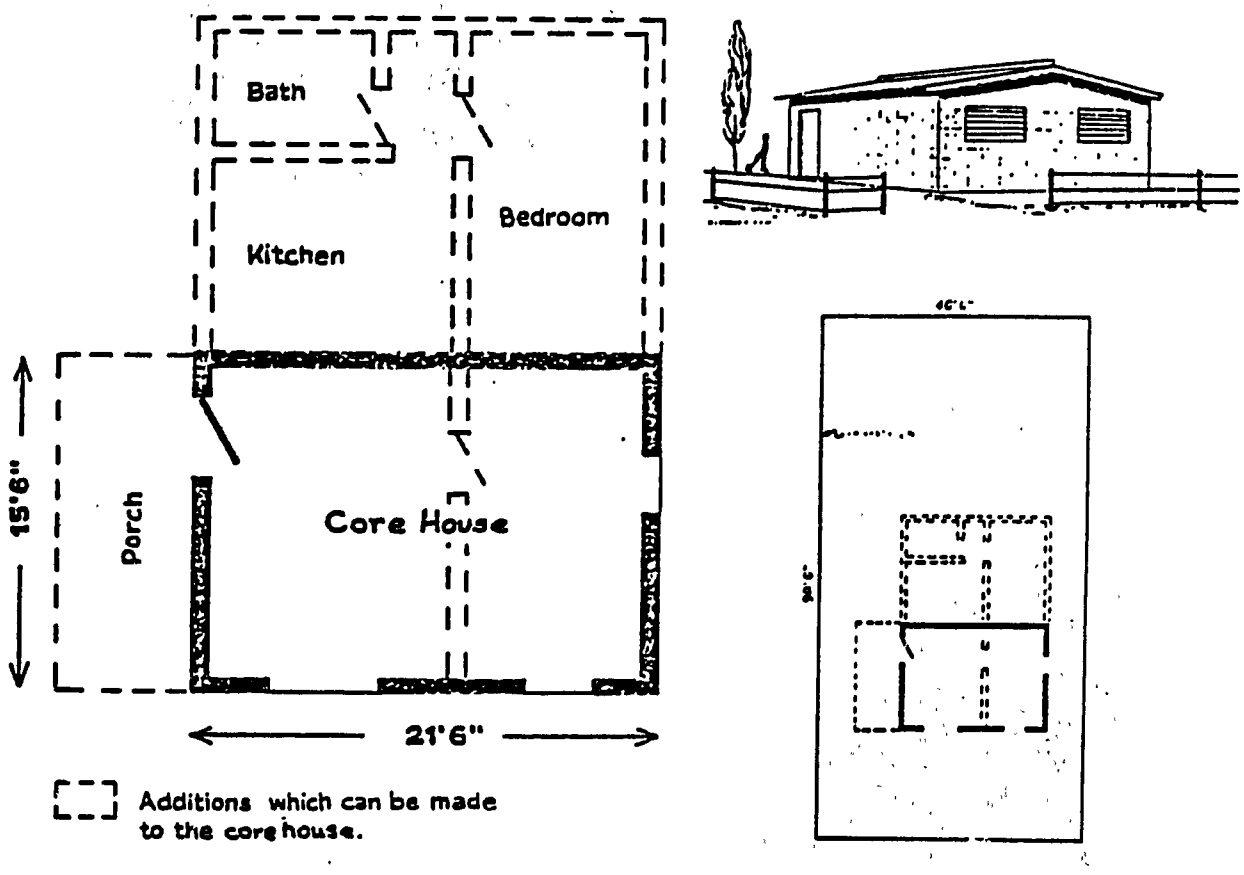
CORE HOUSE EXPANSION
(Colombia)



SOURCE: USAID Bureau for Latin America, Housing and Urban Development Division. "Cooperative Housing and the Minimum Shelter Approach in Latin America." (Vol.1), 1972, Washington, DC, p.vii

FIGURE III.6

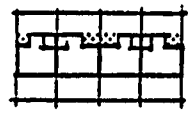
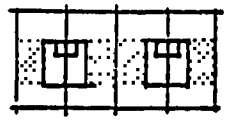
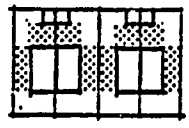
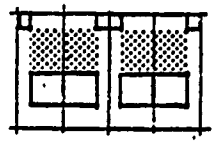
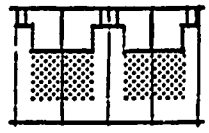
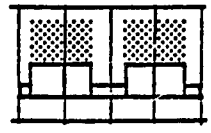
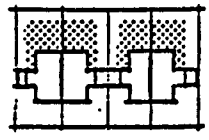
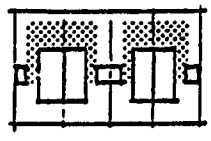
CORE HOUSE EXPANSION
(Zambia)



SOURCE: "Evaluating Successful Low-Income Housing Projects in Less Developed Countries: Criteria and Case Studies." 1977, Washington, DC, p.69

FIGURE III.7

CORE HOUSE EXPANSION POTENTIAL
(Indonesia)

LOT SIZE	LOT SHAPE	CORE TYPE	SANITARY UNIT	SIZE or CORE	EXPANSION POTENTIAL	% of LOT
$60m^2$	5½x11		Integral	$20m^2$	$4m^2$	40
$80m^2$	6½x12½		Integral	$14m^2$	$20m^2$	43
$77m^2$	5½x14		behind	$20m^2$	$15m^2$	45
$90m^2$	6x15		behind	$20m^2$	$21m^2$	46
$78m^2$	6x13		beside	$20m^2$	$20m^2$	51
$90m^2$	6x15		beside	$18m^2$	$28m^2$	51
$90m^2$	6x15		beside	$24m^2$	$16m^2$	45
$90m^2$	6x15		beside	$24m^2$	$16m^2$	45

SOURCE: PERUMNAS/PADCO. "Land Planning and Architectural Standards." (Vol. II of an 8-volume Working Paper Series) 1978, Jakarta, p.71.

1. Sanitary Block

a. **Description:** the sanitary block is the most common single element found in core house schemes and is usually comprised of a privy, water tap, enclosure and frequently, bathing and laundry facilities.

b. **Spatial Requirements**

- The privy area always requires some form of enclosure or barrier from view; dimensions derived from human body require a minimum dimension (width) of around .75m, a depth of 1m and a wall height around 1.8m
- Showers require an element of privacy and a bare minimum of .75m by .75m by 1.8m; a 1m square shower is preferable
- Laundry facilities can take the form of a 1m square slab in close proximity to a water tap and open space for drying

c. **Design Considerations**

Sanitary units may be designed:

- With or without roof, depending on climate and potential pest problems
- With or without a door, depending on location and configuration, and potential pest problems
- May provide water for kitchen and laundry use
- Laundry may also be done in courtyard, on verandah or porch
- Water taps (i.e. laundry, kitchen and privy) should be concentrated in one location to minimize service lines

2. Multipurpose Room

a. **Description:** the second most common element found in core houses is comprised of a secure enclosed and roofed space with access to outside circulation and the plot. The room functions as a living, sleeping and storage area, and sometimes as a kitchen and work space.

b. **Spatial Requirements**

- The multipurpose rooms should be as large as is affordable, if it is the only enclosed space for a family

- Sleeping space mandates a 2m minimum dimension but this is very restrictive for multipurposes and complicates circulation; 3m is a much more useful minimum dimension
- Minimum construction costs may dictate use of specific structural roofing materials with limited span capabilities, in turn translating to a minimum room dimension
- To calculate absolute minimum sleeping area required, use 1.5 to 2 square meters per person

c. Design Considerations

- Sleeping may take place on a roof (necessitating flat and strong structure) or anywhere outside (courtyard, verandah, porch), with an element of privacy, especially in hot dry climates (Pakistan, Egypt) and where the enclosed space is minimal
- Multipurpose rooms should be secure and well-ventilated

3. Kitchen

a. Description: a generally small, enclosed and roofed space is needed for food preparation and storage; sometimes shelves and a fireplace may be incorporated in the design.

b. Spatial Requirements

- One person can prepare and cook food in no more than 2 sq. meters although 3-4 sq. meters is preferable
- In Pakistan and many other countries, kitchen space need not be over 2m high as food preparation and cooking are traditionally performed while squatting; however, where the cooking is traditionally done with a smoky fuel in poorly ventilated and/or chimneyless space (Bhutan, Nepal), the kitchen should be designed with higher ceilings

c. Design Considerations

- An open air, or at most a roofed area, may be all that is required
- Provision of a kitchen in a Sudanese project led to its use as a children's room while cooking was done outside and utensil storage was in the bedroom

- In several projects in Kenya, kitchen space was used primarily for sleeping, reflecting both low priority for enclosed kitchen space and overcrowded habitable area

4. **Boundary Wall**

a. **Description:** in some regions, a boundary wall as an essential delineation of the plot is needed for privacy, security and as a base for additional rooms to be built upon

b. **Spatial Requirements**

- For security, 2.5 to 3 meters height
- For privacy, 1.8 to 2 meters height
- For delineation of plot, any height

c. **Design Considerations**

A boundary wall:
- Should be structured to carry additional wall, floor and roof construction according to anticipated future changes and core house additions
- Construction material may depend on regional traditions (i.e., thorny bush in sub-Saharan Africa, bamboo in South Asia, masonry with broken bottle topping in Latin America, Middle East and South Asia)

5. **Bedroom, Living Room, and/or Dining Room**

a. **Description:** bedroom, living room and/or dining room should be enclosed and roofed; it is used for sleeping, storage, dining, family activities, privacy and children's play.

b. **Spatial Requirements:** 2m is an absolute minimum dimension, though as noted above, 3m is preferable.

c. **Design Considerations**

- A bedroom generally serves multipurposes and should therefore be naturally lighted for daytime use
- The separate identity of bed, living, and dining rooms may not be a traditional spatial concept or

designation as the Western idea of their functions may take place outside, on verandahs or in multi-purpose rooms

6. Corridor

a. Description: a corridor may be enclosed and roofed or not; it is used for passage between other functional areas and for storage.

b. Spatial Requirements

- If sided by blank walls, .9m will barely allow passage of two people
- Clear passage at the side of an open space or between objects can be made within as little as .75m depending on layout and intensity of activity
- Long corridors generally require wider dimensions

c. Design Considerations: where crime is a factor the corridor should be a secured area, even within the plot walls.

7. Verandah, Porch

a. Description: a verandah or porch can be roofed and sometimes screened or partially walled; it is used for sitting, entertainment, work, play, sleeping and many other activities.

b. Spatial Requirements

- If used only for passage and infrequent passive activities, 1m depth may be adequate
- For sitting, entertainment and frequent passive activities; 1.5 to 2m may be adequate, especially if the user's attention is oriented outside
- If attention is oriented laterally along the verandah (as around a table or while working), width should respond to the specific activities and may require more than 2m

c. Design Considerations

- In rainy climates, provision must be made for protection against the elements (i.e., low overhangs, greater width, orientation to lee)

- In Zambia, core house owners placed high priority on addition of verandahs, while in Kenya, verandahs were used for storage instead of sitting or other activities
- If traditionally used for sleeping, consideration should be given to insect-proofing

8. Courtyard

a. Description: a courtyard is formed by walls, rooms or other identifiable spaces surrounding it, used for intraplot privacy, work, play, sitting, sleeping, entertainment, storage and many other activities.

b. Spatial Requirements: depends on the configuration of the walls, rooms or other identifiable spaces surrounding it.

c. Design Considerations

- Traditional feature in North Africa, the Middle East and Latin America
- May service more than one family unit and can form an organizational design element in itself

D. Synthesis of Components and Unit Design Development

1. General Process

Design of the core house unit takes as its point of departure the following data and analysis:

- Socio-economic surveys
- Cost of housing construction surveys
- Existing house plans
- Affordability analyses
- Comparative studies
- Designer's experience
- Legal requirements

Based on local conditions and using the data noted above, the designer must establish basic parameters and priorities within which the design must be developed. This is a

matter of selectivity and individual choice as no overall scientific formulae exist to help resolve the multitude of problems and choices to be made. In the Cameroon,[5] three primary considerations guided the design process:

- Plans should reflect the housing patterns and life styles of the selected target group as witnessed by the results of the socio-economic survey
- Plans should be economic and easy to build as self-help housing
- A significant variety of plans should be offered

Figure III-8 shows the outline of activities for model house design and construction which followed from the above.

Another useful exercise during final design is a "take away analysis" whereby each component of the core unit is reviewed with an eye for cost reduction via minimization of standards and substitution with lower cost alternatives.

2. Spatial Relationships

a. Core house and components to external conditions

- 1.8m or higher boundary wall around the plot excludes external conditions from life within (South Asia, Latin America, North Africa and Middle East)
- A low wall, fence, shrubbery, etc. delimit a plot but allow visual and vocal communication (Southeast Asia)
- No demarcation around the plot extends an invitation at the expense of privacy and security (sub-Saharan Africa without urban tradition)
- Boundary walls fronting the street but not between plots adds to a feeling of community and open space within the block module with a modest security cost
- Given a low wall or no demarcation, social interaction and communication can be enhanced by

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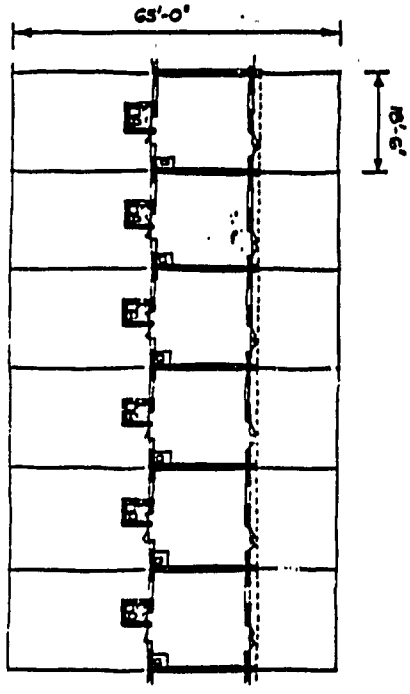
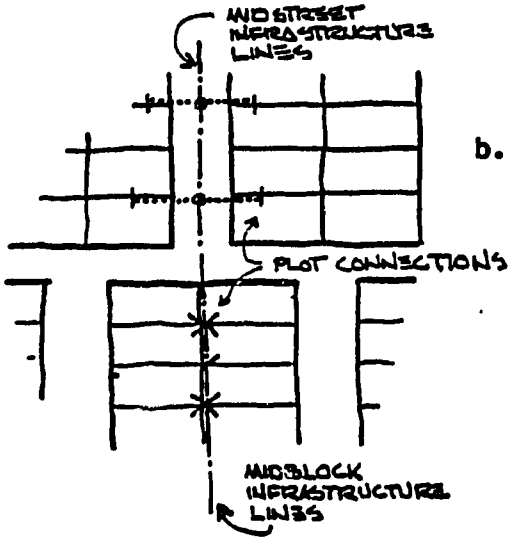
[5]PADCO Final Report: Cameroon Low-Income Housing Project. 1981, p.57.





location of a verandah fronting the street or pedestrian path, potentially adding to community self-policing (Caribbean)

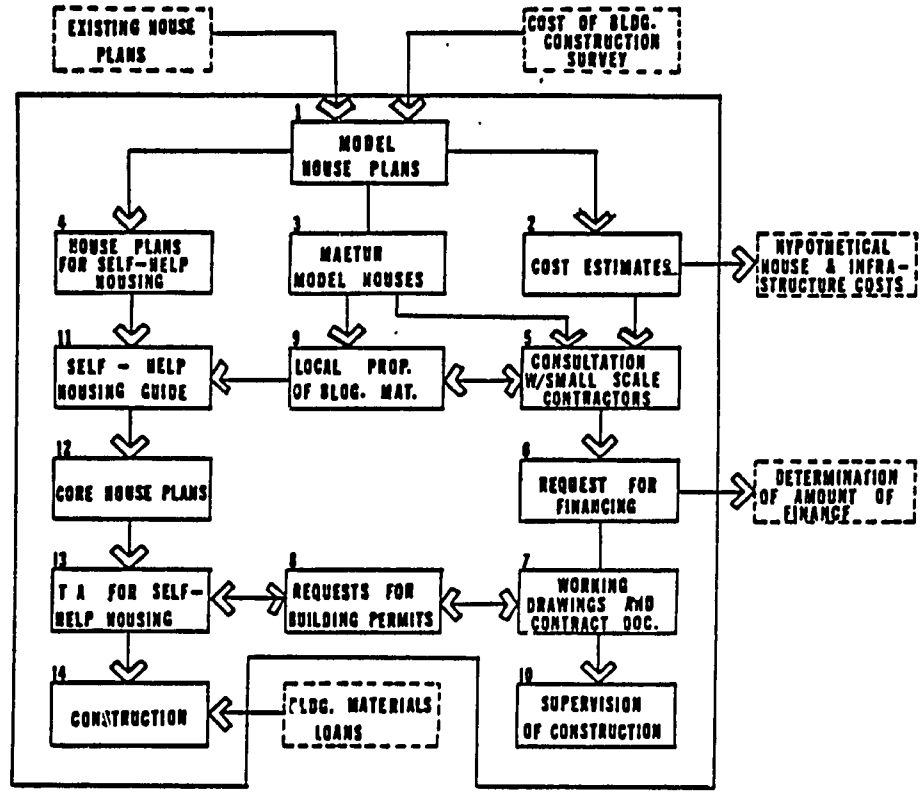
- Wall and room construction along the sides or rear of the plot encourages use of common elements (party walls and concentrated service connections) amongst neighbors and subsequent reductions in construction costs:
  - .. minimum 10cm wall thickness (masonry)
  - .. should be impervious to water, fire-resistant and a good sound barrier
  - .. material should be solid, durable and require no maintenance
  - .. can be no openings and the top of the wall should reach the roof to assure privacy
- Infrastructure lines located in lines of circulation indicate need for sanitary block location toward front of plot and possibility of easily serviceable quad-connection
- Infrastructure lines located down the center of the block minimize connection runs and resultant costs at the expense of necessary rear plot easements (generally 2m) and difficult maintenance access
- Allocation of contiguous plots to members of an extended family or to close friends may reduce costs by avoiding need to build boundary walls
- House and plot runoff should be coordinated with overall site drainage

b. Within the plot

- Core house coverage of the plot, even with maximum anticipated expansion, should generally be limited to 60% but can increase for small plots
- Advantages to sanitary block located behind core house
  - .. proximate to best laundry area
  - .. isolation from public view
  - .. benefits from mid-block infrastructure lines
- Advantages to sanitary block located integral to core house:
  - .. most accessible to house itself
  - .. can integrate into house structure with resultant savings in costs

FIGURE III-8

ACTIVITIES FOR MODEL HOUSE DESIGN AND CONSTRUCTION



SOURCE: USAID/PADCO "Final Report: Cameroon Low-Income Housing Project." 1981, p.55.

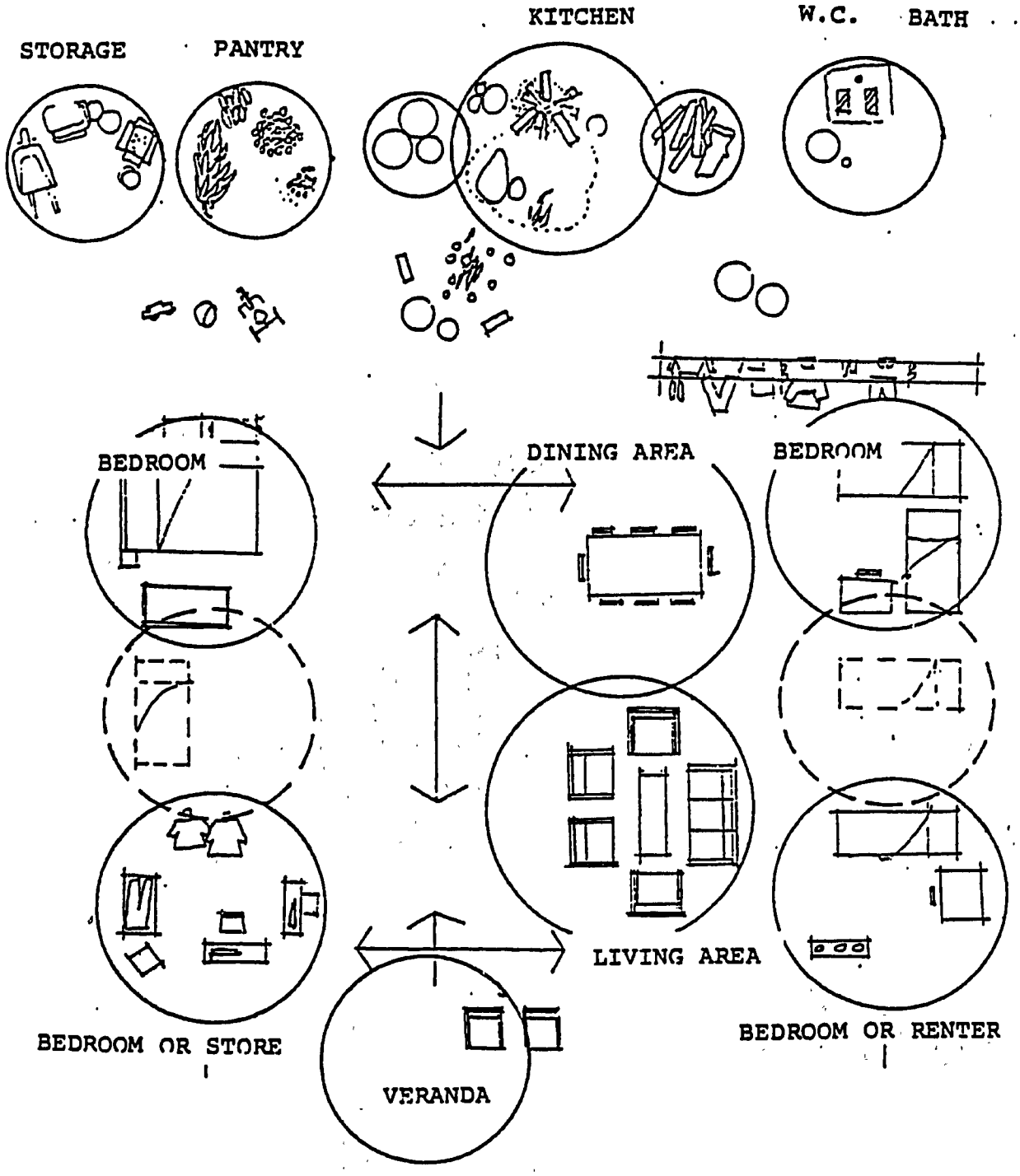
- Advantages to sanitary block located at front of plot:
  - .. benefits from infrastructure lines laid in lines of circulation
  - .. frees rear of plot for cost-saving quadraplex core house plan
- Advantages to setbacks:
  - .. preserve open space for landscaping and outdoor living and work space
  - .. provide additional light and ventilation, as well as increased visual and fire separation between houses
  - .. assure adequate distance between interior living space and potential noise, motor exhaust fumes and other nuisances from the public street
  - .. intercept roof drainage within the lot and allow direct drainage to the street or rear drainage line
  - .. provide corridor for utilities and septic tank/pit privy, with direct access for maintenance or repair
- There should not be any strips narrower than 2m left open between the core house and the plot boundary (useless space) unless absolutely needed for front to back circulation

c. Between components

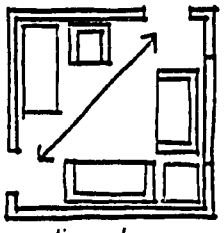
- Figure III-9 shows a functional layout of a typical house in the Cameroon that helps clarify the interrelationships between design components and activities
- Where the norm is one family/one room (reflecting a large percentage of renters, as in Kenya), it may be necessary to provide separate access to each multipurpose or bedroom and direct unencumbered access from each to the kitchen area
- Depending on the type of privy (pit type being the worst), it should be separated from the kitchen and living areas of the house structure to eliminate smell and possible contamination
- In smaller core houses interior partitions should not be provided except for structural purposes
- Small houses should be designed in terms of areas for related activities rather than individual rooms

FIGURE III-9

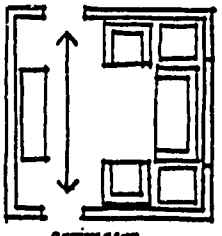
FUNCTIONAL LAYOUT OF A TYPICAL HOUSE
(Cameroon)



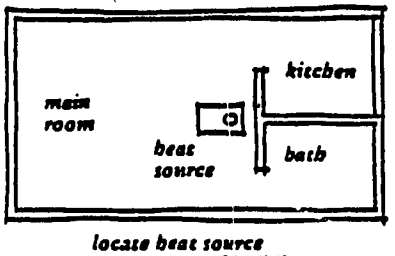
SOURCE: USAID/PADCO "Final Report: Cameroon Low-Income Housing Project." 1981, p.31.



Diagonal circulation makes room difficult to use.



perimeter circulation creates quiet, "dead-end" space.



locate heat source near center of building

and of activity centers rather than a series of tiny rooms

- Circulation space should either be kept to a minimum or it should be enlarged somewhat to accommodate another activity
- Circulation space crossing a room on a diagonal wastes space; it should be planned along a space's perimeter
- The location of the kitchen area should take into consideration the frequent carrying in of supplies
- An entry porch can act as a transition zone helping to keep the house clean during rainy and muddy days

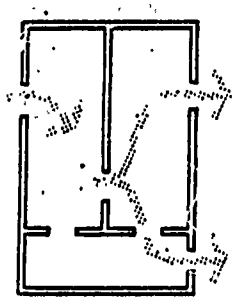
3. Response to Natural Environment

a. Cold climates

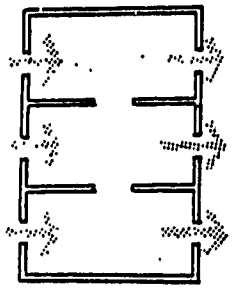
- Building mass should be as compact as possible with a minimum of wall perimeter exposed to the exterior
- Cooking fire and chimney should be located centrally and enclosed in masonry, capturing the heat for radiation
- Attic space should be enclosed to prevent drafts and the ceiling should be insulated
- Windows oriented to the winter sun enable a house interior to warm up during the day whereas shutters will insulate at night to keep the warmth in
- Where tradition provides for family and social gathering space in the kitchen (frequently the only means of heat is the cook fire or stove), such as in Bhutan and Nepal, consideration should be given to making the kitchen as commodious as possible
- Small rooms heat easily

b. Hot climates

- In hot, mid climates, the roof should be solid and heat-storing with a reflective upper surface
- In hot, humid climates, the roof should be thin, light with a reflective upper surface
- Cross-ventilation near the top of each room will rid it of the hottest air (Kenya requires ventilation openings at least equal to one-hundredth of the room's floor area)



WRONG



CORRECT

- Large rooms generate cooling drafts
- Consideration should be given to providing only small windows when possible
- To maximize cross-ventilation, the house should turn a broad side to the prevailing wind with windows and interior partitions creating a smooth flow of air directly through the interior
- Small openings to wind and large ones to lee create suction effects and cooling drafts inside

c. Wind

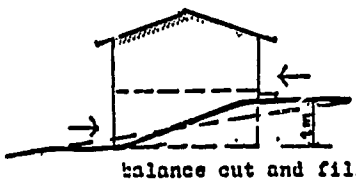
- Courtyard arrangements and staggered alignments of building facades can help diminish strong winds
- Where high and destructive winds predominate from one direction, orient a corner into the wind, if possible
- Wide eaves and roof overhangs are subject to uplift during high winds

d. Insects and pests

- Screened openings, especially in privies and bedrooms should be provided if at all affordable
- Tight joinery in construction and keeping all animals outside (provision of cage or tether space, and access from circulation to plot required) will minimize the problem

e. Slope

HOUSING ON STEEP SLOPE



balance cut and fill

- For 0 to 10% slopes there are few restrictions on buildings, but for slopes over 10% there are restrictions on types of soil, building types, construction systems, foundations and other aspects of buildings
- For slopes over 10% plot access becomes increasingly difficult and may require a different type of house plan and section
- The quadraplex unit is best suited to flat land and adapts poorly to sloping sites

f. Soil conditions: Figure III-10 shows a range of soil types and their relative desirability for various uses.

FIGURE III-10

SOIL CHARACTERISTICS

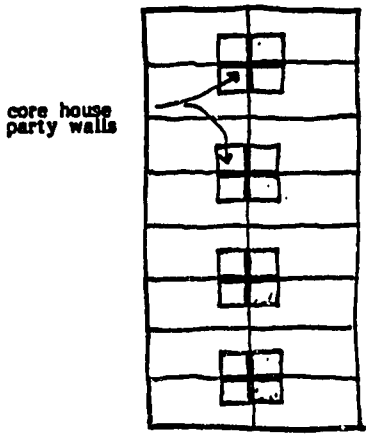
[1] MAJOR DIVISION		[2] GROUPS SYMBOLS	[3] TYPICAL NAMES OF SOIL GROUPS	GENERAL CHARACTERISTICS								RELATIVE DESIRABILITY FOR VARIOUS USES						
												ROADWAYS					FOUNDATION	SEWAGE
				[4] WORKABILITY AS A CONSTRUCTION MATERIAL	[5] COMPACTION CHARACTERISTICS	[6] SHEARING STRENGTH WHEN COMPACTED & SATURATED	[7] COMPRESSIBILITY & EXPANSION	[8] DRAINAGE CHARACTERISTICS	[9] POTENTIAL FROST ACTION	[10] CORROSION POTENTIAL	[11] UNIT DRY WEIGHT LB/CU FT.	[12] SUB BASE WHEN NOT SUBJECT TO FROST ACTION	[13] BASE WHEN NOT SUBJECT TO FROST ACTION	[14] SUB-BASE WHEN SUBJECT TO FROST ACTION	[15] WEARING SURFACE (UNTREATED)	[16] SURFACE STABILIZATION WITH ADDITIVES	[17] LOW BUILDINGS ON COMPACTED FILL	[18] DOMESTIC SEWAGE DISPOSAL AREA
COARSE-GRAINED SOILS	GRAVEL & GRAVELLY SOILS	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.	1	1	1	1	1	1	1	125-140	1	1	1	3	1	1	1
		GP	Poorly graded gravels, gravel-sand mixtures, little or no fine.	2	2	2	1	1	1	1	120-130	2	2	2	3	2	2	1
		GM	Silty gravels, gravel-sand-silt mixtures.	2	3	3	2	3-4	2 3	1	130-145	2	2-4	3	4	1	2	2
		GC	Clayey gravels, gravel sand-clay mixtures	2	3	4	3	5	2 3	2	120-140	2	3-4	3	1	2	3	2
	SANDS & SANDY SOILS	SW	Well graded sands, gravelly sands, little or no fines.	1	1	2	1	1	1	1	110-130	1	2	2	4	1	2	1
		SP	Poorly graded sands, gravelly sands, little or no fines.	3	2	3	1	1	1	1	105-120	3	2-4	2	4	1	3	1
		SM	Silty sand, sand-silt mixtures.	3	3	4	2	3-4	4	1	120-135	3	3-5	4	4	2	3	2
		SC	Clayey sands, sand-clay mixtures.	2	3	5	2-3	5	4	2	105-130	3	5	3	2	2	3	NS
FINE-GRAINED SOILS	SOILS & CLAYS LL 50	ML	Inorganic silts, very fine sands, rock flour, silty, clayey fine sands, clayey silts with slight plasticity.	3-4	3-4	5	2-3	3-4	3-5	2	100-125	4	NS	5	NS	3	4	NS
		CL	Inorganic clays of low to medium plasticity, gravely clays, sandy clays, silty clays, lean clays.	3	3	5	3	5	3-4	3	100-125	4	NS	4	5	4	4	NS
		OL	Organic silts and organic silty clays of low plasticity	4	5	5	3-4	4	3-4	4	90-105	4	NS	5	NS	5	5	NS
	SOILS & CLAYS LL 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	4	4 5	5	4	3-4	3 5	2	80-100	5	NS	5	NS	5	5	NS
		CH	Inorganic clays of high plasticity, fat clays	5	4 5	5	4	5	3	3	90-110	5	NS	4	NS	5	5	NS
		OH	Organic clays of medium to high plasticity, organic silts.	5	5	5	4	3	3	4	80-100	5	NS	5	NS	5	5	NBS
Highly organic soils		PT	Peat and other highly organic soils.	NS	NS		5	3 4	2	5		NS	NS	NS	NS	NS	NS	NS

NOTE: Above soil groups are rated according to relative desirability for being used

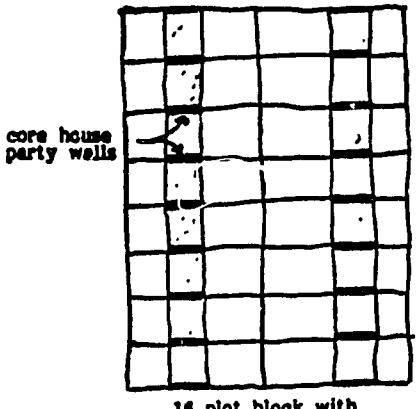
1 - Most desirable (excellent)
2 - Desirable (good)
3 - Medium (fair)
4 - Undesirable (poor)
5 - Most undesirable (very poor)
NS - Not Suitable

LL Liquid limit The water content (0-100%) corresponding to the arbitrary limit between the liquid and plastic states of consistency of a soil

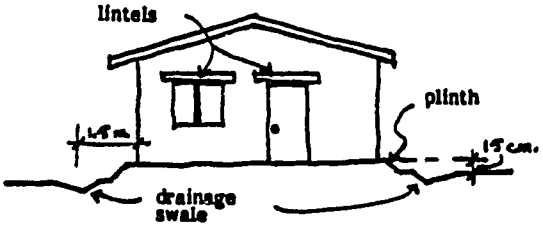
Source: Caminos, H.&R. Goethert. Urbanization Primer, 1978, Cambridge, MA, p.69



16 plot block with quadraplex units



16 plot block with row house units



4. Cost Implications

- Quadraplex and narrow row house configurations are generally the lowest cost units, being more efficient in use of both land and materials
- Figure III-11 charts resulting costs (Kenya, 1970 and Jamaica, 1977) for various combinations of sites and services/core housing components

5. Technical Considerations

- A flat roof is probably the easiest to add to vertically, providing that:
  - .. foundations, walls and columns can support a two-storey load
  - .. structure of flat roof can support floor loads
  - .. annual precipitation is light, as in the case in North Africa, Botswana, Afghanistan, coastal Peru, and other desert regions
  - .. a slight pitch of 1cm/3m allows rainwater runoff
- A shed roof is simple to build, sheds water (and snow), and is a good shape for later horizontal additions and extensions
- Braced corners and preferably a ring beam around the core house help brace the structure against strong winds, flood waters, seismicity, settling and general degradation
- All openings should have lintels and be located away from corners and each other
- Each house should be built upon a platform or plinth (minimum 15cm height but greater depending on drainage and flooding conditions) and surrounded by a drainage swale 1.5m away from walls
- Superstition and religious beliefs frequently have an effect on design; for example,[6] in some Philippine locations steps from the raised house to the ground must face the Southern Cross so the house will always be "occupied," and the number of steps is based on numerological calculations; in some Philippine muslim areas, house sites should slope towards Mecca
- User participation in the design process should be creatively maximized to assure acceptance and proper use of the final product

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[6]Tabujara & Manahan. "Low-Cost Housing in the Philippines" in Goodman, et al, Low-Cost Housing Technology: An East-West Perspective. Elmsford, NY 1979, p.44

FIGURE III-11

SITES AND SERVICES/CORE HOUSING COSTS

INCOMPLETE PERMANENT HOUSING, 3-4 roomed

Components Supplied:

		Road and site £ 75	Comm. service £ 25	Services £100	Hygienic unit £105	Kitchen 5m² £105	Plinth 50m² £125	Roof 50m² £125	One Room 10m² £140	Approximate Cost and Cost Bracket*	
Site Scheme		x								£ 75	(A1)
Site and Service	I	x	x							100	(A1)
	II	x		x						175	(A1)
	III	x		x	x					280	(B1)
	IV	x		x	x	x				385	(B1)
	V	x		x	x		x			380	(B1)
Roof Scheme	I	x	x					x		225	(A2)
	II	x		x				x		300	(B1)
	III	x		x	x			x		390	(B1)
	IV	x		x	x	x		x		470	(B2)
	V	x		x	x		x	x		550	(B2)
Core Housing	I	x	x						x	240	(A2)
	II	x		x					x	315	(B1)
	III	x		x	x				x	420	(B1)
	IV	x		x	x	x			x	525	(B2)
	V	x		x	x		x		x	495	(B2)

*Cost Brackets: A1= £ 0-175 A2= £175-250 B1= £250-425 B2= £425-600

Base of Calculation NHC revised figures May 1970.
Cost of Permanent Housing: 31.5 shs/sqf floor area

3-4 roomed Housing (app. 50 sqm plinth or 45.5 sqm floor area) approximate cost £770 (15.4 £/sqm)

a. part with sanitation: 10 sqm @ £21 = £210
b. part without sanitation: 40 sqm @ £14 = £560, total £770
c. roof: 4.5 shs/sqf or 2.5 £/sqm
d. plinth: 4.5 shs/sqf or 2.5 £/sqm

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Infrastructure

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Chapter IV
Infrastructure

A. Introduction

1. Context

Infrastructure elements are reasonably permanent installations, and once designed and installed, are not often affected by growth. In most cases these are extensions of a much larger service network installed are maintained by non-housing agencies. Regulating the initial level of utilities to plots is the most common way project planners adjust the standards and costs of plots to match families' ability to pay.

2. Major Issues

a. **Affordability** (See Section III.B.1.)

b. **Minimum standards** (See Section III.B.2.)

c. **Cost recovery.** Scarce public funds available for project costs can best be used by designing a mechanism through which the private sector fully pays for infrastructure and other site preparation costs. Cross-subsidization should be considered as a way of reaching the lowest income levels of the population as a means of recovery infrastructure costs.

d. **Maintenance and operations.** Responsibility and continued financing for the maintenance and operations of infrastructure systems after completion must be established and structured during the planning process.

3. **Major Infrastructure Components.** These include circulation, drainage, water supply, sewerage/sanitation, solid waste removal and disposal and electricity and street lighting.

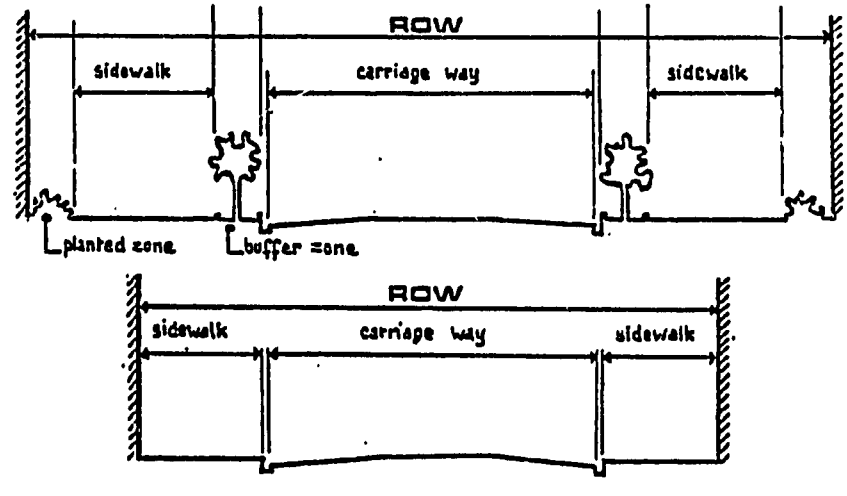
B. Circulation

The primary objective of circulation is to provide adequate and safe means of vehicular and pedestrian circulation. The secondary objective of circulation is to provide storm water drainage, planting areas and on-street vehicle parking.

1. Design Considerations

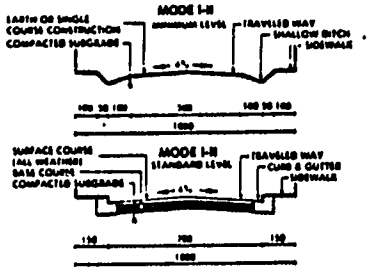
a. General observations

- Minimum standards consist in the basic treatment of the soil to provide a wearing surface for circulation and drainage, and to minimize erosion, dust, mud and maintenance. When possible, this treatment will provide a subgrade for future surfacing or paving
- Upgraded standards consist in the improvement of the minimum level to the level established by local codes in terms of traffic load and bearing capacity
- Circulation right-of-ways (ROWs) consist of:
  - .. carriageways (vehicular circulation and parking lanes
  - .. walkways
  - .. "buffer zones" (median strips, planting areas, etc., most appropriate in major arteries and expressways)



Source: Ministry of Municipal Affairs. A Handbook of Physical Planning Standards. p.30.

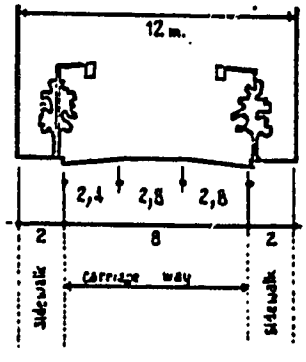
- ROWs should be determined by projected traffic volume, modes of travel, and desired speeds
- Initial level of standards do not affect the width of ROWs
- Figure IV-1 shows ROW cross-sections for minimum and upgraded standards for four specific types of circulation
- Three types of pedestrian ways:
  - .. linkages within residential areas and to minor commercial centers of activity
  - .. linkages and dispersion spaces in active work areas
  - .. recreation and leisure spaces
- Small open spaces associated with pedestrian ways should be integrated into overall land use planning for larger open spaces
- Pedestrians take the shortest route between two points unless constrained by physical barriers or directed to points of visual interest
- The smaller the plot sizes, the more that household activities (i.e. social gatherings, weddings and children's play) will overflow onto circulation ways, making it an extension of the house



Source:
Caminos and Goethent, Urbanization Primer. p.136.

b. Physical standards and technical guidelines

- Figure IV-2 shows physical standards for five types of circulation
- Circulation ways should have a minimum slope of 1% longitudinally and 2-4% from crown to gutter for drainage
- Curb height should be no more than 15cm for pedestrian comfort
- Minimum vehicular lane widths:
  - .. 2.40m to 3.00m (parking)
  - .. 2.80m to 3.20m (up to 60 kph)
  - .. 3.00m to 3.50m (over 60 kph)
- Minimum pedestrian way widths:
  - .. 1.50m (inside residential areas)
  - .. 1.70m (on local streets)
  - .. 2.00m (general, for three people passing)
  - .. 2.40m (beside vehicular parking)
  - .. 3.00m (beside community or commercial facilities)

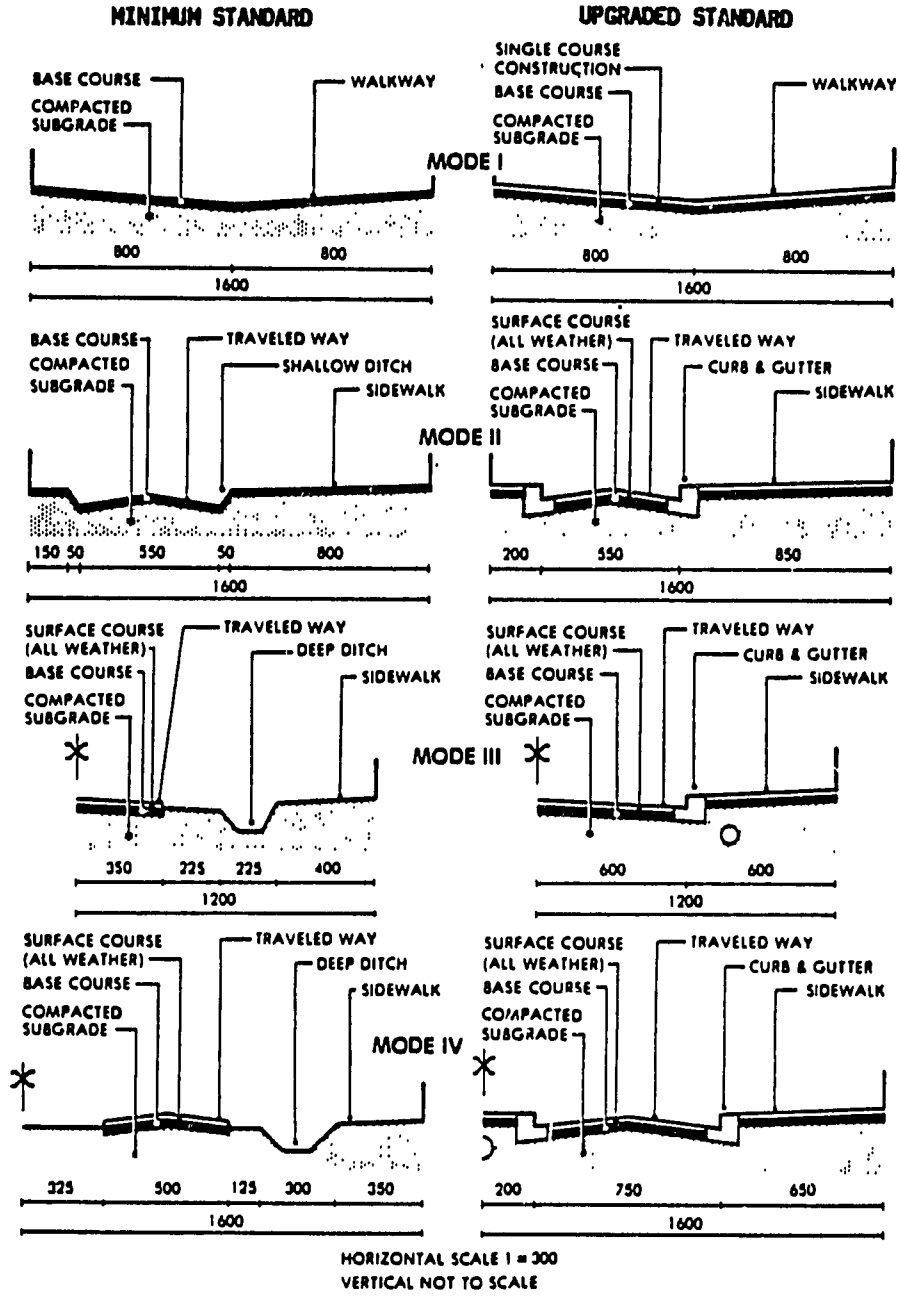


SHORT ACCESS STREET
CUL DE SAC
ROW : 12m

Source:
Ministry of Municipal Affairs. A Handbook of Physical Planning Standards. p.35.

FIGURE IV-1

STREET SECTIONS AT MINIMUM AND UPGRADED STANDARDS



STREET SECTIONS AT MINIMUM AND UPGRADED STANDARDS.
Dimensions are in centimeters.
For "Modes", descriptions, see Figure IV.2.

Source: Caminos and Goethert. Urbanization Primer. p.36.

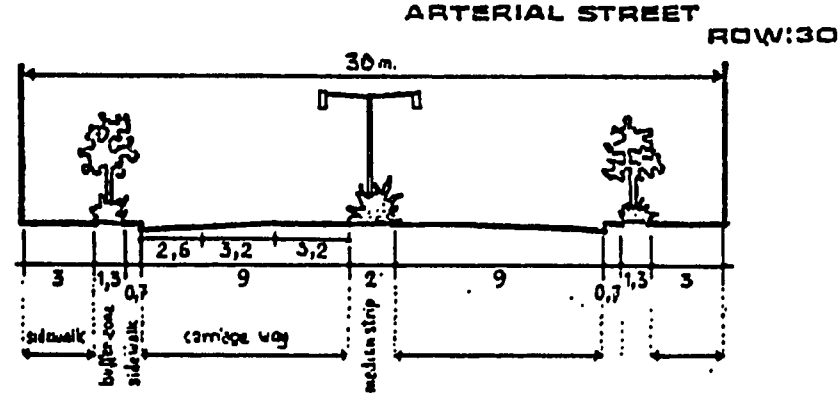
FIGURE IV-2

TABLE OF CIRCULATION MODES, USERS AND ROAD CHARACTERISTICS

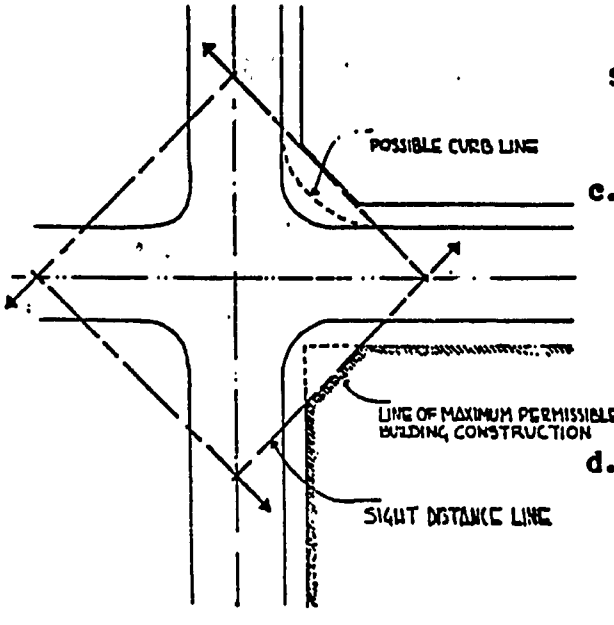
GENERAL TYPES	MODES 1	SPECIFIC TYPES 2	USERS: PEDESTRIAN SPEED Km/H 3	USERS: PEDESTRIAN CHARACTER 4	USERS: AUTOMOBILES SPEED Km/H 5	USERS: AUTOMOBILES CAP. V/L/H 6	USERS: AUTOMOBILES CHARACTER 7	USERS: AUTOMOBILES CONTROL 8	ROAD CHARACTERISTICS: WIDTH m 9	ROAD CHARACTERISTICS: LANES No. 10	ROAD CHARACTERISTICS: GRADES % 11	ROAD CHARACTERISTICS: FUNCTION 12	ROAD CHARACTERISTICS: Accepted SPACING m 13
ACCESS CIRCULATION	PEDESTRIANS	Paths	4	Pedestrian circulation and other social functions: Children games, people gathering, strolling, leisure, etc.	NOT APPLICABLE		NOT APPLICABLE Only emergency vehicles access	Is established by the design, the street layout and use.	1.5-6	NOT APPL.	80	Serve primarily for pedestrian access to interior lots and communal parking facilities. Secondarily for limited and controlled access of service and emergency vehicles such as fire trucks, ambulances, police patrols, etc.	80-200
	PEDESTRIANS (dominate) AND VEHICLES	Residential Street Neighborhood Street Minor Street Local Street	4	Pedestrian circulation, strolling	16 24		Pedestrians dominate over vehicles. Usually local traffic limited to pedestrians and private, emergency, service vehicles	Control of traffic frequency, character and speed are mainly established by the street layout and use.	9-12 12-16	2 3	32	Give access to residential property.	80-200
THROUGH CIRCULATION	VEHICLES AND PEDESTRIANS	Collector Street Secondary Street — Connector Street	4	Pedestrian circulation, strolling	30 40	300	Vehicles dominate but do not control circulation. Usually local and through traffic for all kinds of vehicles and pedestrians.	Controls are established for the protection of pedestrians: crosswalks, traffic lights rails, overpasses and underpasses	12-16 18-22 23-28	3 4	5 to 15	Provide for through traffic, may delineate a neighborhood, give access to communal parking lots, pedestrian paths, service streets and are used for secondary transport routes.	400-800
	VEHICLES (dominate) AND PEDESTRIANS	Inter-Community Access Minor Arterial Distrubutor Primary Street Main Spine R.	4	Pedestrian circulation	60	600 900	Vehicles dominate strongly over pedestrians. Usually through traffic for all kinds of vehicles and pedestrians.	Stricter controls are established for the protection of pedestrians: rails, traffic lights, overpasses and underpasses.	23-28 29-36	4 6	5 to 15	Provide access to the locality from intra-community highways and also usually determine major transportation routes within locality; forms the principal locus or spine of the development.	1200-1600
	VEHICLES	Major Arterials	NOT APPLICABLE		56-72	1000 1800	Exclusive use by vehicles; relatively high speed with large volume of traffic flow. Through traffic for all kinds of vehicles.	Controls for driving safety are established.	29-36	6 or more	2 to 4	Provide unity throughout contiguous urban area. Usually form boundaries for neighborhoods	2400-3200
		Expressways Intra Community Highway			60-80				60-76			Provide metropolitan and city continuity and unity	4000-5000
		Freeway Thruway Railroad Interstate			96 100				60-90			Provide regional and metropolitan continuity and unity	Variable

Source: Caminos and Goethert. Urbanization Primer. p.87.

- Three interrelated elements to be considered regarding intersections:
  - .. angle f intersection (not less than 60°)
  - .. inner curb radius (4m minimum for minor streets, 10m minimum for collector streets, 12m minimum for arterial streets)
  - .. sight distance line (45 kph, 60m; 60 kph, 75m; 80 kph, 100m)



Source: Ministry of Municipal Affairs. A Handbook of Physical Planning Standards. p.34.



Source: Ministry of Municipal Affairs. A Handbook of Physical Planning Standards. p.56.

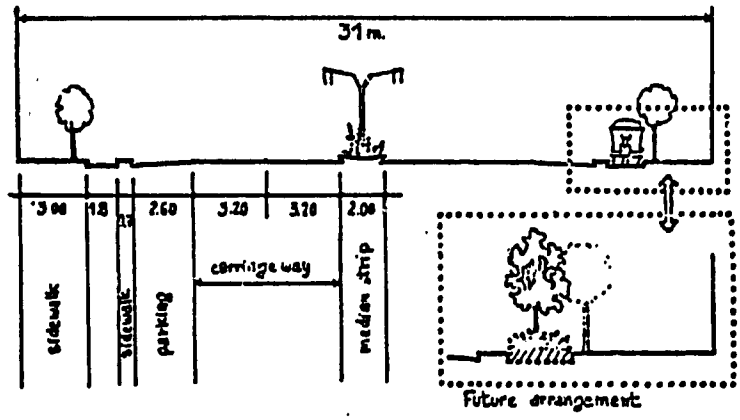
c. **Response to the natural environment**

- The greater the slope of the land, the more roads should parallel contours
- Regions with heavy rainfall, flooding, snowfall or icing require special consideration in drainage plans and construction

d. **Response to the cultural environment**

- Local norms will help determine modes of travel, travel times for particular trips, speeds and frequency of trips
- Road design may have to consider special features such as separate lanes for bicycles, animals and animal drawn carts

Special design for low speed vehicles



Source: Ministry of Municipal Affairs. A Handbook of Physical Planning Standards. p.50.

2. Cost Considerations

- Circulation and accompanying drainage generally account for the highest proportion (35% to 45%) of on-site utility costs, and 10% to 15% of total site costs
- Additional costs incurred in upgrading from minimum standards are generally greater for circulation and drainage than for other infrastructure elements (Figure IV-3)
- Labor intensive technologies should be maximized especially in circulation and drainage provision because they carry the highest cost of labor and may not require much specialized skills
- Median strip provision means less private land and less potential for cost recovery
- Figure IV-4 illustrates that per capita costs of circulation increase as land requirements increase and gross densities decrease.

C. Storm Water Drainage

The primary purpose of storm water drainage is to remove storm water runoff to prevent flooding.

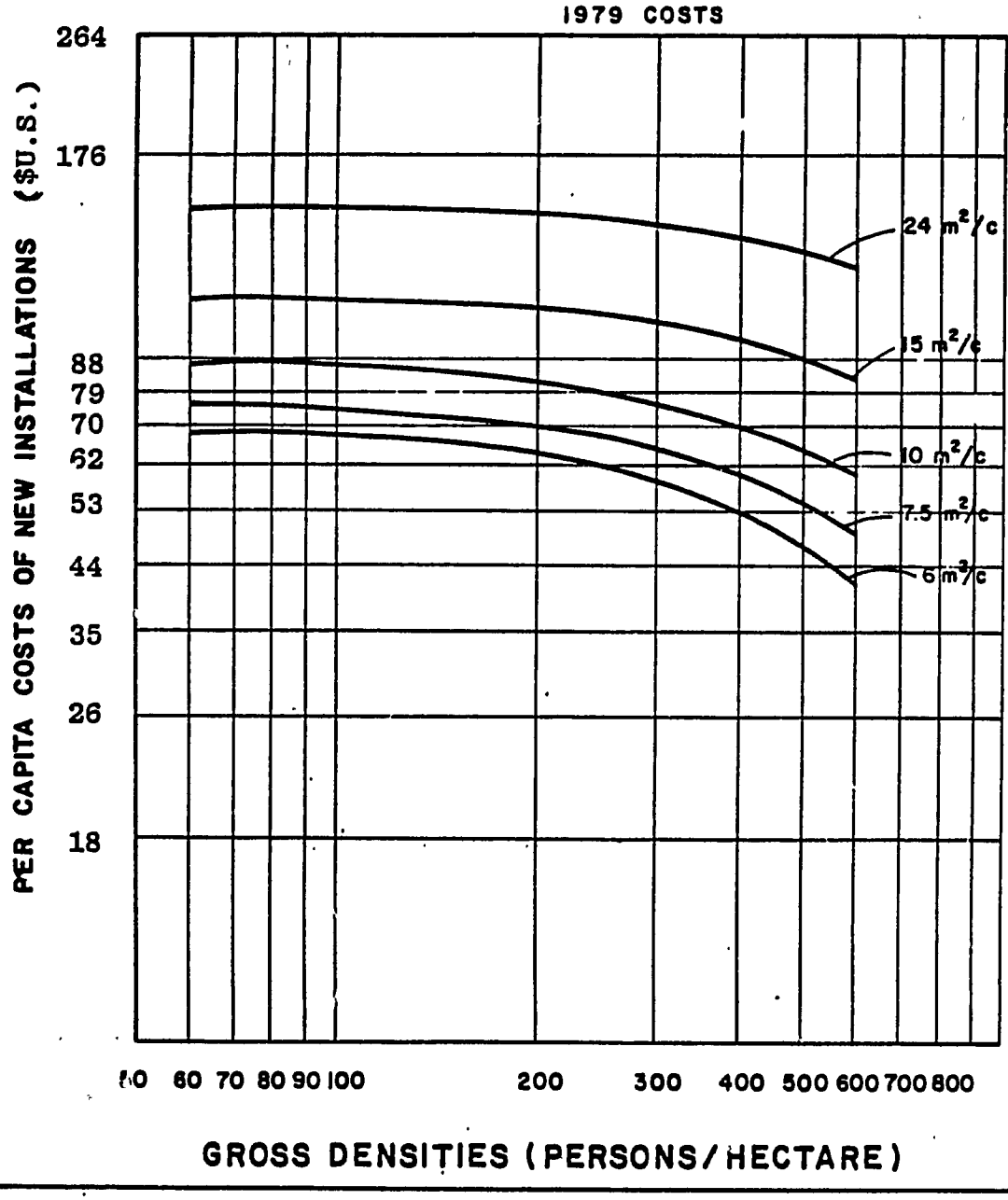
1. Design Considerations

a. General observations

- Minimum standards consist of a system of shallow and deep ditches discharging into natural drainage channels

FIGURE IV-4

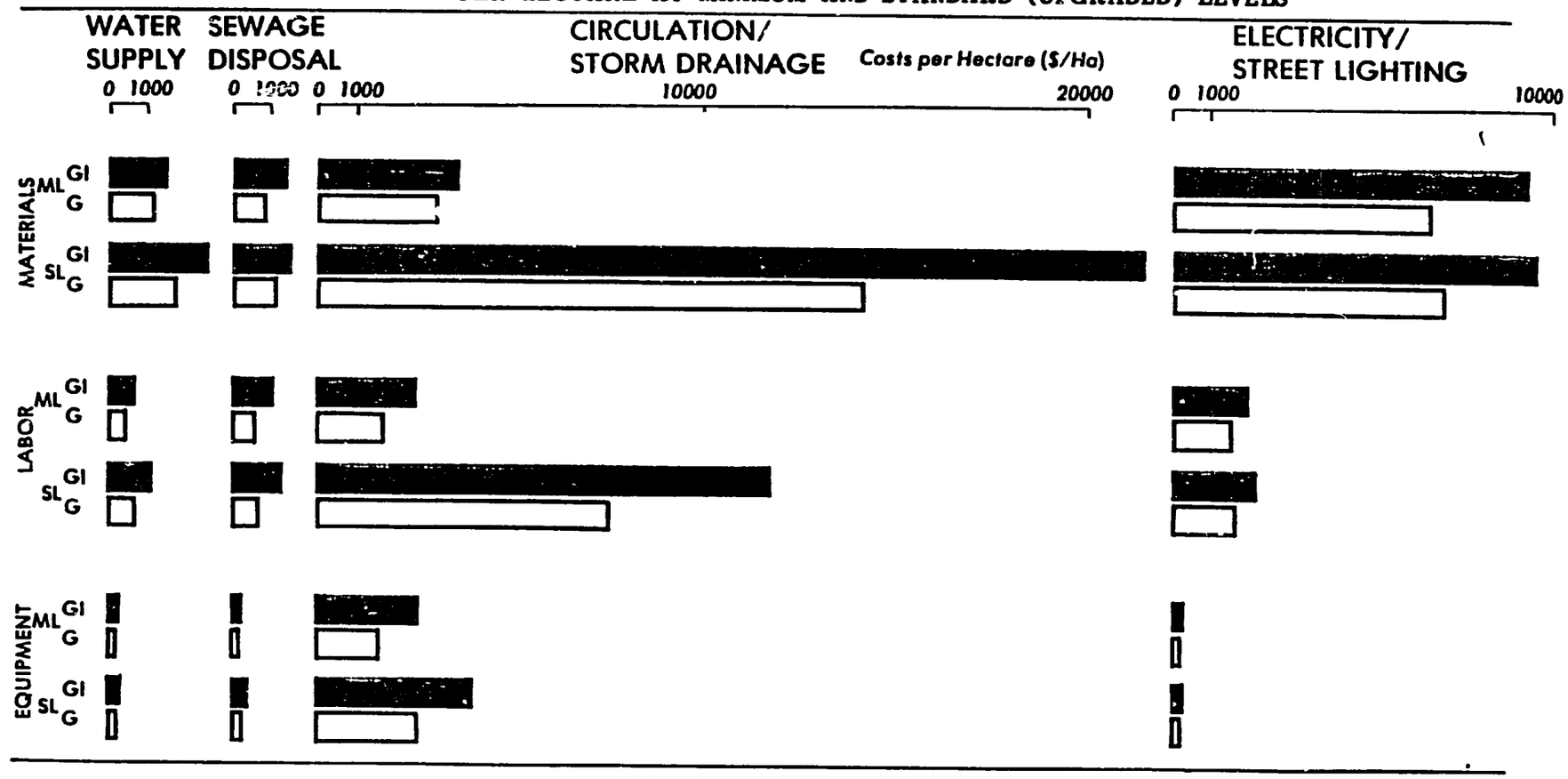
INDICATIVE PER CAPITA CIRCULATION COSTS AT DIFFERENT GROSS DENSITIES AND LAND REQUIREMENTS



SOURCE: Advisory Committee. NUPS. Vol. 2, p.234.

FIGURE IV-3

COSTS OF MATERIALS, LABOR AND EQUIPMENT OF BASIC NETWORKS PER HECTARE AT MINIMUM AND STANDARD (UPGRADED) LEVELS



ML: Minimum Level; SL: Standard Level; GI: Gridiron Layout; G: Grid Layout

SOURCE: Caminos, H. and R. Goethert. Urbanization Primer. 1978, Cambridge, MA. p.162.

The purpose of this chart is to compare costs of materials, labor, and equipment of different basic networks at both minimum/standard levels of services. Two models are used: a *GRIDIRON* layout and *GRID* layout; both have the same lots: 6.03m x 16.66m = 100m^2.

Materials carry the highest total costs at both minimum and standard levels. Electricity/street lighting carry the highest costs of materials at the minimum level; but circulation/storm drainage are the highest at the standard level. Sewage disposal carries the lowest costs at the minimum and standard levels.

- Upgraded standards consist of a system of curb gutters and underground pipes discharging into either natural drainage channels or a more extensive built drainage system
- Primary drainage interceptors for abutting properties are streets
- Flow concentration collectors are ditches and pipes
- Capacity should be sufficient to keep the water running along the ditches or curb gutters and not overflowing onto walkways
- Although designed and constructed similarly, storm water and sanitary sewer lines, if combined, may overload treatment facilities; also, there may be legal problems with combined systems and consumption of water may be inadequate to clear the system in dry periods
- Design of major collectors is crucial; in the Tunis (Mellassine upgrading project - HG 003), for example, inadequate design of a major storm water collector resulted in flooding and severe environmental problems which has taken several years to correct
- drainage components:
  .. ditches and/or pipes
  .. curbs and gutters
  .. curb inlets
  .. manholes

b. Physical standards and technical guidelines

- Figure IV-1 shows cross sections for minimum and upgraded standards for four types of roads and drainage channels
- Shallow ditches can be designed as part of the roads and walkways and should facilitate cleaning (no sharp angles)
- Deep ditches should not be designed in light of the local soil, rainfall and topographic conditions; wide ditches with gently sloping sides facilitate cleaning and minimize accidents
- Pipe sizes are determined by plan layout, soil type and profile, rainfall intensity, gradient and roughness coefficients; pipe material is determined by economy, availability and local regulations

- Size, number and placement of curb inlets determine how free the streets are kept of runoff water; their location next to manholes facilitates cleaning
- Manholes should be located at intersections, bends, dead ends and generally at 100m intervals

c. **Response to the natural environment**

- Flat land requires preparation for drainage
- Land that slopes 5% to 10% facilitates drainage
- Land that slopes more than 20% requires special preparation for drainage
- Drainage plans in regions with heavy snowfall or icing may require special consideration

2. **Cost Considerations**

- See Section IV.B.2 for comments

D. Water Supply

The primary purpose of water supply is to provide the community with an adequate supply of safe, potable water for drinking, cooking, personal hygiene, and sanitary purposes.

1. **Design Considerations**

a. **General observations**

- Minimum standards consist in a limited supply of water within the plot or at a limited distance (usually 100m maximum, but 200m in emergencies) from the plot
- Upgraded standards consist in the full supply of water to each plot
- Water supply components:
  .. source
  .. pumps
  .. supply
  .. lines
  .. valves
  .. filters
  .. service connections

.. meters
.. fire hydrants
.. communal or individual facilities
.. roof tanks

- Individual roof tanks adequate for a day's supply are an upgraded feature and alleviate problems with varying pressure and line supply

b. Physical standards and technical guidelines

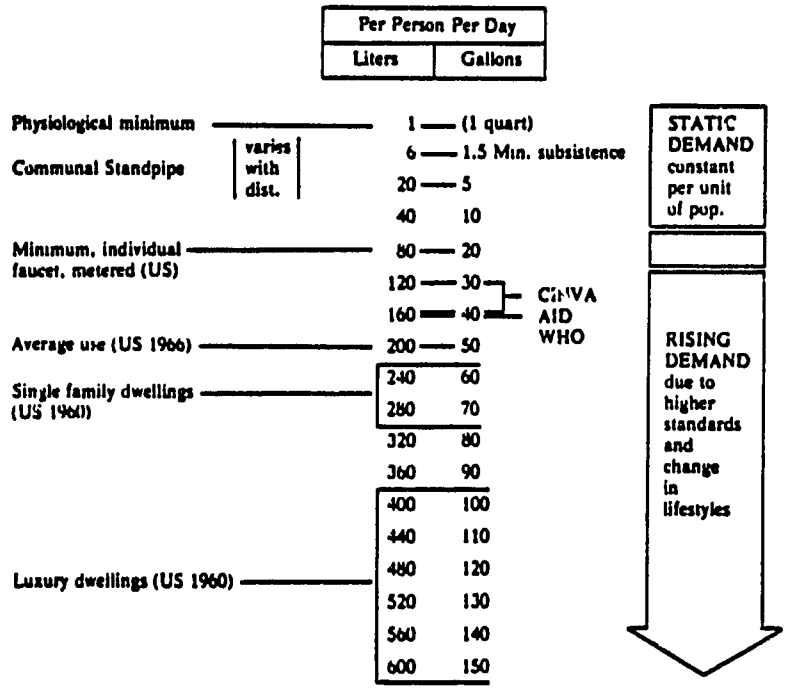
- Water requirements will vary widely according to:
  .. population
  .. climate
  .. standards of living
  .. extent of water-bourne sewerage
  .. water pricing
  .. extent of private supplies
  .. water quality
  .. type and scale of commercial and industrial activities
  .. use of meters
  .. distribution system pressure
  .. system management
- Figure IV-5 shows the range of water demand per person per day with regard to actual demands and various standards
- Water pipes should be located under public roads and walkways for maintenance and repair; they should be buried at least .5m and should not be placed in the same trench with sewers; the trench should have a good foundation and be tested for leakage after installation
- Piped water systems should be laid out, if possible, with no dead ends in order to facilitate flow and eliminate stagnant water
- Choice of pipe materials should be determined by availability, cost, local regulation and the chemical composition of the soil and water
- Fire hydrants, if feasible, should be located no more than 200m (100m preferred) from any plot

c. Response to natural environment

- Usual sources for water include lakes and impoundments, rivers, groundwater wells and springs, and occasionally oceans; in selecting a source (if a

FIGURE IV-5

WATER DEMAND PER PERSON PER DAY



CINVA: Centro Interamericano de Vivienda y Planeamiento
AID: Agency for International Development
WHO: World Health Organization

CHART OF WATER DEMAND PER PERSON PER DAY.

The chart above indicates the range of water demand per person per day with regard to actual demands and various standards. Note that the demands in luxury dwellings are approximately 100 times greater than demands in communal facilities. Similar extreme ranges exist for the other utility services.

SOURCE: Caminos, H. and R. Goethert. Urbanization Primer. 1978, Cambridge, MA. p.78.

choice exists), one should assess potential bacterial and chemical contamination, reliability of sufficient quantity and the expense of pumping due to the elevation and distance

- Disinfection (usually with chlorine), filtering (through sand) and "softening" may be required
- In regions with poor quality or supply of potable water (i.e. Belize, Maldives) rain water can be caught and reserved through a roof-gutter-tank system
- Large changes in elevation may require pumps or elevated storage tanks to supply sufficient pressure
- Chemical action of the soil and water will partially determine selection of pipe material
- Water pipes must be buried below the frost line

d. Response to cultural environment

- Before providing communal facilities it is necessary to assess target group acceptance

2. Cost Considerations

- Meters to measure water usage, although costly when first installed, help regularize cost recovery from individual users and prevent undue waste
- Figure IV-6 shows that the cost of water supply increases as per capita consumption rises and gross densities fall

E. Sewerage Sanitation

The primary objective of sewerage/sanitation is the removal and disposal of human waste to prevent pollution, disease and contamination of the water supply.

1. Design Considerations

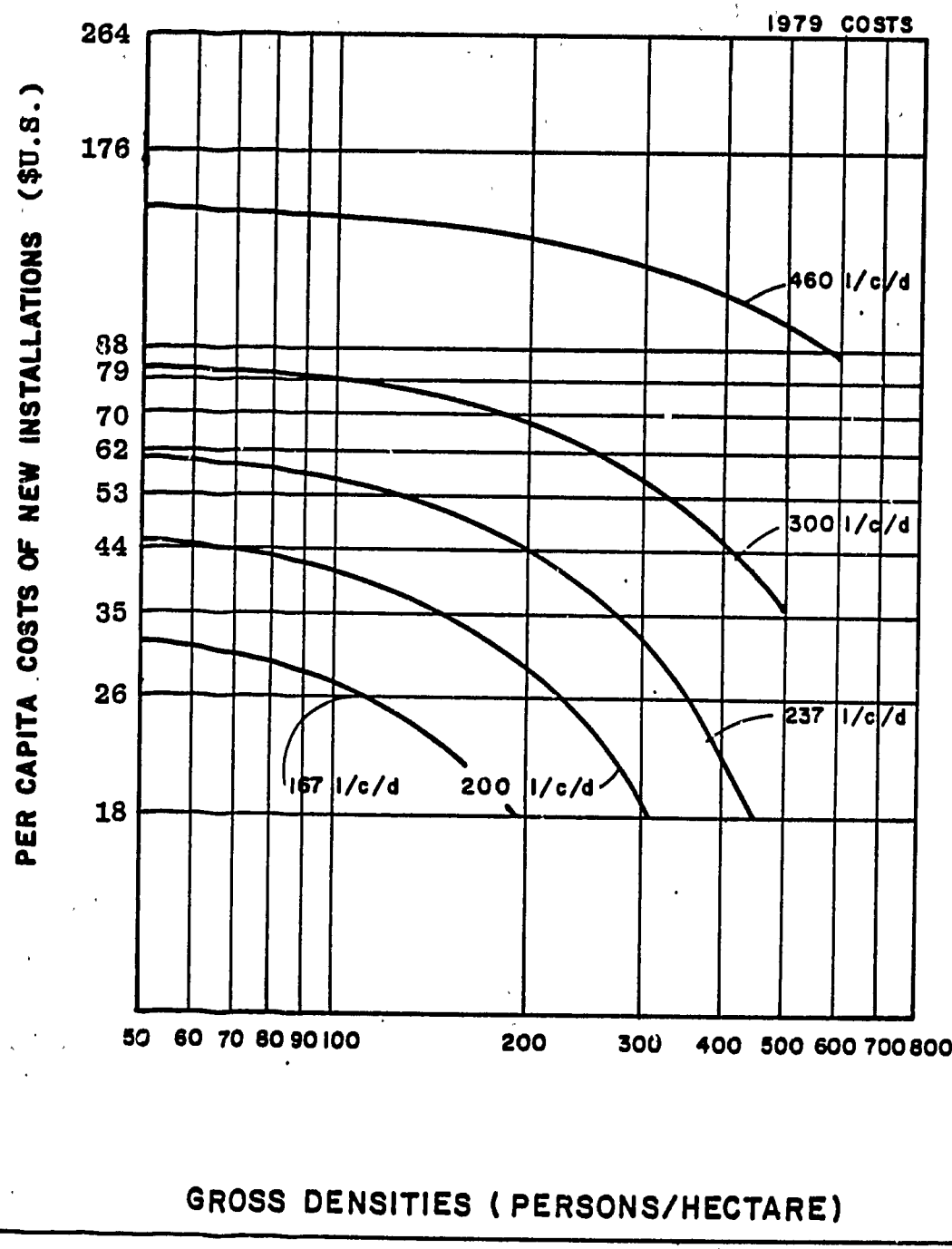
a. General observations

- Minimum standards provide for disposal within 100m of any plot
- Upgraded standards provide for on-site disposal

FIGURE IV-6

INDICATIVE PER CAPITA COST OF WATER SUPPLY

AT DIFFERENT GROSS DENSITIES AND CONSUMPTION RATES



SOURCE: Advisory Committee. NUPS. Vol. 2, p.232.

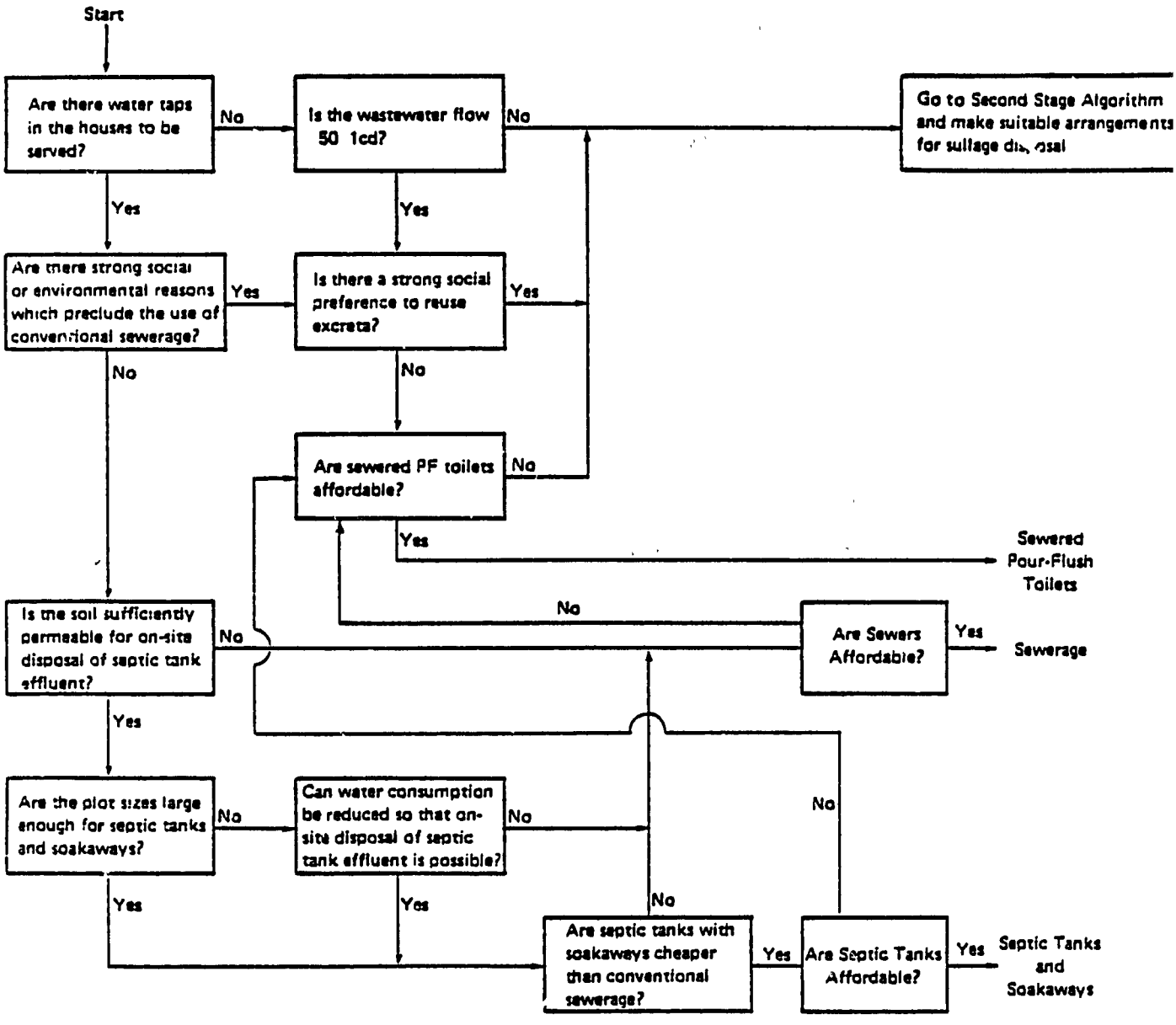
- Household sanitation technologies:
  - .. pit latrines
  - .. pour-flush toilets
  - .. composting toilets
  - .. aquaprivies
  - .. septic tanks
- Community sanitation technologies:
  - .. bucket latrines
  - .. vault toilets with vacuum cart collection
  - .. communal facilities
  - .. sewerage
- Figures IV-7, IV-8 and IV-9 give a step-by-step process for selecting a sanitation technology for a specific project

b. Physical standards and technical guidelines

- Figure IV-10 charts a descriptive comparison of sanitation technologies
- Sanitary sewerage removes approximately 70% of all water supplied
- Pour-flush toilets use a minimum of 50 liters per capita per day (lcd)
- The use of pit latrines and septic tanks generally requires larger plots (minimum 100-200 sq.m depending on soil) providing space for two alternating pit sites or for a drain field
- One family septic tank drain field: minimum 15m length
- One family aquaprivy drain field: minimum 5.4m length
- Communal septic tank drain field: minimum 238m length
- Communal aquaprivy drain field: minimum 60m length
- WHO design criteria:
  - .. 500 gallons: septic tank for one family
  - .. 1 cubic m: aquaprivy tank for one family
  - .. 4 cft: community aquaprivy tank, per person
- Aquaprivies require more maintenance than pit latrines but are less susceptible to blockage
- Bucket latrines create problems of odor, insects, spillage and generally unsanitary conditions

FIGURE IV-7

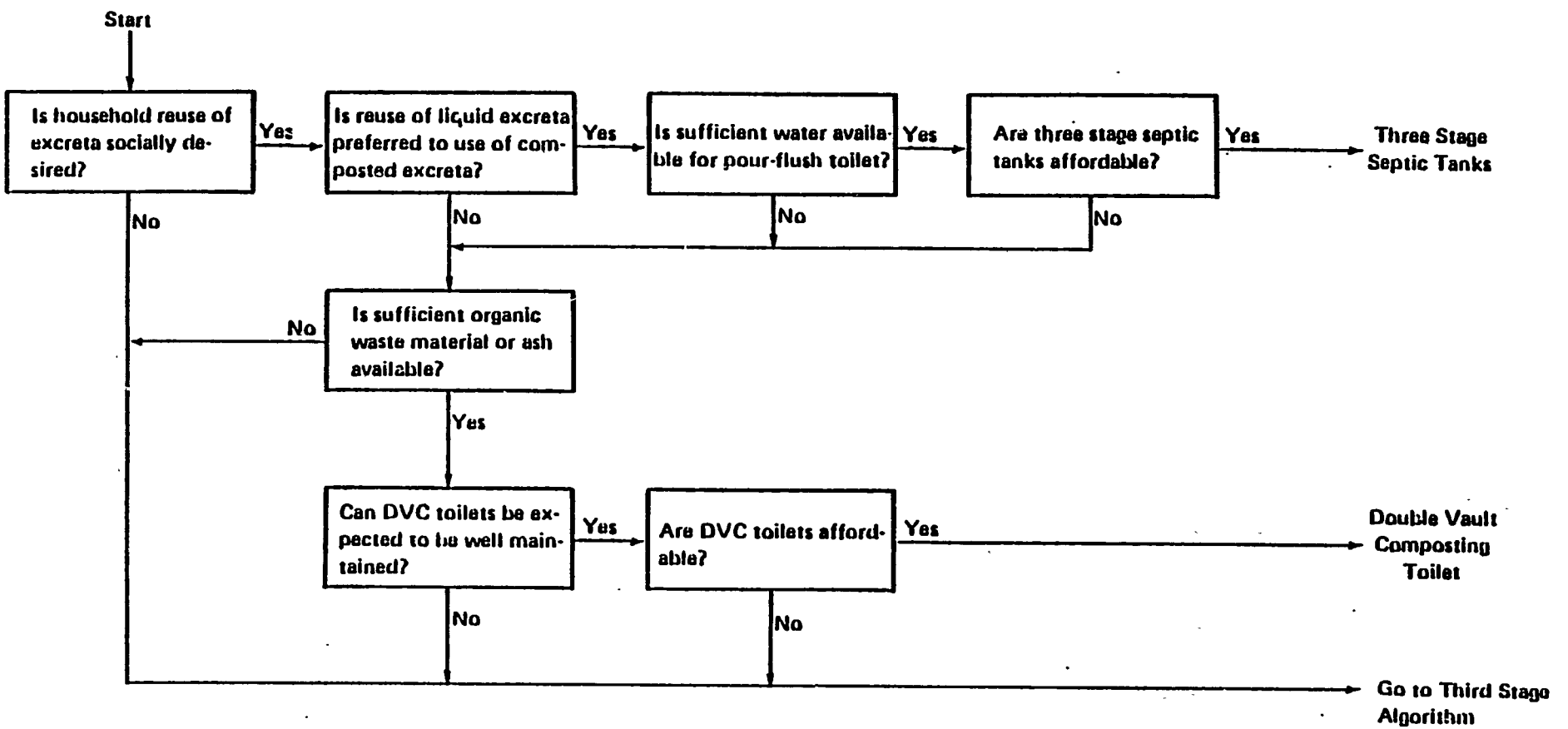
FIRST STAGE ALGORITHM FOR SANITATION TECHNOLOGY SELECTION



SOURCE: The World Bank; Energy, Water and Telecommunications Department. Appropriate Sanitation Alternatives: A Technical and Economic Appraisal, Summary Report. P.U. Report No. RES. 20. Washington, DC. The World Bank, 1979, p.3.

FIGURE IV-8

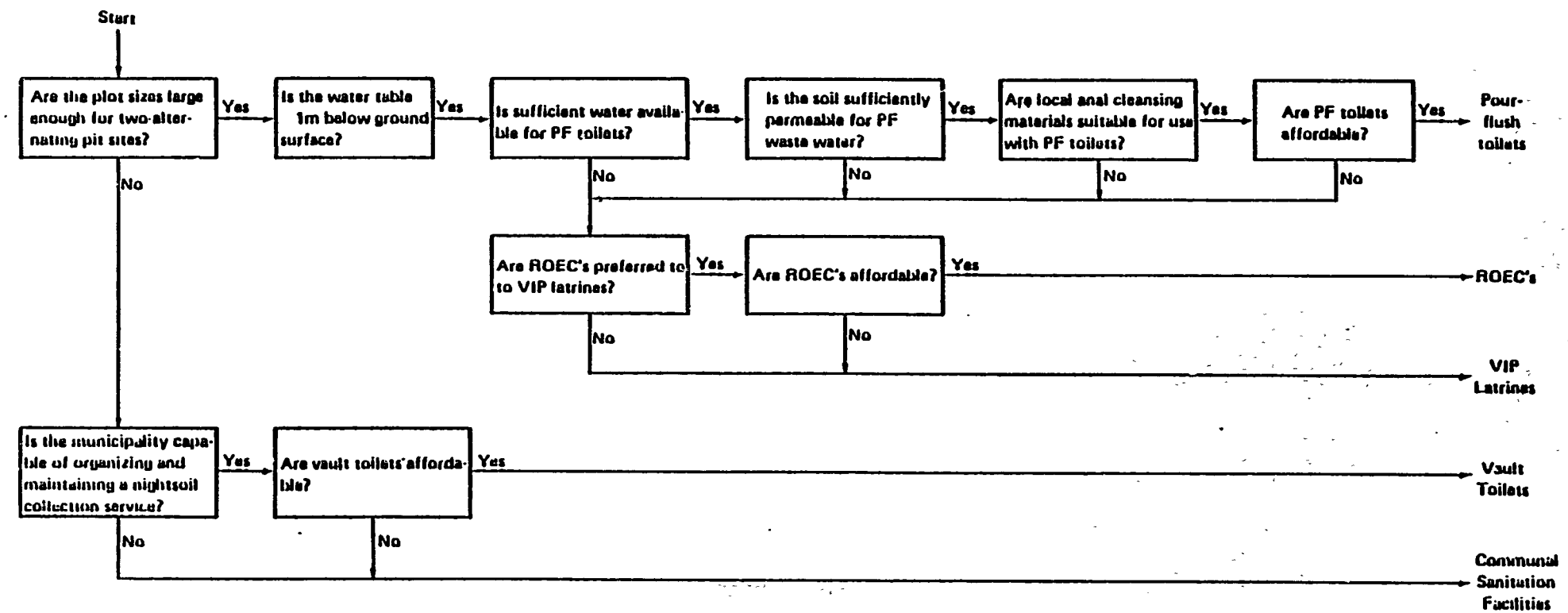
SECOND STAGE ALGORITHM FOR SANITATION TECHNOLOGY SELECTION



SOURCE: The World Bank; Energy, Water and Telecommunications Department. Appropriate Sanitation Alternatives: A Technical and Economic Appraisal, Summary Report. P.U. Report No. RES. 20. Washington, DC. The World Bank, 1979, p.33

FIGURE IV-9

THIRD STAGE ALGORITHM FOR SANITATION TECHNOLOGY SELECTION



SOURCE: The World Bank; Energy, Water and Telecommunications Department. Appropriate Sanitation Alternatives: A Technical and Economic Appraisal, Summary Report. P.U. Report No. RES. 20. Washington, DC. The World Bank, 1979, p.32

FIGURE IV-10

DESCRIPTIVE COMPARISON OF SANITATION TECHNOLOGIES

Sanitation technology	Rural application	Urban application	Construction cost	Operating cost	Ease of construction	Self-help data potential	Water requirement	Required soil conditions	Complementary off-site investments	Reuse potential	Health benefits	Institutional requirements
Pit latrines	Suitable	Not suitable	Low	Low	Very easy except in wet or rocky ground	High	None	Stable permeable soil; ground water table 1 m below surface	Sullage disposal facilities	Low	Good	Low
Composting toilets	Suitable	Not suitable in high density areas	Low	Low	Easy	Medium	None	None (can be built above ground)	Sullage disposal facilities	High	Moderate	Low
Chinese 3 Stage septic tank	Suitable	Not suitable	Medium	Low	Requires skilled builder	Medium	Water near toilet	None (can be built above ground)	Sullage disposal facilities	High	Moderate	Low
Vault toilets and vacuum trucks	Not suitable	Suitable where vehicle access and maintenance available	Medium	High	Requires skilled builders	High	Water near toilet	None (can be built above ground)	Sullage disposal and off-site treatment facilities	High	Good	Very high
Pour-flush toilets	Suitable	Not suitable in high density areas	Low	Low	Requires skilled builder	High	Water near toilet	Stable permeable soil; ground water table 1 m below surface	Sullage disposal facilities	Low	Very good	Low
Sewered Pour-flush	Not suitable	Suitable	High	Medium	Requires skilled engineer	Low	Water piped to house	Preferably stable soil, no rock	Off-site treatment facilities	Low	Excellent	High
Conventional sewerage	Not suitable	Suitable where it can be afforded	Very high	Very high	Requires skilled engineer	Low	Water piped to house and toilet	Preferably stable soil, no rock	Off-site treatment facilities	High	Excellent	High
Septic tanks	Suitable for rural institutions	Suitable in low density suburbs	Very high	Very high	Requires skilled builder	Low	Water piped to house and toilet	Permeable soil; ground water table 1 m below surface	Off-site treatment facilities	None	Excellent	Low

SOURCE: The World Bank; Energy, Water and Telecommunications Department. Appropriate Sanitation Alternatives: A Technical and Economic Appraisal, Summary Report. P.U. Report No. RES. 20. Washington, DC. The World Bank, 1979, p.17.

- Vault toilets (extensively used in East Asia and to a lesser degree in North Africa) require only 3-6 lcd and can easily be upgraded to a sewered pour-flush system
- Minimal quantities of water and fewer connections require greater pipe slope to maintain a minimum velocity of 0.45m/sec. to retard settling of sediment
- Drain fields should be kept a minimum of 30m from surface water or well, and should not be shaded or crossed by vehicles
- Maximum population density for on-site disposal systems:
  - .. 250-300 p/h (single-storey homes)
  - .. 500-600 p/h (two-storey homes)
  - .. 1000 p/h (exceptional cases found in North Africa)
- Grey water is good for irrigation
- Choice of pipe materials should be determined by availability, cost, local regulations and soil characteristics

c. Response to the natural environment

- See Figure IV-10 for comments
- Conventional sewerage systems require steep enough gradients to provide self-cleansing velocities whereas flatter gradients are more appropriate for pour-flush and other technologies using drain fields
- Pipe layout should take advantage of the natural contours of the land
- Pipes should be buried below the frost line

d. Response to the cultural environment

- Community toilets are prone to maintenance problems and may not be culturally appropriate
- In Latin America and other regions where personal cleansing uses solid matter, pour-flush and cistern-flush toilets may not be appropriate; conversely, where cleansing uses water (i.e. South Asia), pit latrines and composting toilets may be inappropriate

2. Cost Considerations

- Figure IV-11 shows that sewerage system installation costs increase with greater total sewerage flows and lesser gross densities
- Figure IV-12 shows average annual costs per household for twelve sanitation technologies
- Figure IV-13 shows financial requirements for investment and recurrent costs per household for 12 sanitation technologies

F. Solid Waste Removal and Disposal

The primary objective of solid waste removal and disposal is the riddance of garbage and other solid wastes to avoid disease and a littered environment.

1. Design Considerations

a. General observations

- Minimum standards consist of the designation of refuse collection points within the neighborhood and weekly removal by public vehicles
- Upgraded standards consist of the construction of collection bins within 100m of any plot, or door-to-door collection by public vehicle, on a bi-weekly or more frequent basis
- The type and location of disposal facilities should be planned together with the removal system; Figure IV-14 shows both a classification of solid waste types and a discussion of disposal technologies
- Unsupervised open spaces, especially near commercial areas, tend to collect refuse

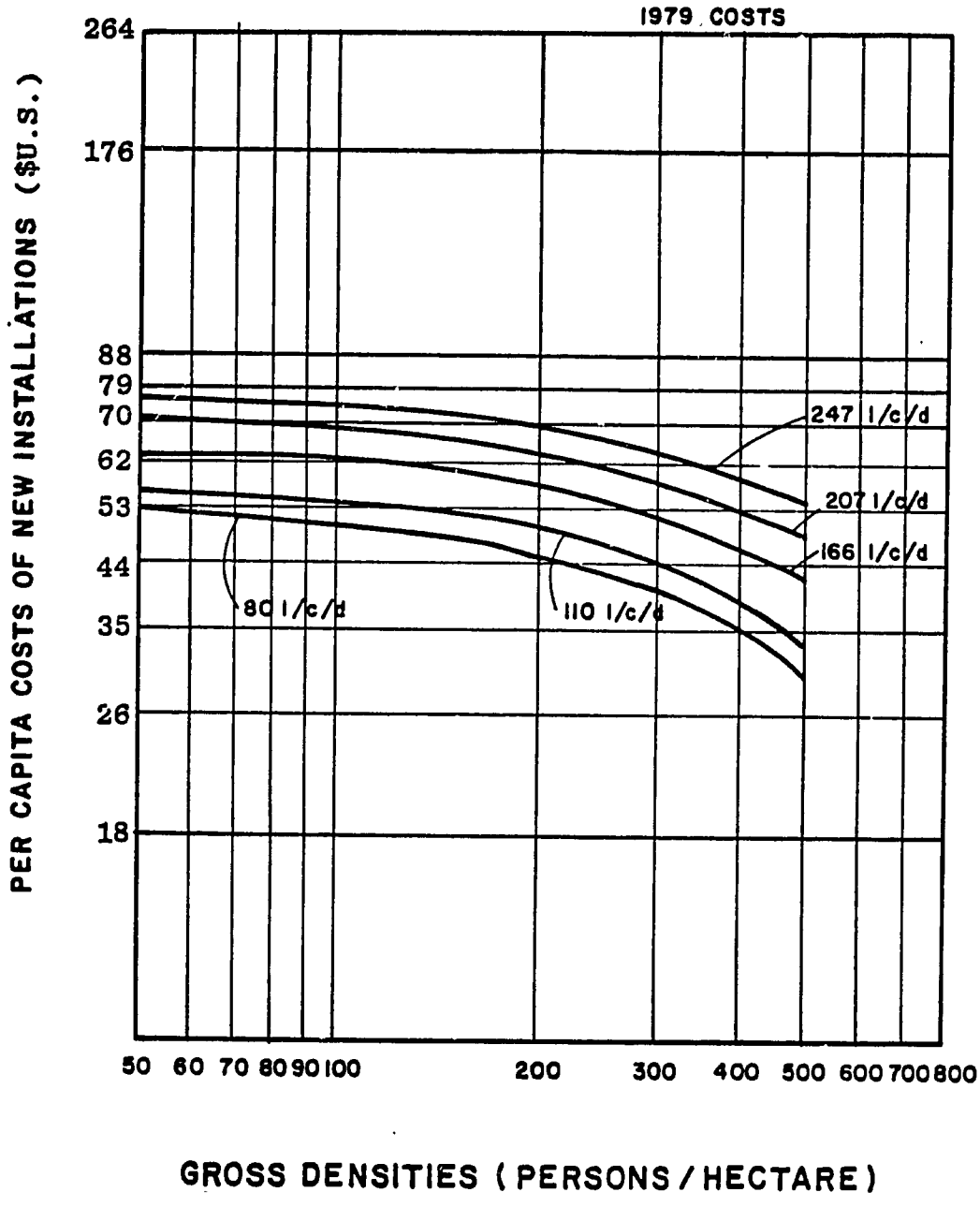
b. Physical standards and technical guidelines

- Door-to-door collection requires accessways of sufficient width to allow passage of carts or trucks (2-4m)
- Collection bins should be sized according to the quantity of solid waste generated, the number of plots serviced and the frequency of service

FIGURE IV-11

INDICATIVE PER CAPITA COSTS OF SEWERAGE SYSTEMS

AT DIFFERENT GROSS DENSITIES AND TOTAL SEWERAGE FLOWS



SOURCE: Advisory Committee. NUPS. Vol. 2, p.233.

FIGURE IV-12

AVERAGE ANNUAL ON-SITE, COLLECTION, AND TREATMENT COSTS PER HOUSEHOLD (1978 $)

	Mean TACH	On-Site Costs	Collection Costs	Treatment Costs
Low Cost				
Pour flush toilet	18.7	18.7	—	—
Pit privy	28.5	28.5	—	—
Communal toilet	34.0	34.0	14.0	6.6
Vacuum truck cartage	37.5	16.8	—	—
Low-cost septic tanks	51.6	51.6	—	—
Composting toilets	55.0	47.0	—	8.0
Bucket cartage1/	64.9	32.9	26.0	6.0
Medium Cost				
Sewered aquaprivy1/	159.2	89.8	39.2	30.2
Aquaprivy	168.0	168.0	—	—
Japanese vacuum truck	187.7	128.0	34.0	26.0
High Cost				
Septic tanks	369.2	332.3	25.6	11.3
Sewerage	400.3	201.6	82.8	115.9

1/ To account for large differences in the number of users, per capita costs were used and scaled up by the cross-country average for six persons per household.

FIGURE IV-13

FINANCIAL REQUIREMENTS FOR INVESTMENT AND RECURRENT COST PER HOUSEHOLD (1978 $)

	Total Investment Cost	Monthly Recurrent Cost	Hypothetical Total Monthly Cost 1/	% of Income of Average Low-Income Household 2/ (percent)
Low Cost				
Pour flush toilet	70.7	0.5	2.0	2
Pit privy	123.0	—	2.6	3
Communal facility 1/	355.2	0.9	8.3	9
Vacuum truck cartage	107.3	1.6	3.8	4
Low-cost septic tanks	204.5	0.9	5.2	6
Composting latrine	397.7	0.4	8.7	10
Bucket cartage 1/	192.2	2.3	5.0	6
Medium Cost				
Sewered aquaprivy 1/	570.4	2.9	10.0	11
Aquaprivy	1,100.4	0.5	14.2	16
Japanese cartage	709.9	5.0	13.8	15
High Cost				
Septic tanks	1,645.0	11.8	25.8	29
Sewerage (Design Population)	1,478.6	10.8	23.4	26

1/ Assuming investment cost is financed by loans at 8% over five years for the Low-Cost Systems, ten years for the Medium Cost Systems and 20 years for the High-Cost Systems.

2/ Assuming average annual income per capita of $180 and six persons per household.

- The quantity of solid waste is determined by:
  - .. population size
  - .. type and intensity of land use
  - .. consumption patterns
  - .. saleability of household refuse
  - .. amount of on-site disposal
  - .. cost of collection

c. **Response to the natural environment**

- Consideration should be given to restricting vehicular access to ravines and natural drainage channels which tend to collect refuse
- The frequency of collection in warm climates should be twice that in cold climates
- Covered bins and garbage cans, and wrapped garbage (usually not feasible) help control pests and diseases and can allow less frequent collection

d. **Response to the cultural environment**

- An education and orientation program may be necessary to ensure that people use communal collection bins as designed
- In evaluations of completed sites and services projects, poor waste removal is one of the most often cited problems
- In some countries such as India, refuse removal and disposal is the specific task of certain peoples, thus placing constraints on the acceptability of communal bins to which everyone must carry his own

2. **Cost Considerations**

- In the poorest LDCs, refuse collection and disposal is a service that people frequently pay to perform as the sorted refuse is a source of income

FIGURE IV-14

SOLID WASTE TYPES AND DISPOSAL TECHNOLOGIES

•*GARBAGE:* wastes from preparation, cooking, serving of food.

•*RUBBISH:* combustible: paper, cardboard, wood, plastics, rags, cloth, leather, grass, leaves, etc.; noncombustible: metals, cans, soil, stones, bricks, glass, etc.
•*ASHES:* residue from fires used for cooking or heating.
•*BULKY WASTES:* large auto parts, tires, large appliances, furniture, trees, stumps, branches, etc.; require special collection arrangements, vehicles.
•*STREET REFUSE:* street sweepings, leaves, catch basin dirt, contents of litter receptacles.
•*DEAD ANIMALS:* from cats, dogs, to horses, cows; require special arrangements.
•*ABANDONED VEHICLES:* autos, trucks; require special equipment.
•*CONSTRUCTION, DEMOLITION WASTES:* lumber, roofing, rubble, conduit, wire, insulation, etc.; require special collections.
•*INDUSTRIAL WASTES:* residues of industrial processes/manufacturing operations; removal should be the responsibility of the industry.
•*SPECIAL WASTES:* hazardous: pathological wastes, explosives, radioactive materials; security wastes: confidential documents, negotiable papers, etc.; require very special handling and disposal.
•*ANIMAL, AGRICULTURAL WASTES:* manures, crop wastes; collected only when agricultural areas are engulfed by urban growth.
•*SEWAGE TREATMENT RESIDUES:* coarse screenings, grit, sludge, etc.

Source: Caminos and Goethert. Urbanization Primer. p.80.

Type of refuse disposal	Advantages	Disadvantages	Central Location	Area required
DUMP Refuse is simply dumped in a designated area. Garbage or rubbish may or may not be separated. Refuse is periodically burned, separated and ploughed under. Generally utilised by small towns with ample open land.	Provides fill for marginal areas. Inexpensive, simple operation and supervision.	Propagation of insects. Propagation of rats and other rodents. Offensive odour produced.	Distance from residential areas located so that wind blows odour away from developed areas. Possible in industrial areas.	6000 m^2 per 10,000 pop. served.
SANITARY FILL Process is similar to dumping, except that refuse is covered over with earth. Dump areas are well organised and specified. Garbage decomposes and fill. Generally used by medium or high density urban areas.	Relatively inexpensive. Simple operation. Provides fill for marginal areas.	Requires constant supervision. May develop insects and rats if poorly operated.	Marginal areas requiring fill.	1.6 ha per 10,000 pop. served.
COMPOSTING Controlled decay of organic matter in a warm, moist environment, by the action of bacteria, fungi, molds and other organisms. Garbage is deposited on piles kept moderately moist. Piles are regularly overturned and mixed for a mixing of air, the process may be done mechanically or by hand in simpler operations.	Relatively inexpensive and simple operation. The end product is very useful as agricultural soil conditioner, so the system may be profit making.	Market for compost soil conditioner must be developed for final disposal of end product. If poorly operated it becomes little more than an open dump.	Preferably on outskirts of city away from residential areas. Advantageous location near agricultural area.	1.2 ha per 10,000 pop. served.
INCINERATOR Destruction by fire of all the refuse in a furnace. The refuse is delivered to the incinerator plant and burned. There are different types of incinerators and each must be carefully engineered. Usually restricted to high density urban areas.	No insects. No rats. Clean operation. Used in combination with Sanitary Fill. Process can be used to make steam to be supplied as a power source.	Relatively expensive in initial cost and operation. Building adds to air pollution. Complicated operation.	In most industrial areas regardless of wind direction.	1.2 ha per 10,000 pop. served.

Source: Ministry of Municipal Affairs. A Handbook of Physical Planning Standards. p.1[illegible].

G. Electricity and Street Lighting

The primary objective in electricity and street lighting is to provide power to each plot for domestic requirements, to provide illumination at night in the streets for safety and activities, and to provide power for public utilities and communications.

1. Design Considerations

a. General observations

- Minimum standards consist in the provision of a high and low tension aerial cable network passing next to but not connecting each plot, with street lamps at each street intersection
- Upgraded standards consist in the connection of each plot to the cable network and the installation of street lamps on each pole
- Electricity and street lighting components:
  - .. high-tension cables
  - .. low tension cables
  - .. transformers
  - .. poles
  - .. service drops
  - .. service meters
  - .. lamps and brackets

b. Physical standards and technical guidelines

- A 120/240V single-phase three-wire system is adequate for lighting, appliances and up to 5HP motors used in some shops
- Maximum circuit length: 200m with a 6V drop
- Upgraded street lighting should provide a minimum of 0.2 to 0.5 footcandles
- Poles should be placed at a maximum of 50m apart and at all points of change in cable direction
- Pole heights are frequently regulated; for high-tension cables and transformers a 10m minimum should be observed, as should 7m for low-tension cables and 5.4m for service drops
- Figure IV-15 gives a discussion about four different pole types
- Maximum distance between service drops: 30m
- Several plots can connect to one service drop

FIGURE IV-15

ELECTRIC POLE TYPES

Type Pole	Description	Advantages	Disadvantages
Aluminum	made from aluminum low alloy	resistant to corrosion; little maintenance; lightweight; easy installation; lower cost	less durable and rugged tensile strength for pendants
Steel	made with alloy steels	highly durable and rugged high tensile strength	needs painting against corrosion; relatively heavy
Concrete pre-stressed	made with centrifugal machine process of pre-stressed reinforced concrete	little or no maintenance; no corrosion; highly dureble and rugged	relatively heavy; requires heavy equipment installation; difficult to attach signs and others
Wood	made from hewn western red cedar, turned cedar or pine	rustic character little or no initial maintenance	must be fully creosoted for proper wear; solid post does not permit interior wiring or other equipment

c. **Response to the natural environment**

- Layout of electric cables should not conflict with tree planting plans
- Yearly pruning of tree branches avoids accidents and service interference
- Warm climates require larger transformers than cold climates

d. **Response to the cultural environment**

- In regions, such as Latin America, where social activities traditionally take place outside the home at night, consideration should be given to a higher level of street lighting
- High street lamps and protective covers help prevent vandalism
- In evaluations of completed sites and services projects, poor street lighting is one of the most often cited problems
- Where only street lighting is initially installed, it is very common for the people to make illegal connections to the aerial network

2. **Cost Considerations**

- Underground supply networks of electricity are too costly for consideration in sites and services projects
- Common circuits for street lighting and for electric service to plots reduce costs
- Efficient lamps, wide spacing of poles and lamps, large lamps and high mountings directly reduce capital costs
- Whereas individual metered connections to plots usually represent approximately 50% of the total costs of the electrical system their provision helps prevent system abuse and better regulates cost recovery

Chapter V
Social Infrastructure

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Chapter V
Social Infrastructure

A. Introduction

1. Context

The concept of housing encompasses all the ancillary services and community facilities necessary to human well-being. The provision and maintenance of services and facilities are more critical to those with fewer options, the poorest. Social infrastructure, therefore, forms an integral part of sites and services/core housing projects.

2. Major Issues

a. **Response to the cultural environment.** The history of housing projects is littered with inappropriate and underutilized community facilities that have not responded to the needs, traditional lifestyles or development patterns of the people. In many situations it may be best to simply provide land in appropriate locations for future facilities that the community or individuals will provide through their own dynamism and initiative. Where facilities are to be provided, the eventual users should be involved in the planning and design process to ensure appropriateness and continuing concern for the facilities' use and maintenance.

b. **Maintenance.** Clear lines of responsibility for continuing operation and maintenance of community facilities must be established during the planning process. Depending on social traditions, some maintenance and operations activities may be assumed by the community itself.

c. **Standards.** Regulatory instruments and state and national policies usually specify desired, or upgraded, standards for social infrastructure components,

whereas the need in sites and services/core housing projects is for minimum standards. Minimum standards should be viewed as transitional during the time necessary for upgrading to occur. Higher levels of social infrastructure are necessary in settlements of fast-growing population or with very large populations. Figures V-1, V-2 and V-3 give representative standards for India, Kenya and Indonesia.

d. **Access.** Location of social infrastructure components should respond to maximum travel distances (Figure V-4) and safe, direct routing from house plots.

3. **Social Infrastructure Components**

- Schools
- Community centers
- Health facilities
- Religious facilities
- Sports and recreation facilities
- Others

B. Schools

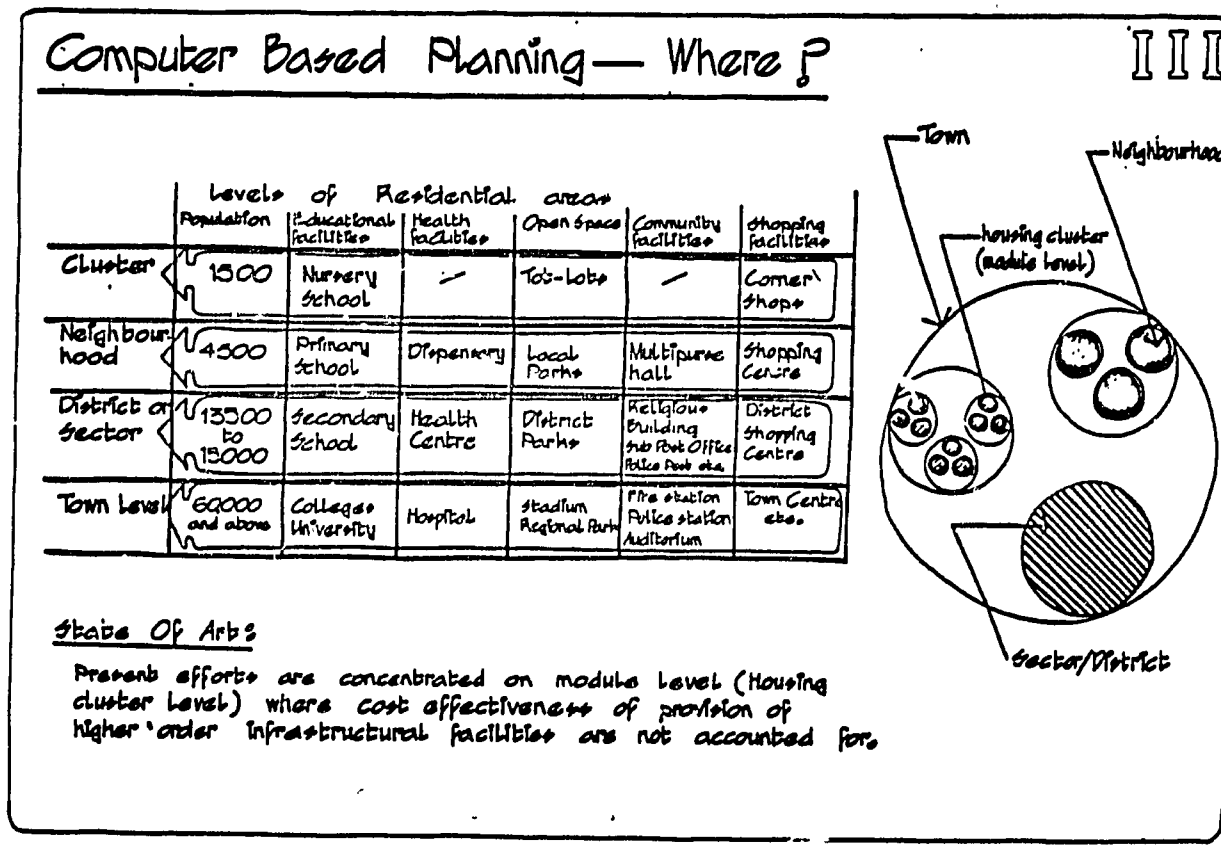
1. **General Observations**

- See Section II.B.6.e
- The provision of day care centers should be considered where tradition exists for working women
- In some Islamic and other cultures, it may be necessary to plan separate schools for boys and girls

2. **Physical Standards and Technical Guidelines**

- See Figures V-1, V-2 V-3 and V-4
- Official standards may be based on overly optimistic estimations of school attendance
- One nursery school for every 1,200 to 1,250 persons, with a site area of 0.1 to 0.2 acres, is a standard established in India
- Realistic standards in El Salvador call for $3.3m^2$ of educational space per student ($1.65m^2$ if two shifts are used), of which $1.3m^2$ would be enclosed; these figures translate to approximately $2.5m^2$ per plot

FIGURE V-1



Per capita social facility space requirement for 15000 population

	Facility	Total in hects.	Per capita (sq. mts.)
1.	Primary School	2.25 (3 nos.)	1.50
2.	Secondary School	1.50 (one)	1.00
3.	Health centre	0.33 (one)	0.22
4.	Post and telegraph office	0.9	0.06
5.	Police station	0.9	0.06
6.	Community/religious buildings	0.99	0.66
7.	Recreational open space	4.50	3.00
8.	Commercial/shopping	1.50	1.00
	Total		7.50

Source: HUDCO. Sector Model. New Delhi. 1983. pp.20 and 27.

FIGURE V-2

LAND REQUIREMENTS FOR COMMUNITY FACILITIES IN THE DANDORA PROJECT

FACILITY	SPINE TOTAL AREA FAC.	RESIDENTIAL TOTAL AREA PER FAC. HA.	TOTAL NUMBER OF SITES	AREA PER SITE HA	POPULATION SERVED PER SITE
SOCIAL FACILITIES					
DAY NURSERY		0.2	40	0.005	2,000
RELIGIOUS CENTRE	1.250		5	0.25	15,000
HEALTH CENTRE	1.0		4	0.25	20,000
MAJOR SOCIAL C.	0.32		1	0.4	100,000
SOCIAL HALL	0.5		2	0.25	25,000
SUB SOCIAL HALL		0.032	16	0.002	5,000
EDUCATION FAC.					
PRIMARY SCHOOL	12.0		16	0.75	5,000
POST PRIMARY SC.	3.0		4	0.75	20,000
SEONDARY SCH.	3.0		3	1.0	25,000
COMMERCIAL FAC.					
MAJOR SHOPPING C.	1.28		3	0.4	25,000
SUB SHOPPING AREA	1.25		5	0.25	10,000
LOCAL SHOPS		0.24	40	0.006	2,000
MAJOR MARKET	1.28		3	0.4	25,000
SUB MARKET	1.25		5	0.25	10,000
LOCAL MARKET		0.32	16	0.002	5,000
INDUSTRIAL FAC.					
LIGHT INDUSTRIAL A.	1.5		3	0.5	25,000
WORKSHOP	1.75		7	0.25	10,000
ADMINISTRATION					
ADMINISTRATION	0.25		1	0.25	80,000
SUB POST OFFICE	0.45		3	0.15	25,000
POLICE STATION	0.5		1	0.5	100,000
FIRE STATION	0.5		1	0.5	100,000
MAJOR BUS ST.		NEAR SITE	1	0.5	100,000
RECREATION					
INFANT PLAY					200
GROUND PARKS		2.4	80	0.03	1,000
PARKS	2.4		3	0.75	25,000
SPORTS CENTRE	5.0		1	5.0	100,000
TOTAL AREA	58.48 Approx				

N.B. 10 PERSONS PER PLOT 8,000 PLOTS
- 246 TOTAL POPULATION 80,000 - 100,000

Source: Preliminary Design Mutiso Menezes Intern. Nairobi, June 1976.

(in Sixth Conference. p.246)

FIGURE V-3

COMMUNITY STRUCTURE AND FACILITIES

	4-Hectare Unit		Small Neighborhood		Full Neighborhood		Sub-District Center		District Center		City Center	
Area of Facilities	No.	Size (ha)	No.	Size (ha)	No.	Size (ha)	No.	Size (ha)	No.	Size (ha)	No.	Size (ha)
Playlots	1	.1	2	.2	4	.4	8-10	1.0	20	2.0	40	4.0
Shops/Prayer House	1	.05	2	.1	4	.2	8-10	.5	20	1.0	40	2.0
Nursery School	1	.1	2	.1	4	.2	8-10	1.0	20	2.0	40	4.0
Primary School			1	.3	2	.5	4-5	1.0	8-10	2.0	20	4.0
Sports Field			1	.2	1	.3	2-3	.6	4-5	1.2	8-10	2.4
Shops/Admin. Ctr.			1	.1	1	.2	2-3	.4	4-5	.8	8-10	1.6
Other Facilities					-	.2	2-3	.4	4-5	.8	8-10	1.6
Jr. High School							1	.5	2	1.0	4	2.0
Football Field							1	.8	2	1.5	4	3.0
Commercial Facilities							1	.5	2	1.2	4	2.0
Mosque							1	.3	2	.5	5	2.0
High School									1	.8	2	2.0
Industrial/Inst.									1	1.2	1	7.4
Major Town Ctr.											1	4.0
TOTAL Open Space	.25		1.0		2.0		7.0		16.0		42.0	
Project Area/ No. of Units	4 ha/300		9 ha/ 600-700		20 ha/ 1,200-1,500		50 ha/ 3,000		100 ha/ 6,000		240 ha/ 12,000	
% Open Space/ Facilities	6%		10%		10%		14%		16%		18%	
Gross Density	75 units/ha		70 units/ha		65 units/ha		60 units/ha		60 units/ha		50 units/ha	

Source: PERUMNAS. Land Planning and Architectural Standards. Working Paper Series, Vol.II. Jakarta, Indonesia. 1974. p.42

C. Community Centers

1. General Observations

- See Section II.B.6.g
- It may be necessary to provide vehicular parking spaces near community centers (up to $5m^2$ per plot)
- Consideration should be given to separate facilities for men and women where necessitated by cultural norms (Islamic countries, Zambia and other sub-Saharan countries)

2. Physical Standards and Technical Guidelines

- See Figures V-1 and V-2
- In India, for cities of 300,000 population or more, official standards specify a center with a multipurpose room, small dispensary, reading room and library creche, craft room and toilets for each 10,000 to 15,000 persons
- In El Salvador, preliminary standards for a community center containing a multipurpose hall, materials storeroom and a basketball court specify $1.25m^2$ of community land per family and $0.5m^2$ of enclosed space per family

D. Health Facilities

1. General Observations

- See Section II.B.6.f
- At the neighborhood level, health services generally take the form of a health center or dispensary that provides curative and preventive health care; maternity and child welfare centers are also provided at the neighborhood level, often in conjunction with family planning centers[7]
- Mobile health vans can be an effective alternative to built centers

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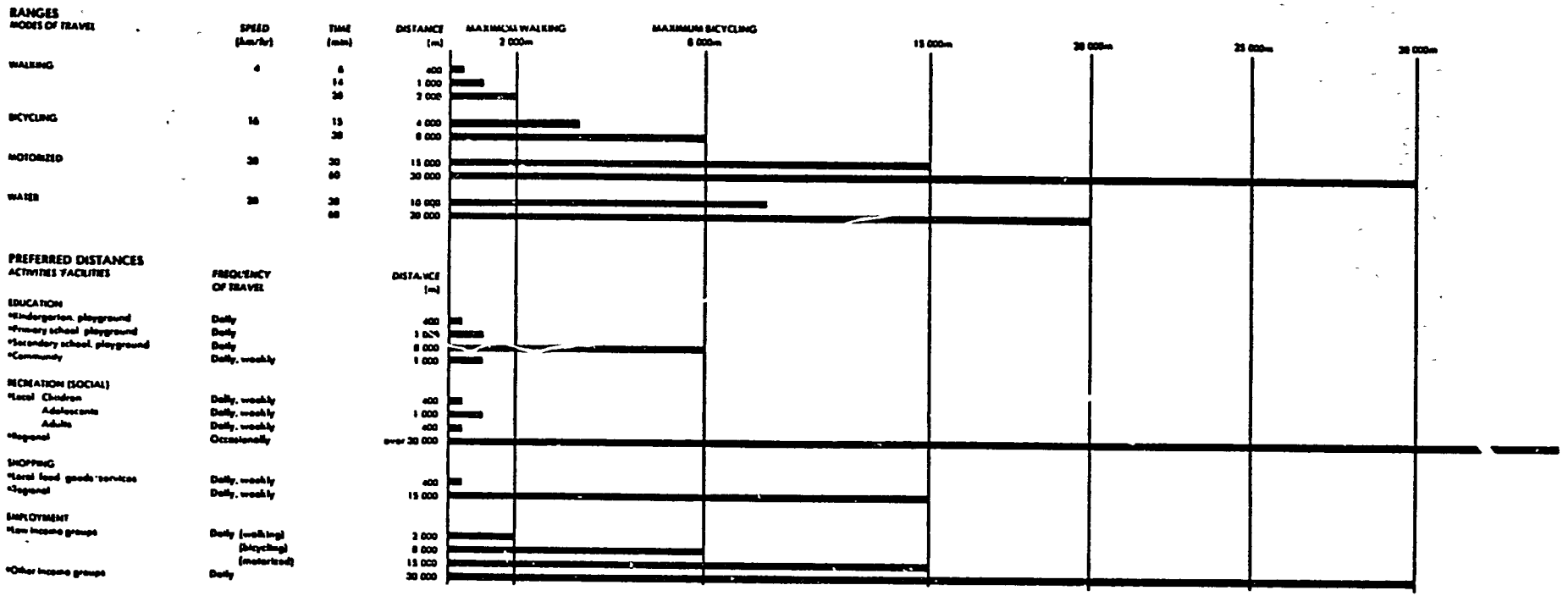
[7]U.N. Social Impact of Housing. 1977. p.42

FIGURE V-4

DIAGRAM OF RANGES, PREFERRED DISTANCES



Source: Caminos and Goethert. Urbanization Primer. 1978. Cambridge, MA. p.61

2. **Physical Standards and Technical Guidelines**

- See Figures V-1 and V-2
- Figure V-5 shows national health standards for India
- Figure V-6 shows health standards for local (El Shams) and national (GOPP) application in Egypt

E. Religious Facilities

1. **General Observations**

- In some Islamic countries, such as Egypt, special provisions for land and maintenance of religious facilities are legislated
- Religious facilities are generally built by voluntary community effort

2. **Physical Standards and Technical Guidelines**

- See Figures V-1, V-2 and V-3
- Usually no standards exist for religious facilities; requirements are based on the size and composition of the community; some development plans specify an area of .5 acre for a population of 15,000

F. Sports and Recreation Facilities

1. **General Observations**

- See Section II.B.6.d
- The need for open space close to the home is greater for low-income families than for upper-income families
- In Latin America, sports clubs and community groups may finance development costs of community sports and recreation facilities

2. **Physical Standards and Technical Guidelines**

- See Figures V-1, V-2, V-3 and V-4
- Figure V-7 gives physical standards for recreational activities in North Yemen

FIGURE V-5

STANDARDS FOR HEALTH FACILITIES (INDIA)

Health Survey and Planning Committee (1962)	1 bed per 1,000 persons
Madras Metropolitan Development Plan	
(urban)	4 beds per 1,000 persons
(rural)	1 bed per 1,000 persons
Delhi Master Plan	i) 4.8 beds per 1,000 persons 1 hospital per 125,000 persons 500 beds per hospital 15 acres per hospital
	ii) One health centre of 1 acre for 22,000 to 25,000 persons, with 15 bed hospital
Calcutta City	4 beds per 1,000 persons
Bombay	4 beds per 1,000 persons 50 sq. yds. per bed for city 100 sq. yds. per bed for suburbs

Source: UN. The Social Impact of Housing. 1977. New York. p.42

FIGURE V-6

HEALTH STANDARDS
COMPARISON OF EL SHAMS CITY GOPP STANDARDS

STANDARD	FACILITY	NO FACILITIES POPULATION	AREA OF FACILITIES (m^2 PER CAPITA)	COMMENTS
GOPP	General Clinic	1/28,000	.075	Ministry of Health Standard 1/40000
El Shams	Polyclinic	1/100,000	.025	Sadat City Standard 1/250000
GOPP	Secondary Health Centre	1/56,000	.011	GOPP Standard equivalent 5.36 beds/1000
El Shams	Ambulance Centre	1/100,000	.03	
GOPP	Child Care Centre	1/28,000	.075	
El Shams	District Health Centre	1/20,000	.025	
	Neighborhood Health Centre	1/7,142	.014	

Source: General Organization for Physical Planning. Department of Development and Planning and Research Studies, "Directory I. Planning of Neighborhoods." (in NUPS. Vol.2. p.190)

FIGURE V-7

STANDARDS FOR RECREATIONAL ACTIVITIES

Type of Recreational Activity	Space Requirements for Activity Per Population	Size of Space for Activity	Recreational Area Wherein Activity may be Located
Active Recreation			
1. Children's play area	2,000m²/1,000 pop.	4,000m²	Playgrounds in neighborhood or community parks, school playgrounds
2. Field play area for young children	6,000m²/1,000 pop.	12,000m²	Playgrounds in neighborhood and community parks
3. Older children and adult field sport activities	6,000m²/1,000 pop.	60,000m²	Playfield in community or district park
4. Outdoor court sports (tennis, basketball, etc.)	4,000m²/5,000 pop.	8,000m²	Playfield in community park
5. Swimming	1 outdoor pool/ 25,000 pop.	8,000m²	Playfield in community park
6. Other major sport activity	40,000m²/1,000 pop.	200-400 ha	District park, regional park
Passive Recreation			
Any activity	4,000m²/1,000 pop.	16,000m² to 40,000m²	All parks
Other			
Indoor recreation centers	4,000m²/10,000 pop.	4,000m² to 8,000m²	Community parks
Parking	Varies with rate of automobile use, but should be provided in the vicinity of all areas where outside influx of people is to be expected -- community and district parks, regional park.		

STANDARDS FOR RECREATIONAL AREAS

Type of Area	m²/Population	Size of Site (ha) Ideal	Size of Site (ha) Minimum	Radius of Area Served
Playgrounds	6,000/1,000	1.5	1	800 meters
Neighborhood parks	8,000/1,000	4	2	800 meters
Playfields	6,000/1,000	6	4	1,500 meters
Community parks	14,000/1,000	40	15	2,000 meters
District parks	8,000/1,000	80	40	5,000 meters
Regional parks and reservations	6,000/1,000	300	varies	20 kilometers

Source: Ministry of Municipal Affairs. A Handbook of Physical Planning Standards. 1974. Sana'a. p.120.

- Official standards may specify open space requirements as a percentage of surface area (10% to 55%) or on a per capita basis (2.4 to $5m^2$), depending on density, plot sizes, cultural and economic factors
- Indian standards specify that open space should be distributed amongst clusters of 20 to 30 plots

G. Others

- See Section II.B.6.g and Figures V-1, V-2 and V-4
- Materials stores may be a necessary provision if alternatives are too distant or do not provide sufficient service; their location and design should allow for theft prevention
- Provision of markets in urban projects may be counterproductive to existing trends, such as noted in Zambia,[8] that promote their informal evolutionary development

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[8]Bamberger, et al. Evaluation of Sites and Services Projects: The Experience from Lusaka, Zambia. World Bank Staff Working Papers Number 548. 1982. p.72.

Annexes

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ANNEX A

TARGET GROUP IDENTIFICATION AND DATA COLLECTION METHODOLOGIES

1. The Concept of Target Groups

AID's target group is defined as households below the median household income in a given urban area. This definition recognizes the importance of assisting the urban poor and places an income and affordability "ceiling" on potential beneficiaries and shelter selections. However, its purpose is not to define the characteristics of low-income households which is required for good project design. This is the purpose of target group analysis.

Target group is a term designed to denote a specific identifiable group of the population for whom a particular program or project is planned.

A national shelter policy will consist of a variety of program actions for a variety of groups. There cannot be a standard solution for all nor a custom solution for each household. Therefore, the population must be grouped into target groups and a specific program designed for each of a limited number of target groups. It is important for policy and program planners to consider target groups and their particular characteristics when designing projects. The failure to match the program content with the target group will lead to a misuse of scarce capital resources and less effective programs.

2. Data Requirements for Target Group Definition

In Chapter I, a checklist of data is presented which will be required in overall project conception and design. At the end of this Annex is given a case example of target group identification in Cameroon in which the definition of target groups was concerned with the urban populations of three cities. However, it is also possible to focus on a specific population group to disaggregate sub-groups.

The following data elements are generally used to distinguish and define target groups:

- Household income
- Urban fabric and dwelling unit types (graphic data)
- Household size
- Monthly rent/mortgage payment
- Dwelling unit size (m^2) and area per capita

- Residential area per capita (from residential density)
- Potable water
  .. percent households with access or connections
  .. liters per capita per day
- Electricity
  .. percent households with access or connections
  .. Kwh per capita per day
- Sanitation
  .. percent households with access or connections to system types
  .. liters per capita per day (if applicable)
- Circulation
  .. percent with direct access to paved/unpaved roads
  .. percent with access to paved/unpaved pedestrian paths

In general, four or five data elements are sufficient to define target groups. The problem is in collecting the necessary data to make the appropriate distinctions. Data in the form of urban averages is not adequate. It is necessary to collect data by urban locations which are sufficiently small that ranges in data are not too significant. The best sources for this type of information are census enumeration districts.

3. Sources of Data for Target Group Identification

Three types of sources for such information will be mentioned: (a) census and special sample survey data, (b) data derived from aerial photography and selective field investigation and (c) data derived from field identification of target groups and selective field investigation within those target groups.

a. Census and Special Sample Surveys Data

If census and special surveys are well designed and executed, they will be the most reliable of the three discussed here, although not necessarily the most cost effective. Even special surveys usually will require much longer to execute than either of the two other methods that will be suggested.

General census data will not provide data by target group. These must, therefore, be obtained from census enumeration districts or special sample surveys designed specifically for the identification of target groups. In considering the use of existing regular surveys or special surveys, it should be borne in mind that survey design, data collection and data processing may take as much as six months or even a year with a city of one million and usefulness of the results depends, obviously, upon the quality of the survey design and execution. The problems encountered in using survey results are well known. It should be noted also that regular surveys of household consumption and expenditure may have sample designs such that the results are usable on a national scale but not for individual cities. Sample designs must be examined carefully to determine the utilization of results in individual localities.

b. **Interpretation of Aerial Photographs Supplemented by Selective Field Investigation**
This procedure has been used with considerable success recently in several cities worldwide. There are many variations on this procedure, but only its basic components will be outlined here.

As a first step, aerial photographs of the area in question are prepared at a suitable scale, if recent ones do not already exist. Two sets from differing times, i.e., three to five years apart are suggested.

Second, the photographs are analyzed to identify a housing or settlement typology to provide a basis for a subsequent field investigation of household characteristics. The identification of the housing typology itself will require some field checking. In a city of 500,000 three skilled professionals should be able to identify an appropriate typology in about two weeks.

Third, selective field surveys are conducted for each of the housing categories identified in the typology in order to get limited but usable information. If recent census data are available, the total population estimates and household structure can be checked. This third step, resulting in the identification of target groups, might take something of the order of six to eight weeks with four skilled professionals in a city of 500,000.

The information on target groups obtained in this way is likely to be cruder than that resulting from conventional sample surveys, but is likely to be adequate for project preparation purposes and it may take as little as three months to prepare, compared with the six to twelve months often required for conventional surveys. An illustration of this type of data collection is illustrated in Section 4 of this Annex.

c. **Field Demarcation of a Housing Typology Supplemented by Selective Field Investigation**
This third procedure is similar to the second except that the original housing or settlement typology is identified by direct field investigation and mapping if aerial photographs cannot be obtained. The time required for the preparation of the typology will depend on the degree of precision sought. To obtain precision comparable to that achievable with aerial photography in a city of 500,000, presuming that good base maps showing every street in the city area available, a team of four skilled professionals might require six to nine months, compared to the two weeks achievable with three professionals working from aerial photographs.

4. **Case Example: Use of the Aerial Photo Interpretation, Housing Typography and Selective Field Surveys in Cameroon**

a. **Introduction**
A methodology for obtaining socio-economic data and classification by target groups has been developed and implemented in several countries including Tunisia, Haiti, Indonesia, El Salvador and others. The methodology was designed to shorten the traditional costly and time consuming survey methods and to provide greater specificity regarding target groups.

The results of the application of the methodology in three cities in Cameroon have been selected as a case example to illustrate the principles of the methodology.

In the Cameroon example, the survey methodology was designed to gather data on the characteristics of urban households and their housing based on two objectives:

- To collect sufficient data to do urban extension and rehabilitation projects which would correspond to the needs, desires and financial capabilities of a given target group population

- To establish an overall framework for data collection and subsequent surveys based on a housing typology

This approach, by means of which socio-economic surveys and the establishment of a data base are structured within a housing typology, proved particularly useful in the study of cities in Cameroon.

b. **Housing Typology**

The housing typology developed for the three Cameroonian cities consists essentially of seven types of existing urban fabrics which can be clearly identified through the interpretation of aerial photographs. Slight variations in the typology were made for Douala (three additional subtypes) and Garoua (combination of Types A and B fabric). Each housing or urban fabric type can be described as including physically homogeneous areas with similar characteristics such as spatial organization, density and size of housing construction, types of housing construction, infrastructure levels, land use, etc.

The seven basic types found in three Cameroon settlements can be briefly summarized as follows:

- **Type A:** Traditional type of development, densely urbanized, very limited infrastructure and vehicular access, largely residential areas with occasional mixed land use.

- **Type B:** Traditional type of development, densely urbanized and located along major secondary roads, higher level of infrastructure than Type A due to commercial functions in the area, highly mixed land use.

- **Type C:** Traditional type of development, semi-rural in character located on the fringes of urban development, large houses and plots, very low level of infrastructure, largely residential/agricultural land use.

- **Type D:** Planned development with regularized streets, medium density and plot sizes, adequate levels of infrastructure either existing or planned.

- **Type E:** Planned development, very low density, almost exclusively residential land use, large plots and villa type houses, high level of infrastructure.

- **Type F:** Government housing projects generally duplexes, row houses or walk-up apartments with some villas, high level of infrastructure.

- **Type G:** Planned city-center development, generally consists of apartments above commercial or office floors, mixed land use but predominantly commercial, high level of infrastructure.

Figure A.1 gives a visual comparison of the three most important urban fabrics in the three cities (i.e. Types A, D and E) and which basically correspond to low-, middle- and upper-income groups.

The predominance of low-income neighborhoods found by grouping the different urban fabrics according to the socio-economic characteristics of their populations is shown in Figure A.2. This figure was obtained by grouping the urban fabric types according to three distinct socio-economic groups found through analysis of the field survey. It provides a comparative view of the distribution of the population in the three cities according to these groups. (Note: Target Group 1 includes urban fabric types A, B and C, considered as including lower-income households, Group II includes types D, F, G or middle-income, and type E or upper-income.) Also noted alongside the drawings are the percentages of population and residential areas for each group. It is interesting to note that the percentages of area and population of each target group for the three cities are quite comparable, with only Garoua having a slightly higher percentage of residential area and population in the lower-income group due to the semi-rural character of some of its neighborhoods and population.

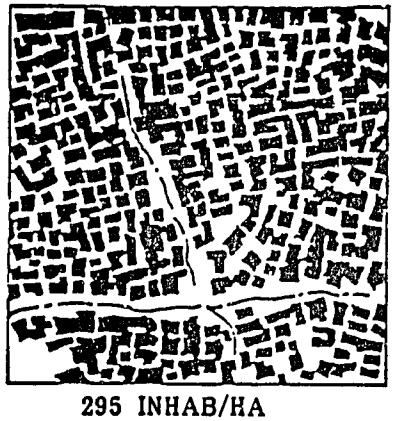
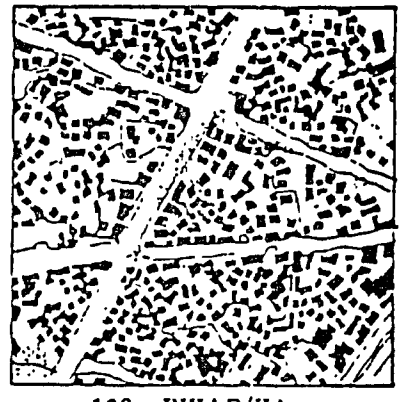
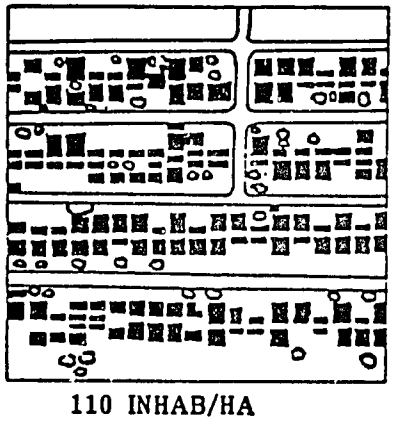
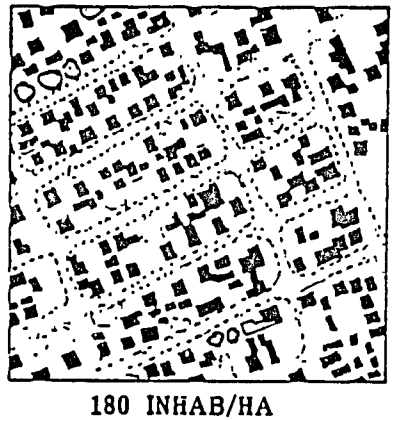
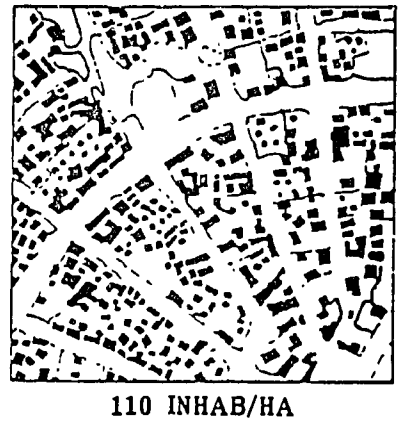
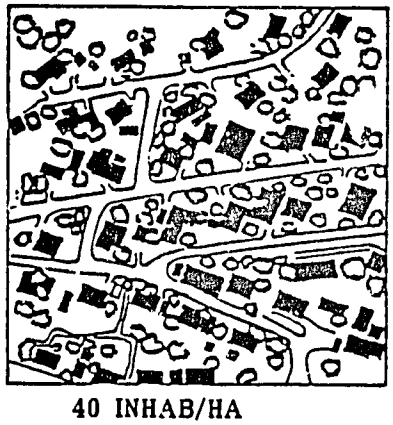
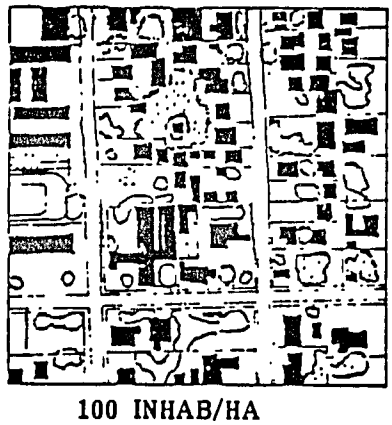
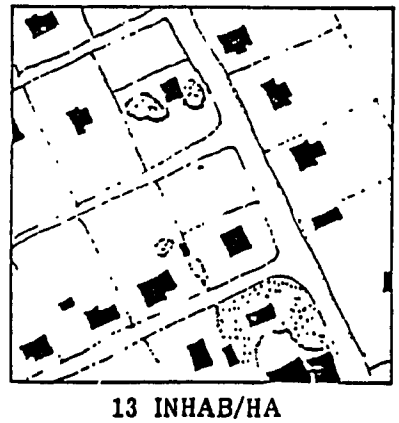
The use of the housing typology in structuring data research proved to have several distinct advantages. First, it allowed the easy integration of other sources of data into each urban fabric type; secondly, it gave a truer indication of real levels of consumption and services than could be found from urban averages or from areas delimited by political boundaries which often have mixed socio-economic groups. Thirdly, it provided a relatively easy way of bringing physical and population growth up-to-date through the interpretation of aerial photographs taken at different times. (most notably, one can measure the growth of informal low-income neighborhoods and estimate their population). And finally, it allowed the planning or upgrading of infrastructure to be more easily related to the needs and financial capabilities of the population concerned.

c. **Socio-Economic Surveys**

Based on the housing typology and on the basic hypothesis that homogeneous neighborhoods with similar physical characteristics (i.e. spatial organization, density, plot and house sizes, infrastructure levels, etc.) are inhabited by relatively homogeneous populations with equally similar socio-economic characteristics, a detailed survey of the socio-economic and cultural characteristics of a limited number of households was designed. The objective of this survey was to obtain an in-depth knowledge of the life-style, consumption levels, infrastructure and public services available to the population and to form a basis for future program and project proposals.

FIGURE A.1

EXAMPLES OF URBAN FABRIC TYPES

	YAOUNDE	DOUALA	GAROUA
A (I)			
	295 INHAB/HA 32 PLOTS/HA Average Size Plot 260M^2	300 PLOTS/HA 35 PLOTS/HA Average Size Plot 220M^2	160 INHAB/HA 20 PLOTS/HA Average Size Plot 390M^2
D (II)			
	110 INHAB/HA 13 PLOTS/HA Average Size Plot 350M^2	180 INHAB/HA 20 PLOTS/HA Average Size Plot 320M^2	110 INHAB/HA 18 PLOTS/HA Average Size Plot 300M^2
E (III)			
	40 INHAB/HA 5 PLOTS/HA Average Size Plot 1200M^2	100 INHAB/HA 12 PLOTS/HA Average Size Plot 700M^2	13 INHAB/HA 2 PLOTS/HA Average Size Plot 2000M^2

A,D,E = URBAN FABRIC TYPES
I,II,III = SOCIO-ECONOMIC GROUPS

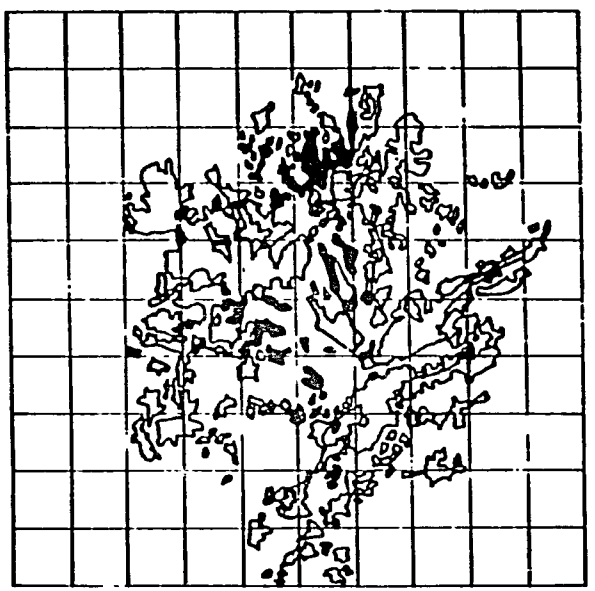
ECHELLE

0 50 100 150 200

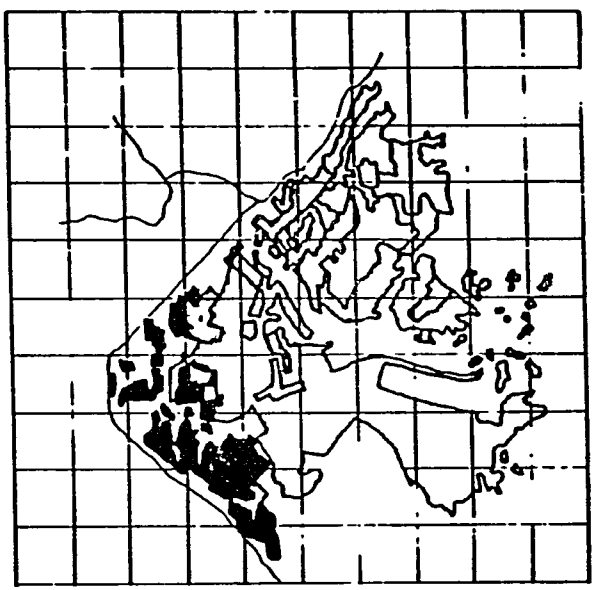
FIGURE A.2

Residential Areas and Population by Socio-Economic Group
(in percentages of total residential area)

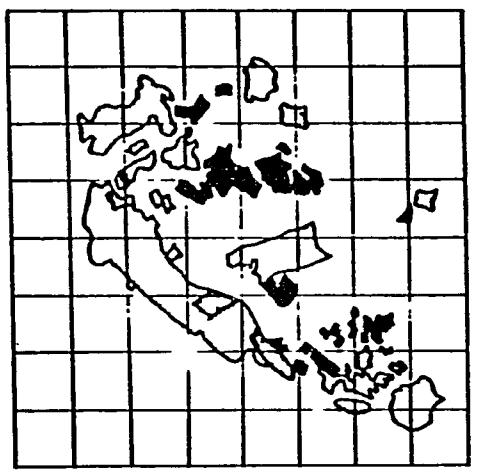
YAOUNDE



DOUALA



GAROUA



SCALE: each square equals 1 square kilometer

SOCIO-ECONOMIC GROUP		YAOUNDE SURFACE	YAOUNDE POPULATION	DOUALA SURFACE	DOUALA POPULATION	GAROUA SURFACE	GAROUA POPULATION
	1	65.5%	82.3%	67.8%	82.9%	72.0%	87.5%
	2	20.7	15.4	20.7	13.0	10.0	10.7
	3	13.8	2.3	11.5	4.1	18.0	1.8

Results of the surveys in Yaounde, Douala and Garoua indicated that based on household and per capita consumption patterns of potable water, electricity, living and residential areas, as well as on other indications such as type of dwelling, profession, income, rents, density, etc., it was possible to clearly define three socio-economic or target groups having distinctly different characteristics and consequently different program requirements. These groups were composed according to urban fabric types as indicated earlier in the report (Group I including types A, B and C; Group II including types D, F and G; and Group III including type E). (See Table A.1)

d. **Measured House Plans**

At the same time as the limited socio-economic survey, measured house plans were made of the housing units surveyed, each of which was considered to be typical of the housing type or urban fabric in which it was located. These plans also included measurements of furniture and the space around the house which proved to be useful in several ways. First of all, the plans provided a means to analyze how people use living space by the kinds and the way in which they placed their furniture; whether or not there was sufficient interior space for family activities, and what kind of activities took place around the house (i.e. space for play, cooking, planting of gardens, etc.). Consequently, the surveyed houses were able to serve as the starting point for developing plans of the eventual model house types. This approach was based on the assumption that since houses in Cameroon are fairly large in size (about 75-80 square meters) the way households use and arrange the space within the house is more a result of their preferences than of any particular constraints. Finally, the surveyed houses included a full range of construction materials in the different cities which enabled an eventual analysis of construction techniques and costs.

In order to illustrate how measured house plans and analysis of functional layout should influence project design, existing and proposed house plans from Cameroon are presented in Figures A.3 through A.5.

TABLE A.1

LEVELS OF SERVICES AND CONSUMPTION
BY CAMAROONIAN TARGET GROUP

(YAOUNDE-DOUALA-GAROUA)

HEAD OF HOUSEHOLD INCOME
MEDIAN MONTHLY INCOME BY
SOCIO-ECONOMIC GROUP
(in CFA)

Group	Yaounde	Douala	Garoua
I	34,290	36,540	39,000
II	72,000	58,260	53,000
III	298,000	123,750	325,000

ACCESSIBILITY TO POTABLE WATER BY*
PRIVATE CONNECTIONS

Group	Yaounde		Douala		Garoua
I	10.8	(24.1)	5.0	(8.0)	20.0
II	76.8	(85.9)	56.0	(63.0)	66.0
III	100.0	(100.0)	100.0	(100.0)	100.0

% with private connection (% with access to private connection)

RESIDENTIAL AREA PER PERSON
(in square meters)

Group	Yaounde	Douala	Garoua
I	46	40	91
II	81	51	92
III	278	101	975

CONSUMPTION OF POTABLE WATER
(liters/person/day: average)

Group	Yaounde	Douala	Garoua
I	23	14	14
II	65	86	39
III	87	105	120

COVERED LIVING SPACE PER HOUSEHOLD
(in square meters)

Group	Yaounde	Douala	Garoua
I	47	41	100
II	74	51	68
III	207	80	285

ACCESSIBILITY TO ELECTRICITY BY PRIVATE CONNECTION*
(in % of households)

Group	Yaounde		Douala		Garoua	
I	22	(30)	42	(54)	21	(26)
II	76	(96)	63	(75)	67	(100)
III	100	(100)	100	(100)	100	(100)

% with private connection (% with access to private connection)

MUNICIPAL GARBAGE COLLECTION
(% of households service)

Group	Yaounde	Douala	Garoua
I	49	64	79
II	54	8	67
III	100	100	60

CONSUMPTION OF ELECTRICITY
(in kwh/person/month)

Group	Yaounde	Douala	Garoua
I	1.2	4.7	4.4
II	8.6	13.7	16.0
III	29.6	23.0	41.0

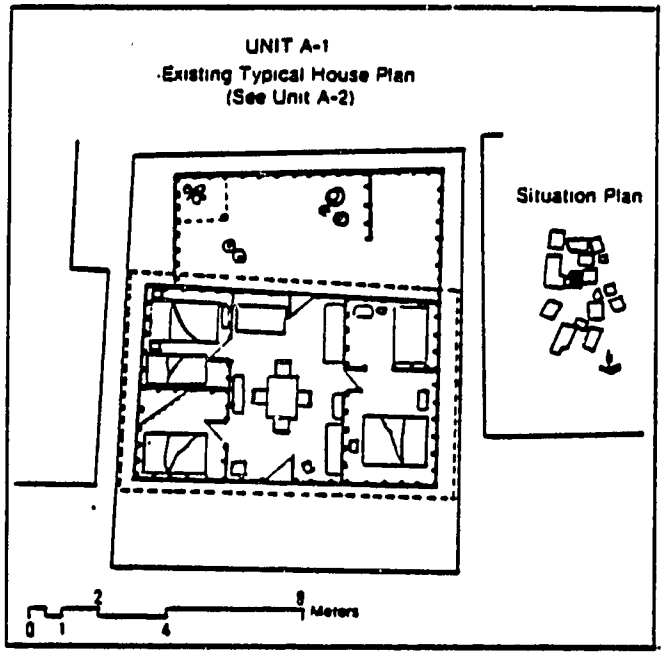
SANITATION SYSTEM
(Access to Pit Latrines/Septic Tanks)

Group	Yaounde	Douala	Garoua
I	96/4	64/19	86/4
II	50/50	25/75	67/33
III	0/100	0/100	

* Note accessibility: Denotes households directly or indirectly served by systems (i.e. sharing of or illegal connections

FIGURE A-3

EXISTING AND PROPOSED HOUSE PLANS



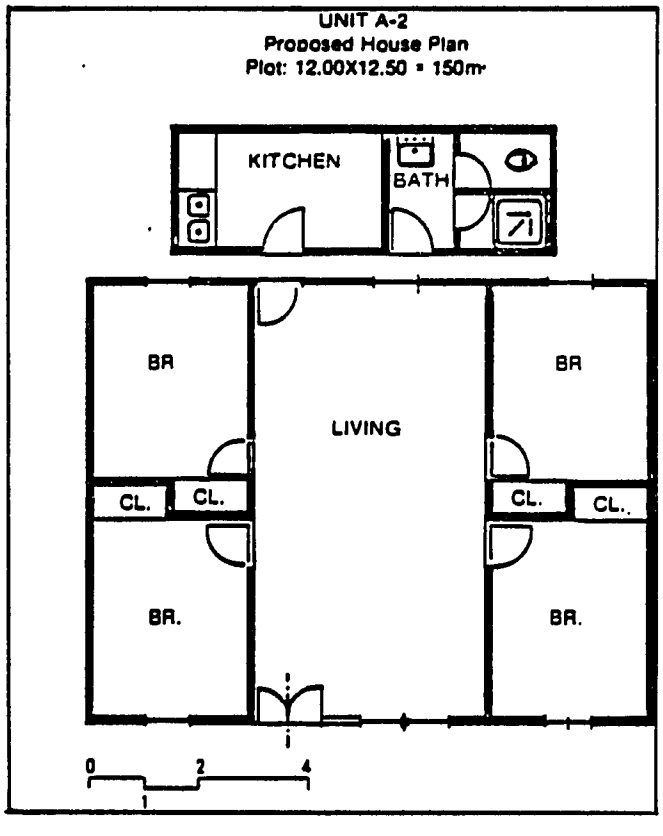
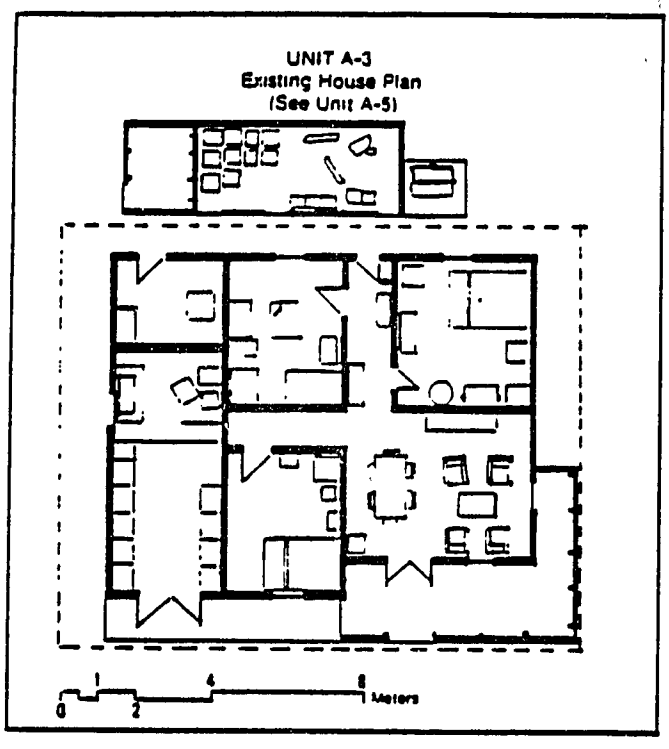


FIGURE A-4

EXISTING AND PROPOSED HOUSE PLANS



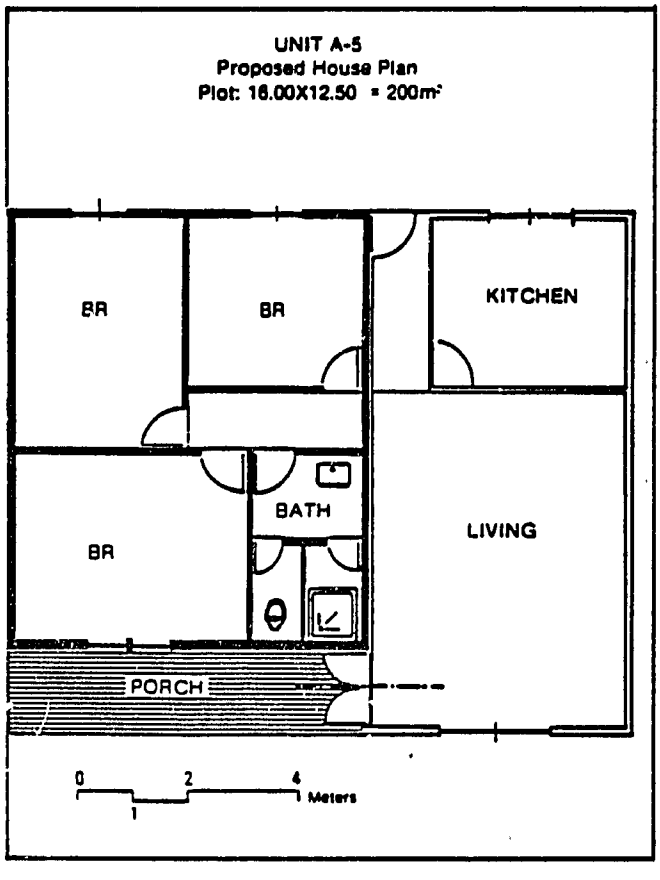
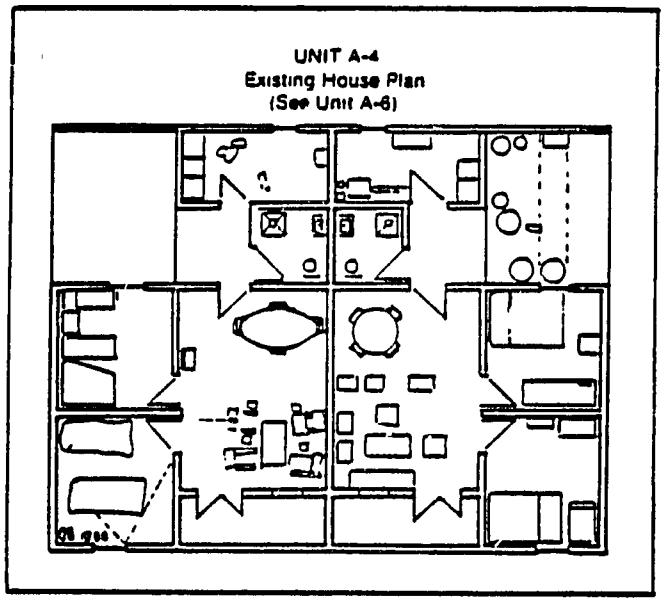
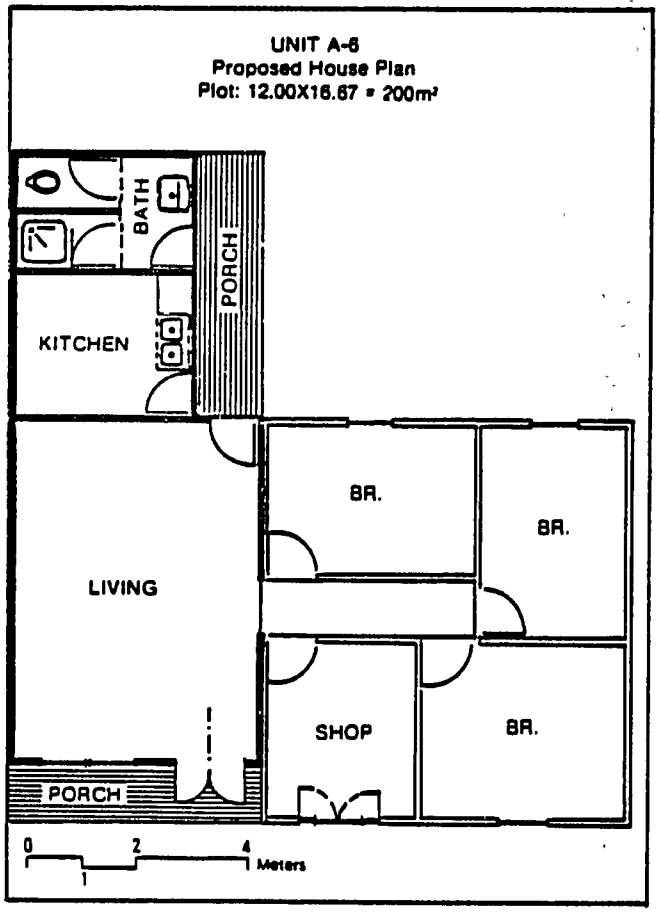


FIGURE A-5

EXISTING AND PROPOSED HOUSE PLANS





ANNEX B

STEPS IN PROJECT DEVELOPMENT AND IMPLEMENTATION

The Site and Unit Design Handbook is concerned primarily with "design guidelines" and not full project development and implementation. Nevertheless, design is part of an integral process. As a consequence, a series of diagrams (Figures B.1 through B.8) have been presented which illustrate the steps in project development.

Figure B.1 is a general graphic while each of the subsequent figures illustrate in more detail the steps indicated in it. For example, Figure B.2 illustrates the steps to be taken under data research in Figure B.1.

FIGURE B-1

GENERAL METHODOLOGY

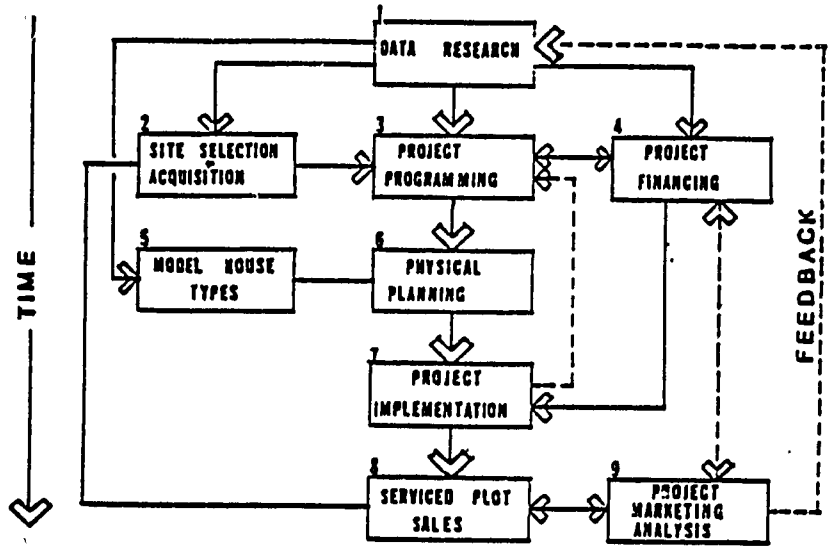


FIGURE B-2

ACTIVITIES FOR DATA RESEARCH

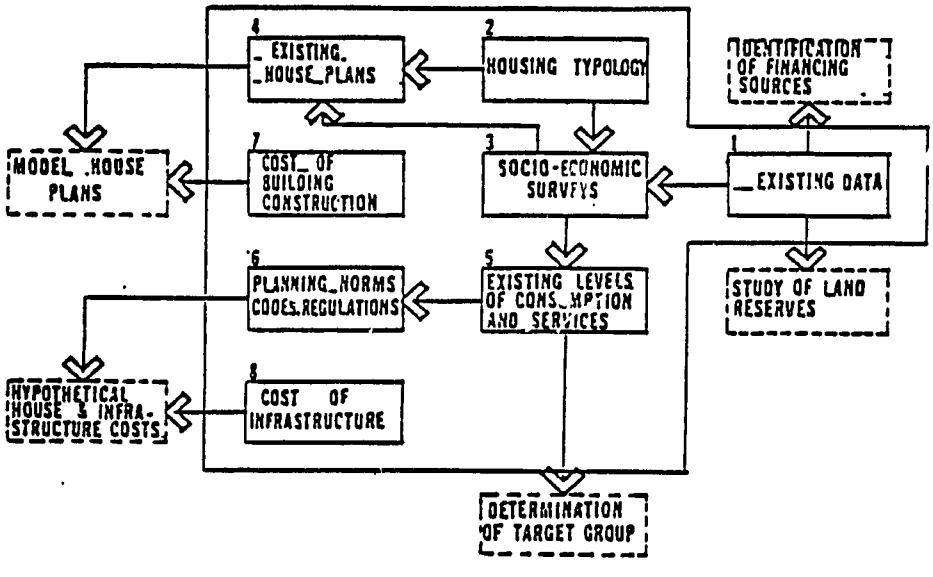


FIGURE B-3

ACTIVITIES FOR LAND ACQUISITION AND SITE SELECTION

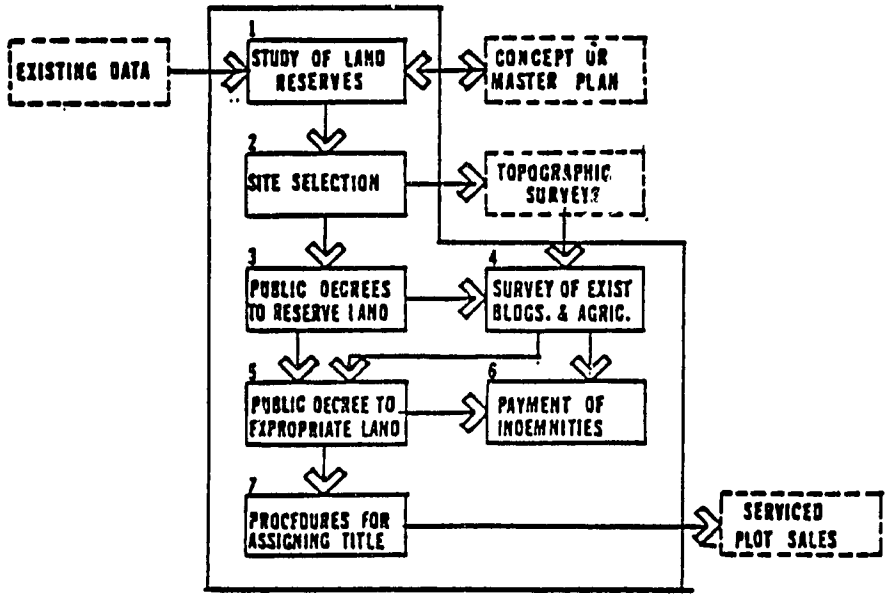


FIGURE B-4

ACTIVITIES FOR PROJECT PROGRAMMING

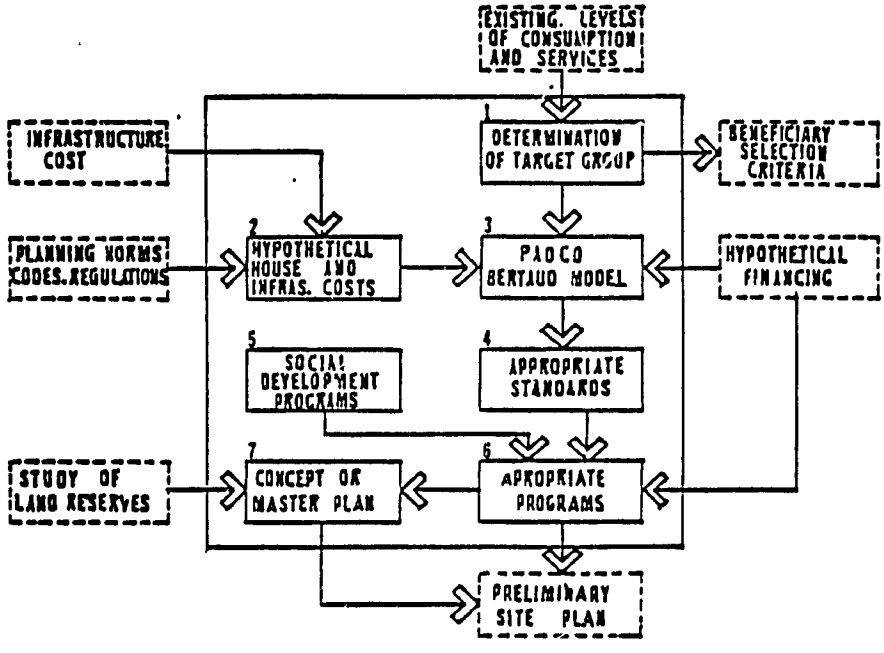


FIGURE B-5

ACTIVITIES FOR PROJECT PLANNING

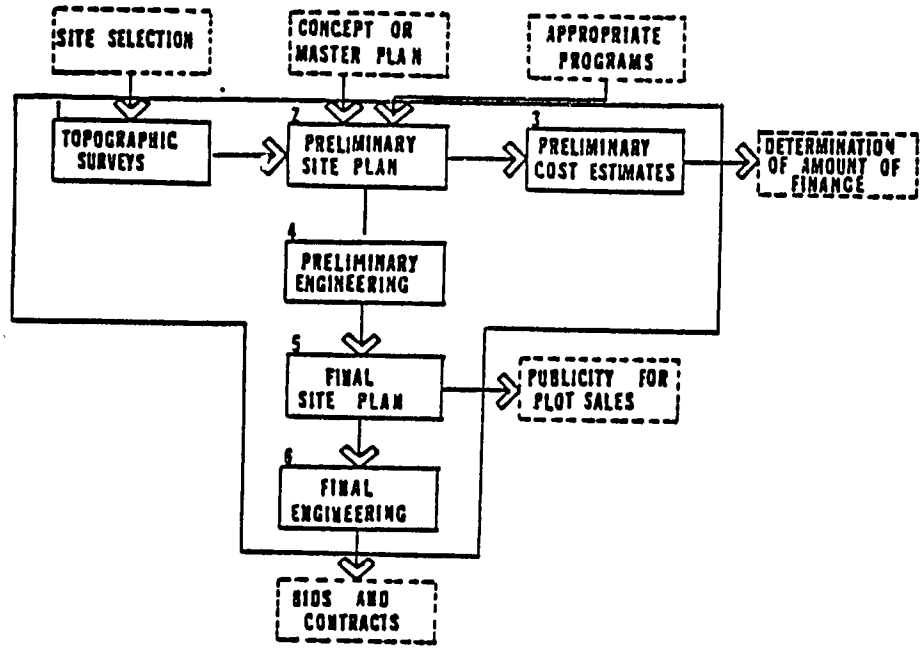
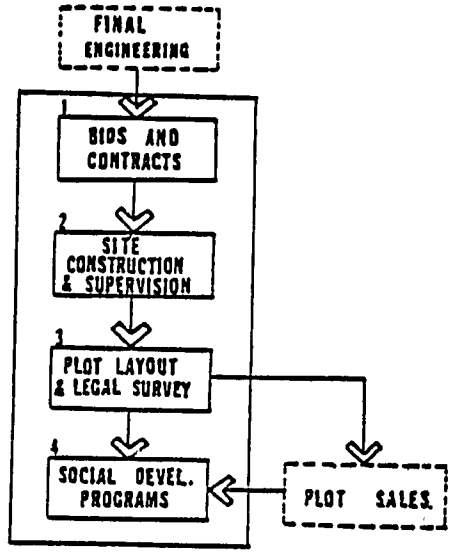


FIGURE B-6

ACTIVITIES FOR PROJECT IMPLEMENTATION



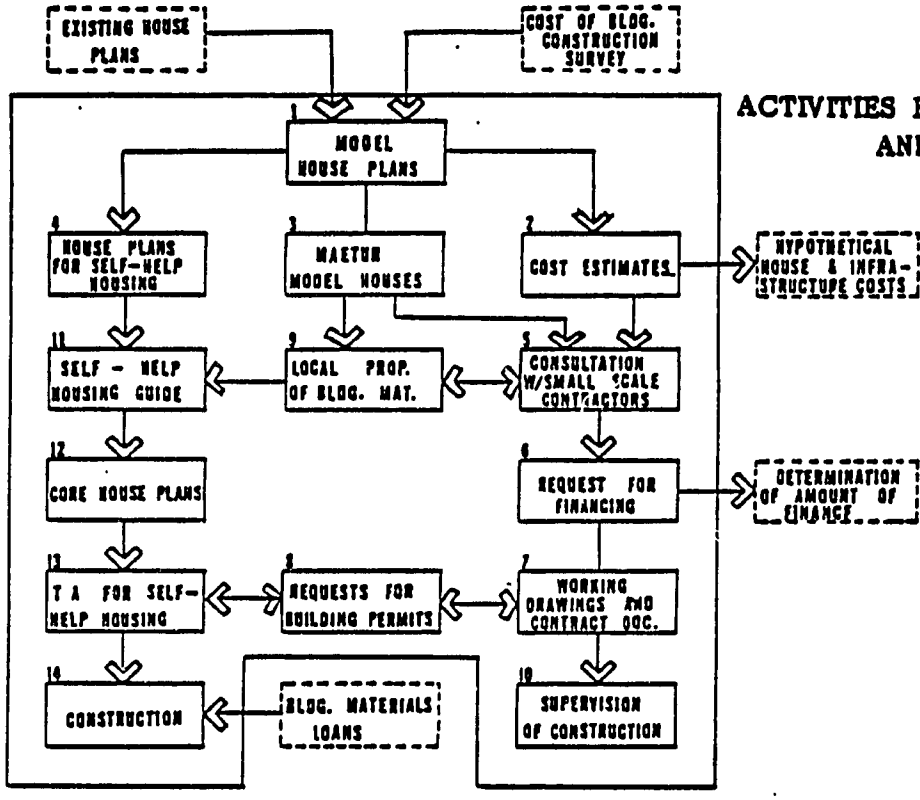


FIGURE B-7

ACTIVITIES FOR MODEL HOUSE DESIGN AND CONSTRUCTION

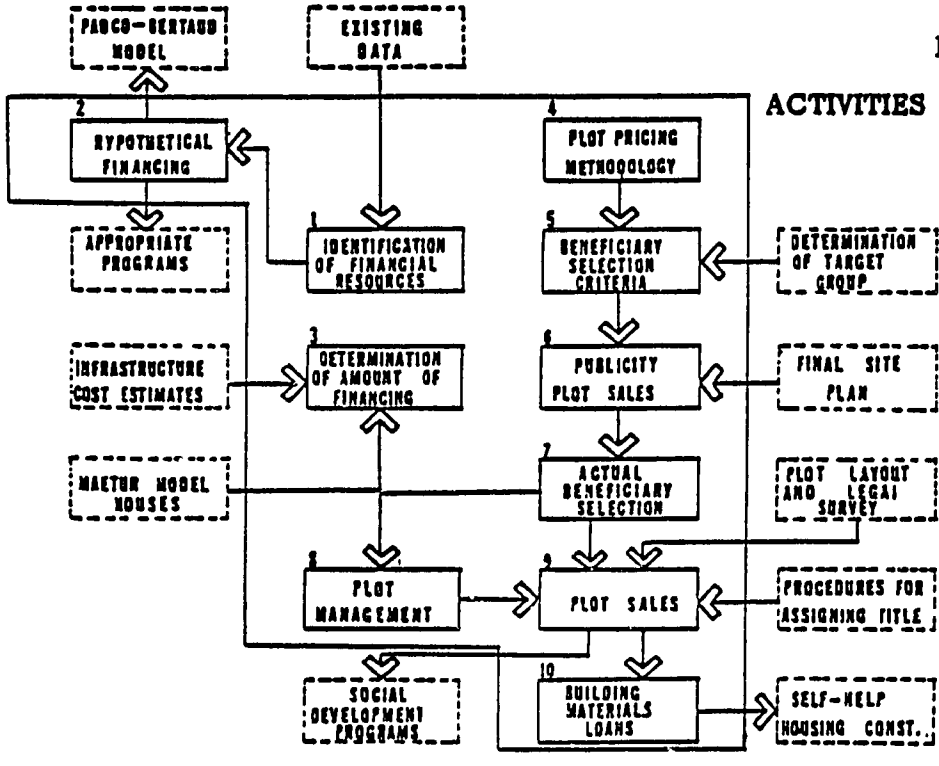


FIGURE B-8

ACTIVITIES FOR PROJECT FINANCING

ANNEX C

PLANNING AND PROGRAMMING GUIDELINES

This Annex provides guidelines for planning and programming in urban areas. It has been included in the Site and Unit Design Handbook to provide a context for sites and services development. Since the Office of Housing and Urban Programs portfolios now include Urban Development, it is recommended that individual shelter projects are firmly established on a conceptual basis within an urban or planning framework.

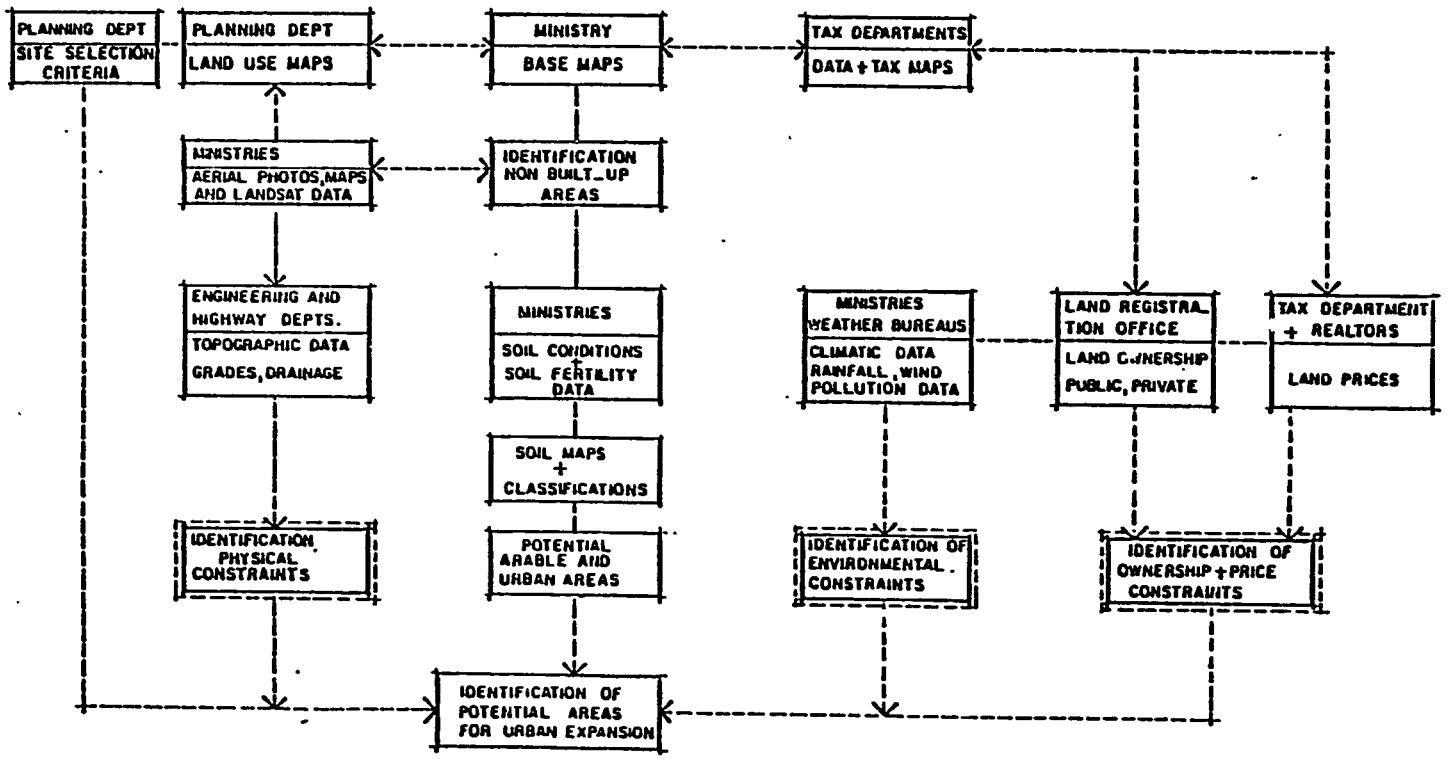


FIGURE C-1

IDENTIFICATION OF AREAS FOR URBAN EXPANSION

TABLE C-1

LOCAL GOVERNMENT PLANNING & PROGRAMMING GUIDELINES

Source	INPUTS Data Collection	ANALYSIS	OUTPUTS Implications for Planning and Programming
- Census Data - LANDSAT Data - Aerial photos and maps from two or more previous years	Regional Land Use (types and areas) - Urban - Agriculture - Barren (vacant) - Water	Change - Increase/decreases growth rates by type Directional growth Existing - Physical (based on area increase over previous years) - Demographic (based on population data over previous years) Future Trend - Physical (based on area projections) - Demographic (based on population forecasts)	Major Land Use Map - Trend Projections - Identify factors contributing to loss of arable land Directional area and population growth diagrams - Existing - Trend - Compare to desirable growth directions
Census	Population and Demographic Data - Urban population for current and previous years - Kism population for current and previous years - Census enumeration data (sub Kism) - Average urban growth rate due to natural increase	Determination of past annual growth rates - Urban - Kism - Census zone (sub kism) if available Determination of net in or out migration	Urban population forecasts based on trends: - Urban - Ward - (target group, if possible) Comparison to population target projections

Census Data
Socio-Economic Surveys: Tax Data
Residential Type[1] Classification
	Household Data[2]
	(socio-economic characteristics)
	
	- Size
	- Age structure
	- Literacy level
	- Education level
	- Income/expenditure
	- Assets (physical)
	  • Dwelling unit ownership
	  • Vehicles
	  • Other (i.e., appliances)
	- Consumption characteristics
	  • Services (water, electricity, share paved roads, etc.)
	  • Calories, meat
	  • Residential land
	- Assets (financial)
	  • Savings formal banking
	  • Accounts
	  • Other types of savings
	  • Access to credit
		- On the basis of disaggregated data determine groups and relate to residential types
		- Determine level of public service by target group and standards of housing
		- Determine household affordability for housing and public services
		- Determine locational characteristics of target groups
		- Relate population projections to target group growth — (i.e., Groups may grow at different rates)
			Program Development
			
			- On the basis of target group standards and current levels of service formulate appropriate programs suited to specific target group need and affordability
			- Location map of target groups
			- Determine implications of target group growth on urban expansion and infill

- Map Data (Previous Years) (Measurements and Field Checks) - Aerial Photos	Physical Data Urban land use (types and areas) - Residential* (by type) - Industrial (large, small) - Commerical (large, small) - Services - Institutional - Open Space - Circulation - Military - Vacant - Others	Existing Standards - Gross and residential densities, by type - Job densities - Percent area by type Change Increase/decreases growth rates	Land use map Density use map Existing land budget standards Recommended changes

1 See Appendix B

2 Two levels of household data and analysis is possible: urban-wide averages and more specific target group analysis. The latter is viewed as a more accurate means of measuring the impact of development programs but may not be possible except in large urban centers.

Source	INPUTS Data Collection	ANALYSIS	OUTPUTS Implications for Planning and Programming
TOPO Maps TOPO Surveys Photo Grammetric Maps Maps Soil Tests Building Experience	Physical Features - Topography - Soil conditions	Gradients or slopes 5, 10, 15, 20% 20% Technical Studies - Bearing capacity - Water table level - Permeability	Gradient and Physical Features Map - Barriers to physical expansion - Areas of possible expansion - Areas subject to flooding Soil Conditions Map - Suitability for construction - Opportunities for alternative sewage disposal
Soil Class Maps, Crops Production Data, LANDSAT Data	Soil fertility	Soil classification • Most/least fertile land • Income (yield) per area Reclamation potential - Urban or agricultural use - Probable development costs	Soil Fertility Map - Arable land to be protected in order of fertility - Barren land most suitable for reclamation • Agriculture • Urban
Meteorological Data, Pollution Tests	Environmental factors - Climate - Rainfall - Windfall - Ecology - Pollution air, water, soil, noise, visual, etc.	Environmental Assessments - Assess environmental impacts on building and site planning distrubance of environment (past and future) - Areas of flooding, areas most affected by sandstorms, ongoing and probable forms of pollution, effects on wildlife habitat and food supply	- Location specific zoning (i.e., industry) - Measures to reduce pollution - Appropriate site planning and building guidelines
Land Registration Office, Property Tax Records	Land Ownership Public - National - Governorate - Waqf - Other Private - Disputed - Not disputed - By owner - Size of holding Vacant and Built-up (Areas by type)	Identification of Sites for Infill - Determine most appropriate public or private vacant sites of urbanization or other use - Order sites for priority development by use See Figure 36 for a description of process	Phased Development Plan - Develop public land as needed - Induce development of private vacant land - Ensure development control
Realtors, Land Owners, Public Records	Land Values - Market prices - Public land sales prices	Survey of Current Land Prices - Survey market land prices within and adjacent to urban boundaries and possible extention areas - Correlate land values to land use, infrastructure networks, public services, site conditions - Compare past public and market land prices	Land Value Maps - Determine future probable value of planned extentions - Use land value data for taxation purposes - Equate public land prices to private prices to increase revenues from sales

INPUTS		ANALYSIS	OUTPUTS
Source	Data Collection		Implications for Planning and Programming
Maps, Utility Companies, Contractors Specifications	Physical Infrastructure Networks - Water - Sewerage - Electricity - Roads - Transport - Telecommunications - Solid waste removal	- Determine existing capacities and standards - Locate plants, primary, secondary networks, areas served by tertiary networks - Assess levels of service or standards at urban, district and target group levels and by residential, commercial, industrial and other use. - Assess operational efficiency (losses, excess capacity, etc.) - Estimate future requirements on basis of population increase economic development requirements, improved level of service	- Formulate program to ensure rehabilitation and maintenance of existing system and expansion of system at five year increments to meet future needs of population and economic development - Integrate levels of service with opportunity to cost recovery and reduced subsidy
Contractors, Tender Documents	Costs - Capital • New areas • Rehabilitation - Operations and maintenance[1]	Existing Costs - Update cost records to include unit items, cost/km of networks, per capita costs Operations and Maintenance[1] - Estimate annual costs per unit of distribution, production & per capita served, estimate shortfall & increased expenditure needed	Cost Accounting - Reduce reliance on central government funds - Use of cost data for programming purposes
Utility Companies, Banks, and Cooperative Societies (Housing)	Cost Recovery - Utilities • Revenues • Expenditures • Deficit - Housing • Revenue (annual payments) • Loan amounts • Interest rates	Cost Recovery Assessment - For regional and local items equate expenditures to cost recovery through tariffs and taxes. - Identify shortfalls, assess implications of full cost recovery on tariffs and taxes, levels of services and needed expansion, maintenance of systems	- Increase cost recovery for public investments built into programs
Field Surveys Manpower Data, Performance Data	Social Infrastructure - Inventory Services • Health • Education • Social Services - Number of establishments - Population served - Personnel	Existing Standards - Determine standards of services, i.e., beds/per capita; students/classroom - Determine space standards • Area • Building - Compare standards with national, governorate and other urban standards Future Standards - Project improvement in standards and future requirements at 5-year intervals	Programming - Formulate development program aimed at maintaining or improving existing standards
Tender Documents Budget Data, Ministries Health, Education, Other	Costs - Capital costs - Operations and maintenance	Cost Assessments - Maintain costs records on provision of social infrastructure facilities per unit and per capita served - Estimate share of social infrastructure costs in overall new development costs	Cost Accounting and Recovery - Use costs for future programming - Keep overall subsidies as low as possible, yet ensure adequate funds for maintenance and operations

Source	INPUTS Data Collection	ANALYSIS	OUTPUTS Implications for Planning and Programming
Census, Enumeration District and Ward Data	**Housing** - Building data • Number of buildings • Number of dwelling units • Number of rooms • Number of floors	**Existing Situation** - Growth rates • Past growth of housing stock • Comparison with growth of population (surplus or deficit)	**Programming** - Formulate housing programs to upgrade or rehabilitate the existing housing stock and for new housing requirements • Achieve density targets • Maintain or improve existing standards • Equate housing costs with household affordability
Census, Ward Data	- Densities • Persons/building • Persons/dwelling unit • Persons/room • Rooms/household	- Existing Standards • Room densities • Rooms per household • Dwelling unit size • Gross and residential densities • Building conditions (see below)	• Provide financial and technical assistance to support renewal, rehabilitation and new housing efforts • With the above provide public serviced desert sites (where possible) to guide private housing development • Develop equitable beneficiary selection procedures to benefit all income groups in proportion to their size • For renewal and rehabilitation, resolve tenant/owner conflicts
Census, Building Surveys	- Constructions • Materials • Types • Condition	- Construction classifications • Materials • Structural soundness • Use of top soil for bricks • Effectiveness of public supplied materials	
Census, Tax Records	- Ownerships • Public (by type) • Private • Cooperative • Other	- Ownership Classifications • Data by type and area • Degree of household dwelling ownership and renting	
Census, Survey	- Uses (Buildings and Housing) • Residential • Work • Combined	• Data by type and area • Relate to land use data • Implications for zoning (feasible or not)	**Other Outputs** - Density maps (by kism or sub-kism or residential type - Average floor area ratio maps (if possible) - Building material and condition maps - Building use maps
Building Permits Records, Interviews With Contractors, Field Surveys	- Costs • Formal • Informal	- Cost Assessments • Update records of construction costs by type • Impact of public materials supply on costs • Means employed for housing finance; assessment of past public subsidies - Future Proposals • Using density targets and household affordability parameters formulate moderately improved housing standards as a guide for primarily private initiative • Test proposals by calculating costs and comparing them with household income levels	
Geological Surveys	**Economic Data Source** - Mineral Resources (Region) • Quantify exploitable	**Development Potential** - Identify potential constraints mineral exploitation - Determine economic feasibility of exploitation	**Programming** - Develop program for economic exploitation, necessary infrastructure, etc.
Ministry of Tourism	- Tourism (amenities) • Quantify attractions • Number of visitor/beds • Room occupancy rates • Local tourism revenues • Local tourism employment	- Identify growth potential and constraints - Determine economic feasibility of promotion - Assess existing and probable net benefit to local area	- Develop program to encourage (or discourage) tourism, needed services, infrastructure Ensure that cost recovery and revenues benefit local area

Source	INPUTS Data Collection	ANALYSIS	OUTPUTS Implications for Planning and Programming
UCUOR, Ministries of Irrigation, Electricity, Regional Distribution Companies	-Water, power • Quantify availability • Quantify use	Efficiency: Supply and Demand - Measure efficiency in uses losses, wastage - Compare current supply to expected needs, determine how much could be satisfied through more efficient use, and increased supply - See also Figure 38 for analysis format	- Establish programs to manage power and water supply efficiently • Increase supply to acceptable levels at economic costs • Adjust water and power dependent economic and urban activities to feasible supply
Census, Socio-Economic Surveys	- Human Resources • Active population by sectors • Education levels • Inventory training programs and placement performance	- Identify strengths and weaknesses in skill mix - Relate to economic development requirements	- Identify economic activities appropriate to local skill mix - Institute literacy and vocational training programs which will enhance potential for economic development
Census, Statistical Indicators Surveys Tax Data	Economic Activities (Public and Private) - Establishment • Manufacturing industry (large, small) by type, no. employment, capital, output, value-added, employment • [illegible]ices (large and small) • Other - Employment • Industry: by type • Services • Admin. finance • Etc.	Economic Assessments - Assess importance of public/private sectors and economic activities by type, formal/informal sectors - Assess national, regional and local functions of activities - Assess locational characteristics of economic activities - Relate to infrastructure, labor supply, resource requirements - Determine productivity industries activities - Assess opportunities for agglomeration, backward and forward linkages	Programming Formulate an economic development program on the basis of: - Exploitable resources - Enhancement of productive economic activities - A hierarchy of national regional or local functions - High pay off opportunities - Rehabilitation and existing activities - Downgrade unproductive and costly enterprises - Favor labor intensive investments - Special assistance to small and medium sized establishments
Surveys, Permit Data Development Plans	- Investment by sector and economic activity	- Equate past investment to sectoral activity increases in employment and value-added - Locate investment spatially, measure impact on development trends, loss of arable land	Other Outputs - Past and planned investment distribution map - Use investment to guide development in desirable locations
Survey, Records	Administration - Organization and function • National • Governorate (governorate and ministry departments) • Municipal - Manpower • Number • Training • Job classifications • Specific responsibilities • Pay scales and benefits origin of staff members	Efficiency and Need Assessments - Assess organizational and and functional efficiency of administrative structure - Identify areas of overlapping responsibilities - Assess manpower capacity for carrying out responsibilities - Equate to national standards for settlement size & location - Assess manpower aptitude and qualifications	Reforms or Outputs: - Current and proposed organization and functions chart - Means to reward competent and motivated personnel - Means to recruit personnel with desired qualifications - Requirements for training: • Institutional development • Skill development

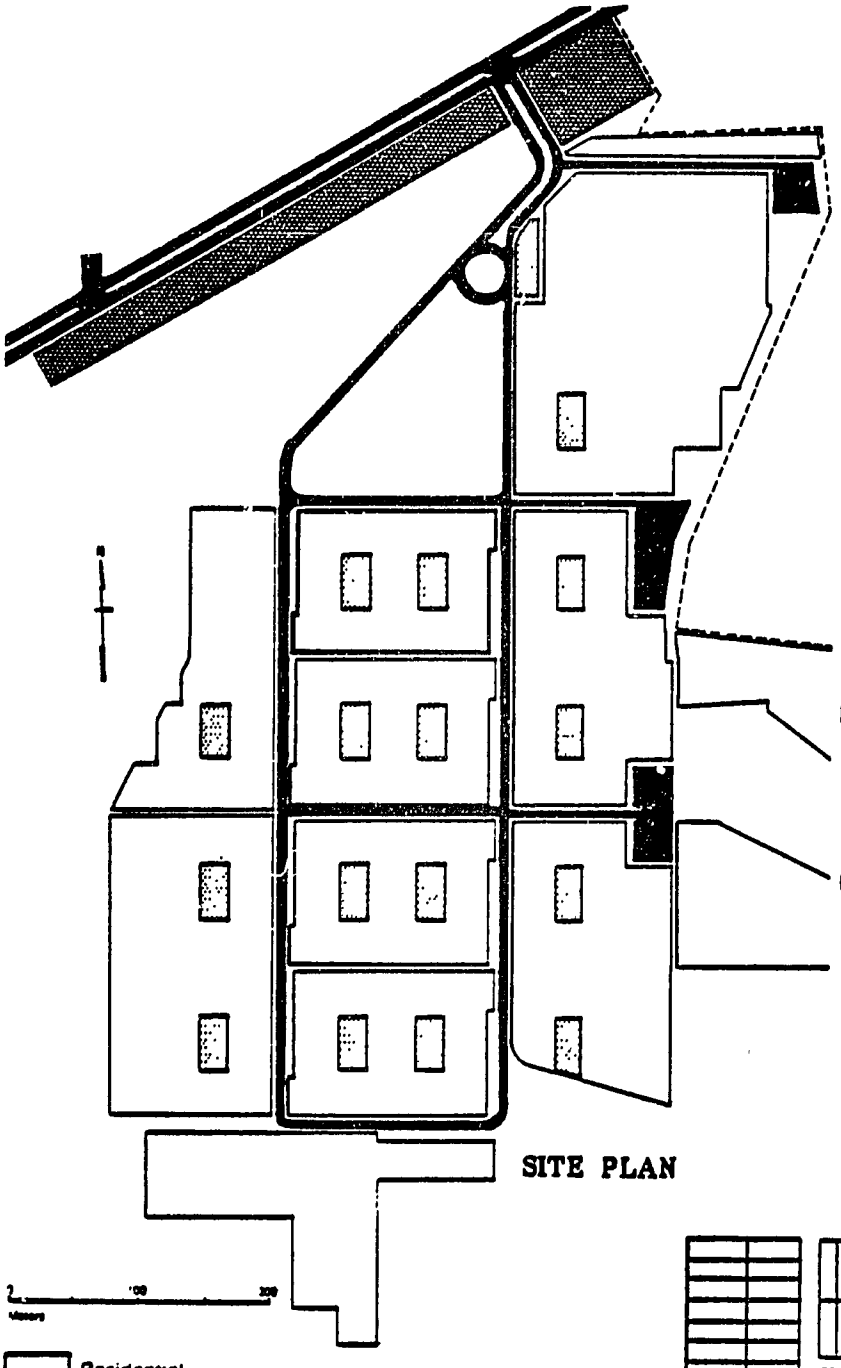
Source	INPUTS Data Collection	ANALYSIS	OUTPUTS Implications for Planning and Programming
Min. Industry Survey Dept.	- Operation and control • Building Permits • Industrial permits • Licensing • Land registration • Subdivision permits	Efficiency and Need Assessment (Continued) - Determine the number of permits, licenses, or transfers made annually • Compare to estimated growth of • housing, industrial, other activities requiring permits or licenses - Assess the average time it requires to process permits, licences or other approvals - Determine bottlenecks in process (i.e., bureaucratic obstacles) and acceptable "approval" time frame - Assess or determine average project size for permit request and approval - Determine amount of building, industry, land, commercial activities actually under control (and that which is not) - Estimate desirable and undesirable effects of past control or lack thereof	Output or Reform - Means to bring development under control through closer, stricter, monitoring of development - Increased inspection and tools to carry inspection - i.e., aerial photos, landsat, field checks (vehicules), etc.
	- Development control violations and enforcements • Building • Industry • Subdivisions • Licenses • Arable land and topsoil - Court actions • Violations registered • Violations processed • Penalties imposed • Violations dismissed	- Determining number of violations (i.e., in past 5 years) - Compare to number of violations which actually occurred (estimated on basis of census and survey data) - Determine general nature and impact of violations • Public • Private - Identify reasons why violations were not detected (i.e., lack of personnel, equipment, etc.) - For violations determine number for which action was/was not taken for public and private offenses - Assess nature and effectiveness of of penalties • Determine bottlenecks in inspection and legal framework for development control • Legal snags - Determine changes needed, personnel equipment, legislation, etc.	- In sectors where violations are known to occur, ensure that alternative sites, standards, ets. are available so that violations are not "forced" to occur - Publish and present to the public areas where restrictions will be applied. • Locations where development by type will be allowed and measured which will be applied to violators - Use aerial photos, maps and field references as a base for monitoring development and violations - Formulate an enforcement program with sufficient personnel, equipment and authority to identify violators - Modify the legal, and approval process to ensure that violators are penalized and that these result in a desired outcome - Publish for public review the names of violators and penalties
Min. Finance	- Fiscal Management • Itemize government revenues by source and tax type	- Determine share of revenues generated locally and those dependent on national contribution, foreign sources - Determine shares for each sector generated locally through national contribution - Determine potential for increasing local revenues with full development control and feasible levels of taxation • Permits and licenses • Property, consumer, income taxes, etc. (includes determining actual number of properties which should be on tax rolls and those which currently are) • Betterment taxes, income taxes, etc. • Utility services, water, power, transport, etc. - Given decentralization efforts determine which taxes could best be managed at the local level, (i.e., real estate taxes) - Determine which taxes could be used to guide urban development (i.e., vacant land tax and property tax) - Review collection efficiency, amount available, amount collected	Develop proposals to improve the local resource base and financial autonomy including: - Increased levels of taxation - Increased collection efficiency - Transfer of funds now managed at central level to local government - Means to permit local level credit and borrowing to finance capital projects

Source	INPUTS Data Collection	ANALYSIS	OUTPUTS Implications for Planning and Programming
Data, Central Government Sectoral Developments Min. Finance	**Fiscal Management (con't)** • Expenditures Budget and programming	**Efficiency and Needs Assessment** - With resource base, measure degree of financial and administrative autonomy at local level - Measure impact of local planning and budgeting at local level • Compare requests to funds received and impact of project items (i.e., number of housing units planned, constructed, etc.) - Assess impact of financial autonomy or lack thereof on decision-making - Compare planned to realized expenditures note differences and causes For operation and maintenance with manpower capacity and requirements estimate funding required to attract, satisfy personnel (salaries, benefits etc.) - Assess impact of financial autonomy or lack thereof on decision-making - Compare planned realized expenditures note differences and causes - For operation and maintenance (with manpower capacity and requirements) estimate funding required to attract, satisfy personnel (salaries, benefits, etc.) - Compare to amount available and identified changes needed to increase manpower and benefits - Estimate needed equipment, spare parts, supplies needed to ensure adequate support facilities and maintenance	**Output or Reforms** - Orient budget and expenditures on the basis of need and fiscal capacity - Reduce reliance on central government funds - Use budget as a tool to implement planned development program - Tie budget to locational aspects of development - On basis of available and potential local resources devise a budget for personnel operation and maintenance that would improve local management, meet special funding requirements - Overall programming and budgeting functions at governorate level should aim at measuring total costs against desired program outputs to determine efficiency of programming

ANNEX D

SITE PLANNING MODULES AND BLOCKS

FIGURE D.1



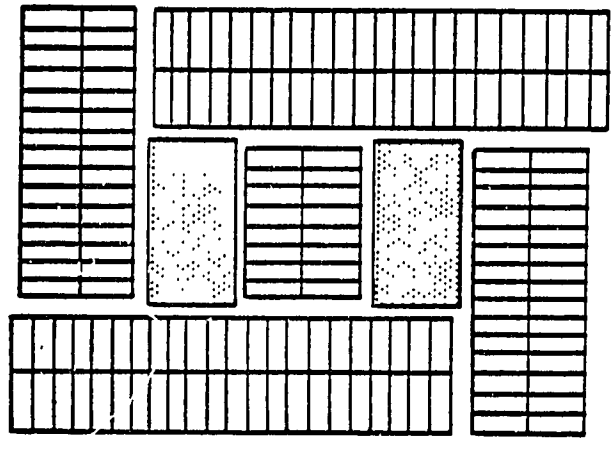
COMMENTS:

Pros:
- good separation of through from access circulation;
- even distribution of open space;
- cost-efficient block lengths and plot proportions.

Cons:
- no variation of plot size to reflect locational advantages or diverse target group.

SITE PLAN

Residential
Major Circulation
Commercial
Institutional & Recreation
Industrial



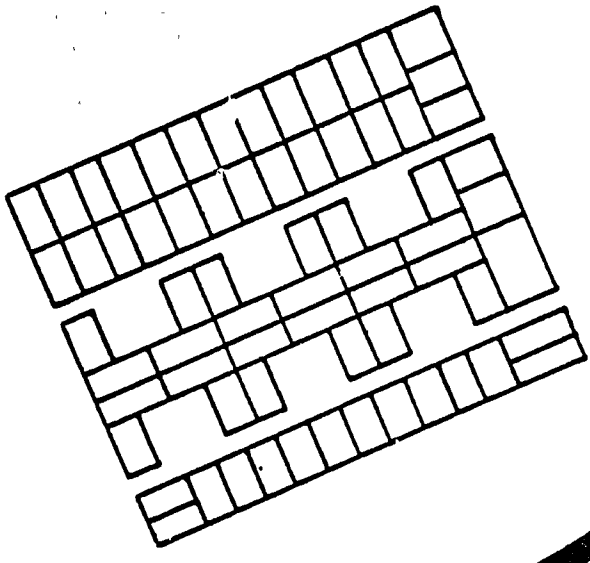
MODULE PLAN

Source: IBRD Sites and Services Project, San Rafael La Laguna V, 1976 GUATEMALA

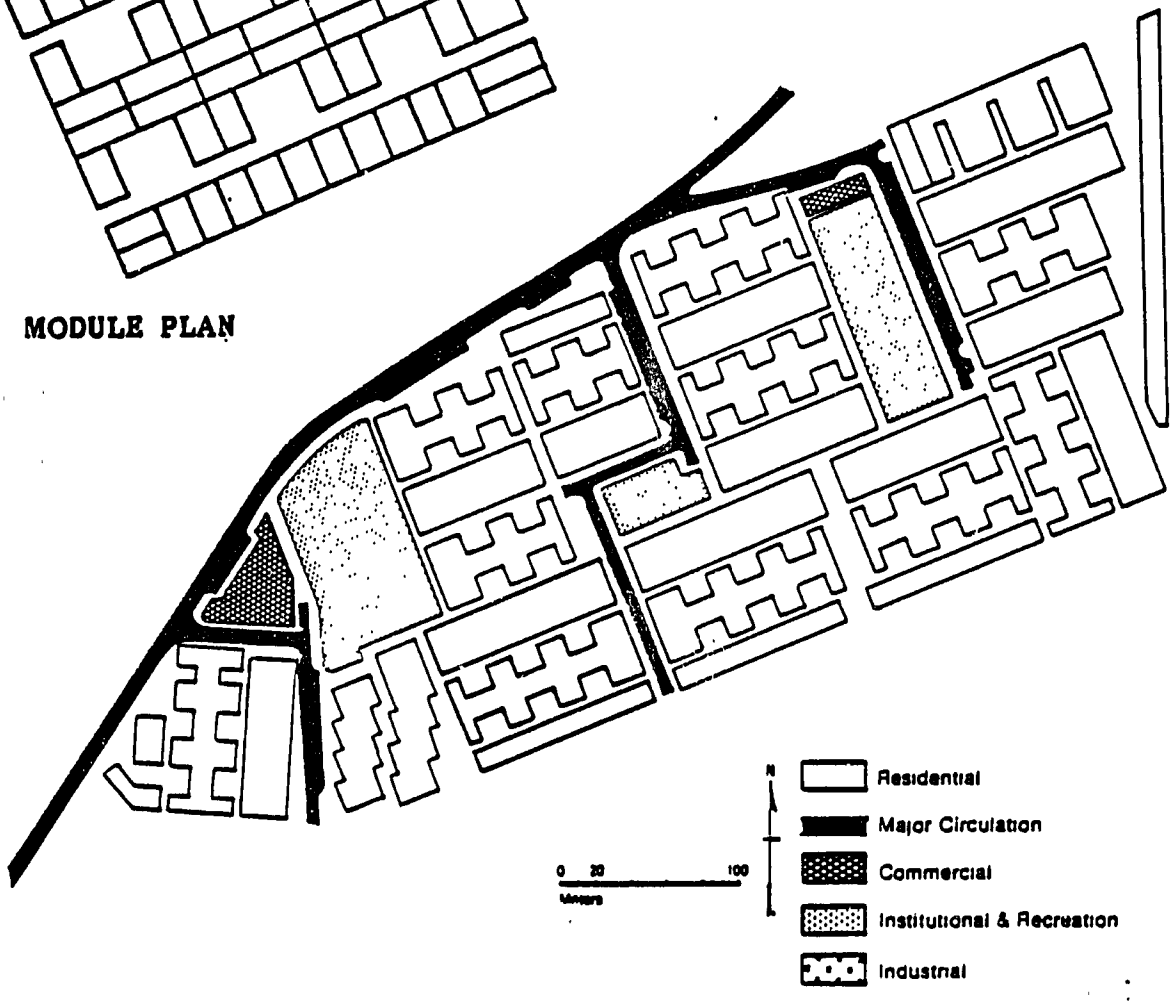
FIGURE D.2

Pro: • good orientation of plots to locational advantages.

Con: • excessive circulation and open space.

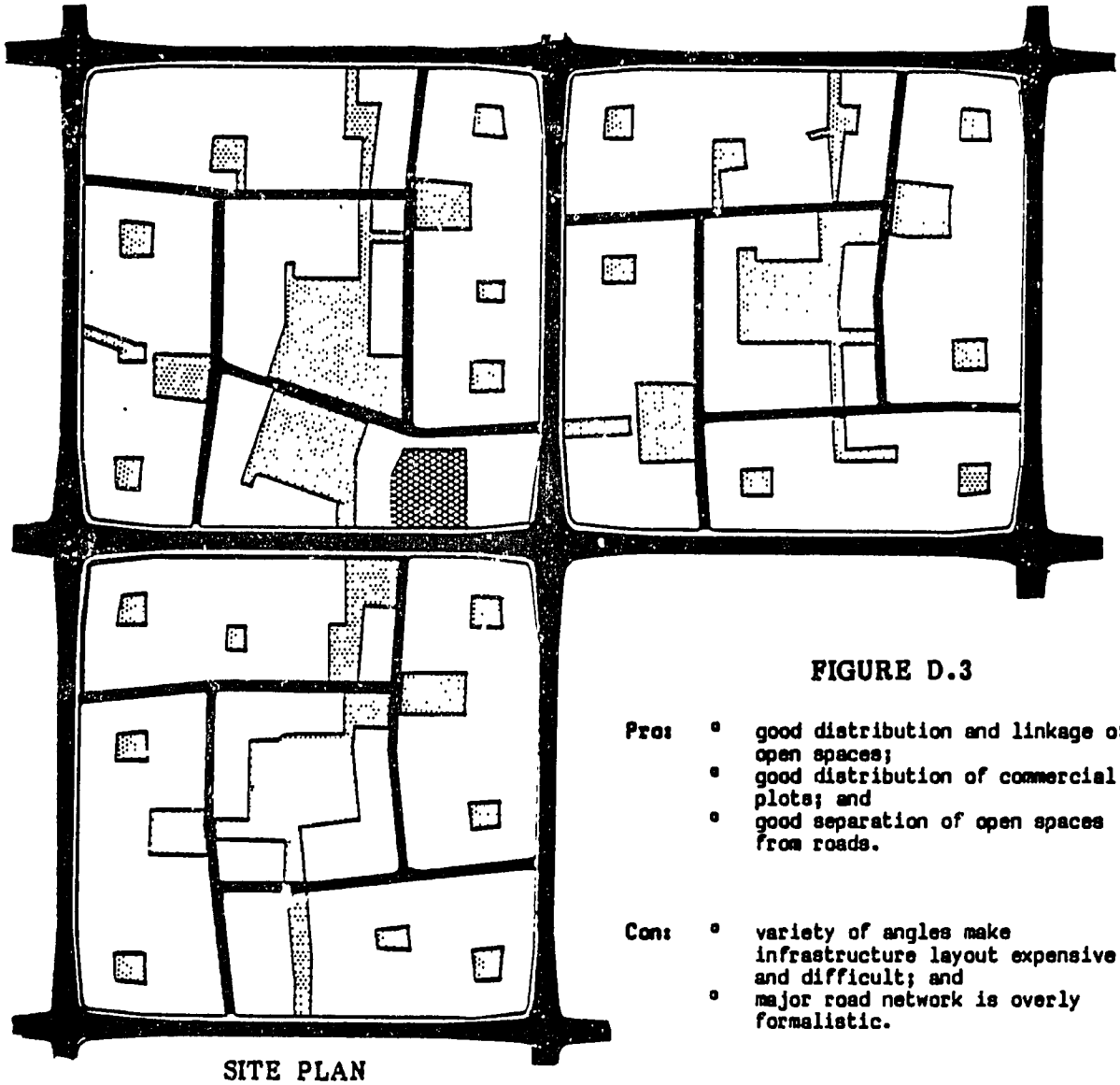


MODULE PLAN



SITE PLAN

Source: IBRD Sites and Services Project
Santa Ana Site, 1974
EL SALVADOR

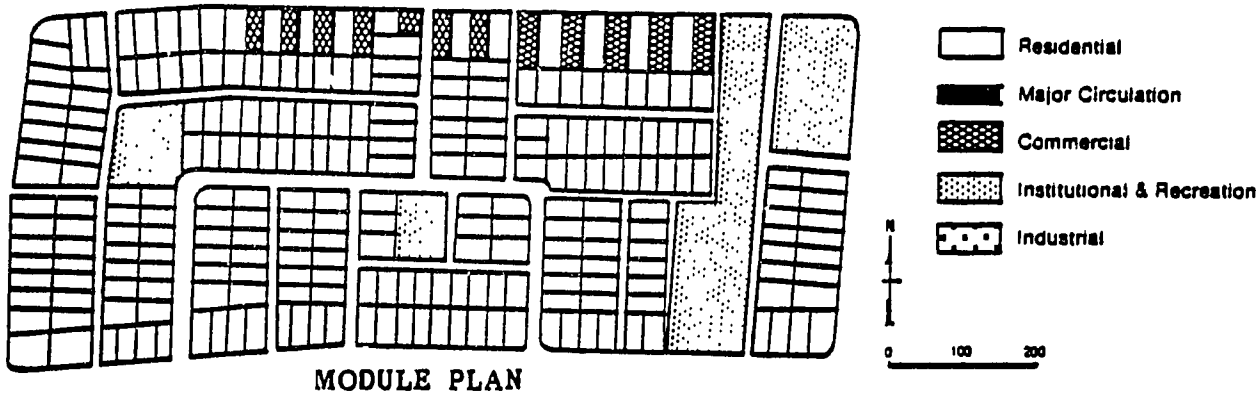


SITE PLAN

FIGURE D.3

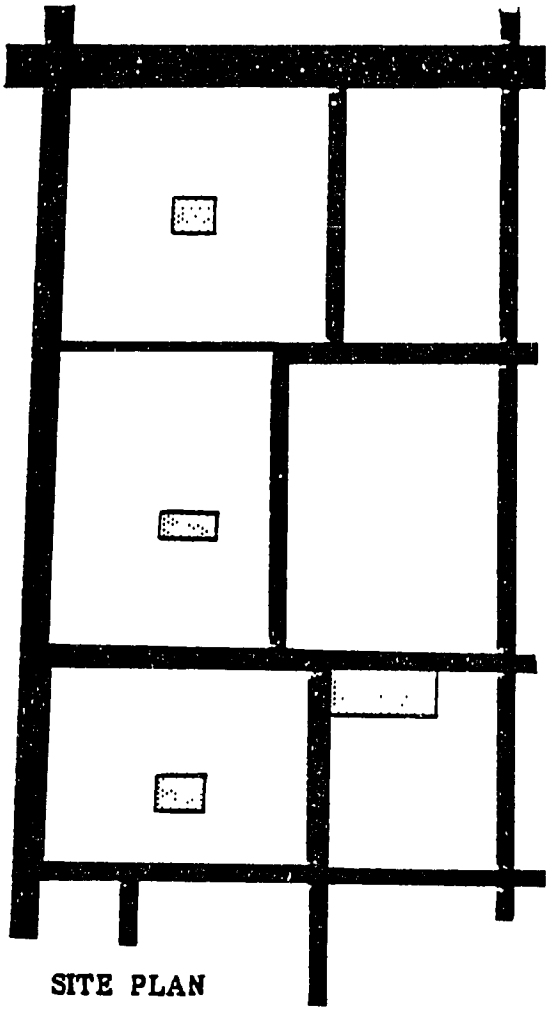
Pro:
- good distribution and linkage of open spaces;
- good distribution of commercial plots; and
- good separation of open spaces from roads.

Con:
- variety of angles make infrastructure layout expensive and difficult; and
- major road network is overly formalistic.



MODULE PLAN

Source: IBRD Second Urban Development Project
Owerry Sites and Services, 1980
NIGERIA

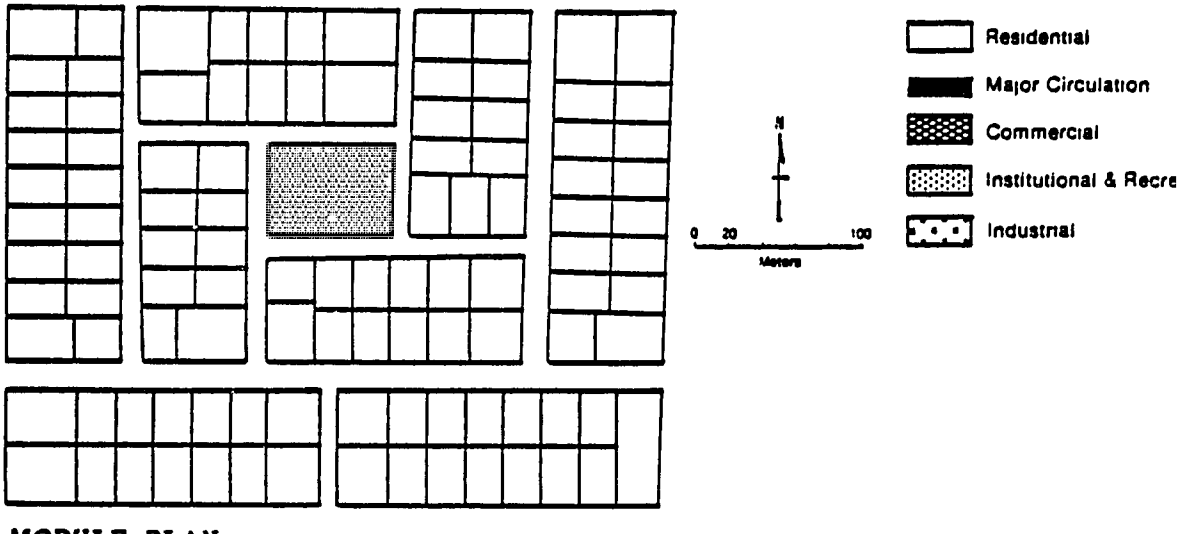


Pro: • good mix and distribution of different sized plots.

Con: • insufficient open space; and
• poorly proportioned plots.

SITE PLAN

FIGURE D.4



MODULE PLAN

Source: IBRD Secondary Cities Regional Project, Magpo Housing Sites and Services - First Stage, 1974 KOREA

SITE PLAN

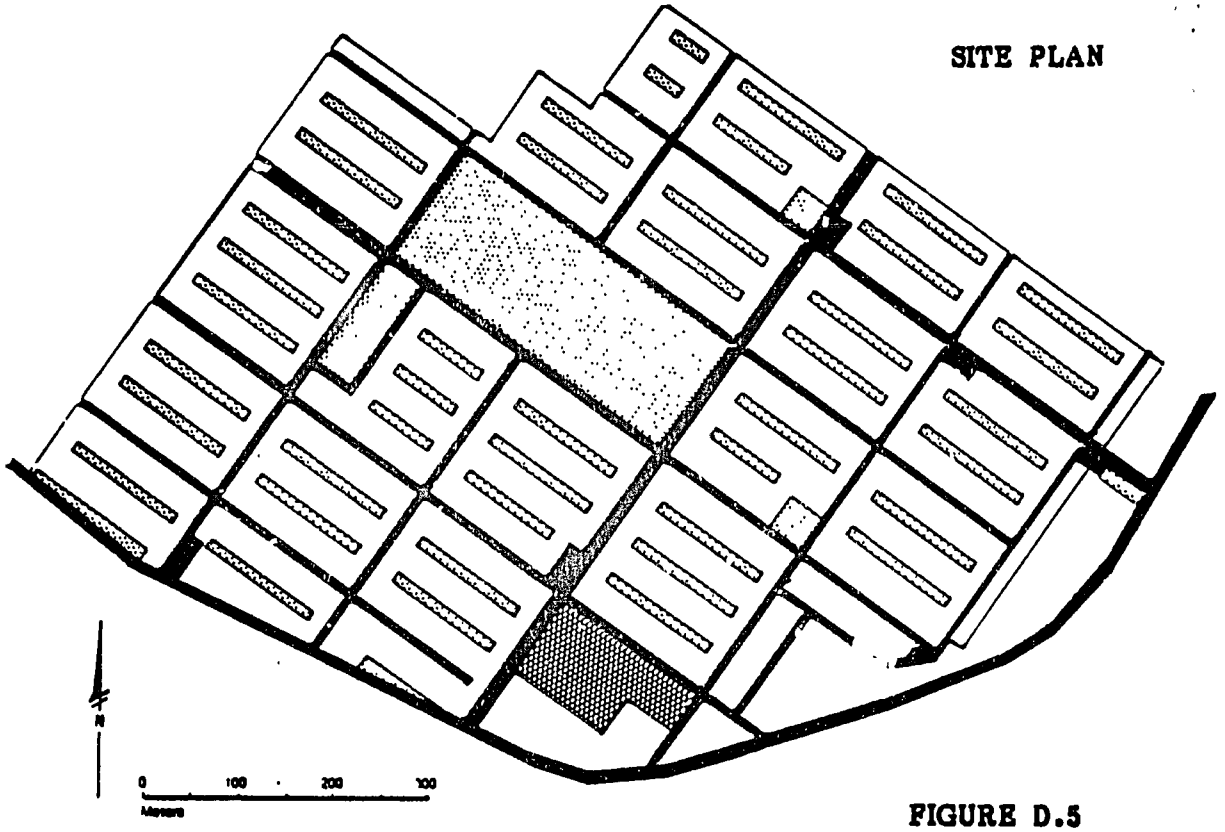
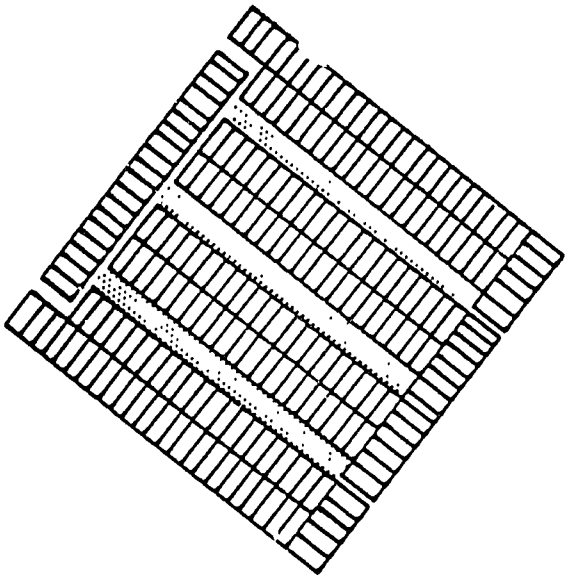


FIGURE D.5

Residential
Major Circulation
Commercial
Institutional & Recreation
Industrial

Pros:
- good linear layout of open space for household activities extension;
- good orientation of edge plots to major roads;
- cost-efficient block length and plot proportion; and
- good separation of through from access circulation.

Cons:
- poor pedestrian access to large-scale open space; and
- no variations in plot sizes.



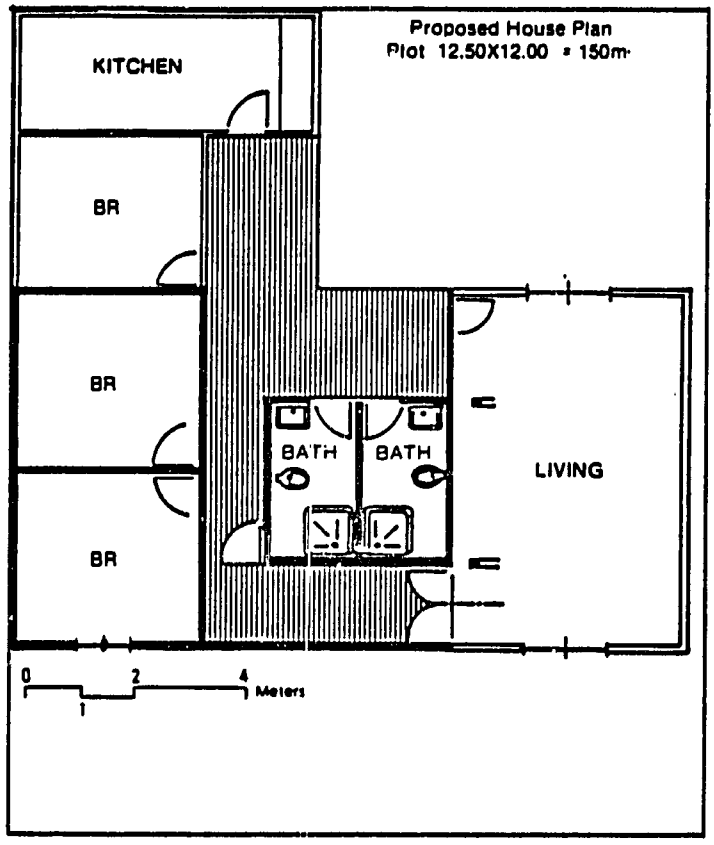
MODULE PLAN

Source: IBRD Sites and Services Project
Haina, 1981
DOMINICAN REPUBLIC

ANNEX E

CORE HOUSE EXAMPLES

FIGURE E.1



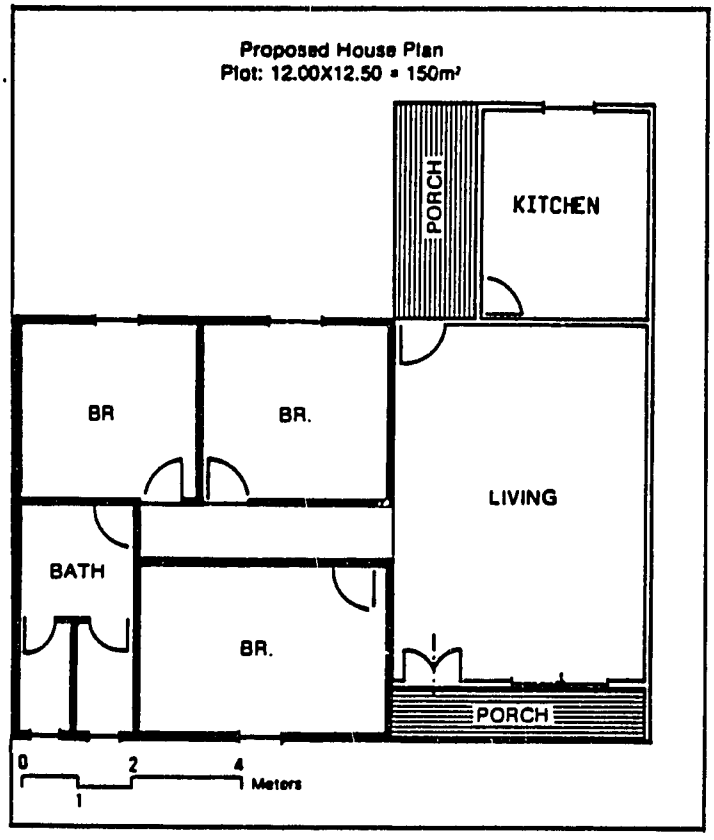
COMMENTS

Pros:

- double bath and corridor appropriate for rental units;
- bathrooms near front require short connection lines to street service main;
- expansion plan allows for party walls at rear and both sides of plot.

Cons:

- bathrooms in central location may generate odors in living and bedrooms;
- double bath is costly;
- bedrooms have poor cross-ventilation.



Pros:

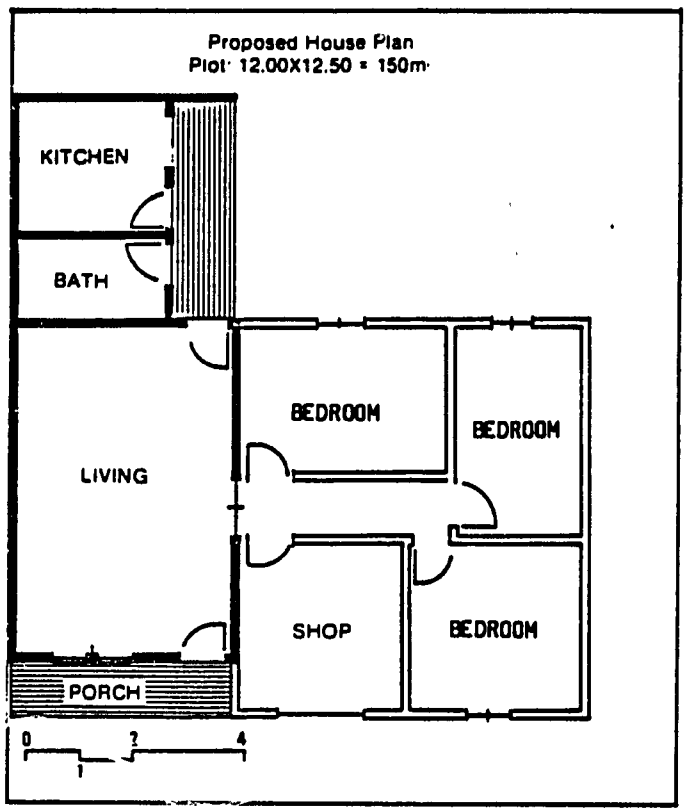
- bathroom at front corner requires short connection lines to street service mains and allows for common service wall with neighbor; and
- bath is convenient to bedrooms.

Cons:

- bath and kitchen service lines are far apart;
- walled and doored divisions within bathroom are costly (but perhaps culturally sympathetic);
- bedroom cross-ventilation is possible only with doors open.

Source: Core House and Expansion Plans
Cameroon Low-Income Housing Project
USAID/PADCO, 1981

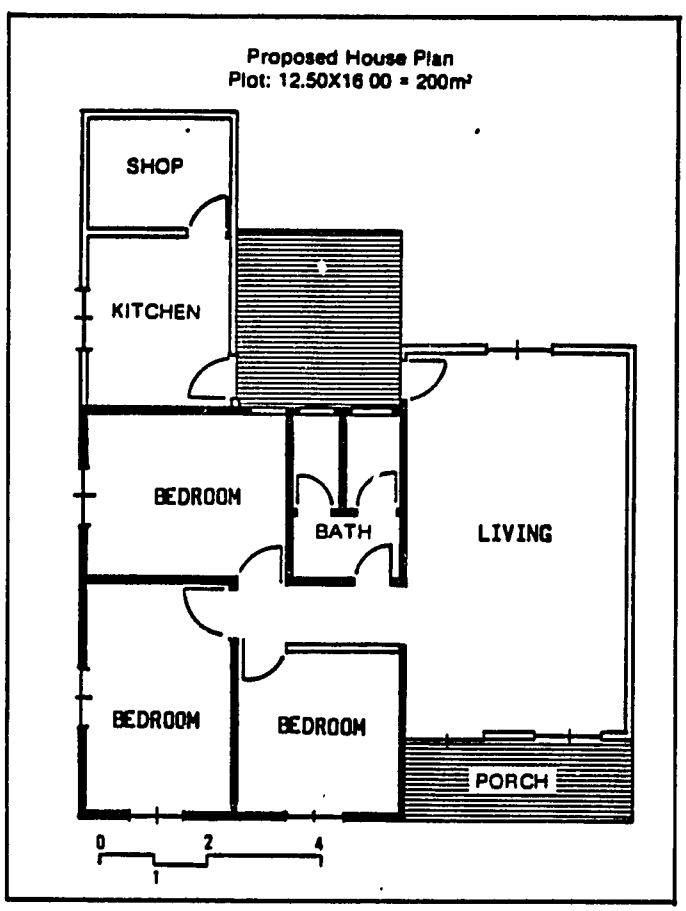
FIGURE E.2



COMMENTS

Pro:
- good concentration of bathroom and kitchen service lines, also allowing for common service wall with neighbor;
- bathroom layout is cost-efficient.

Con:
- shop has no street access for commercial activities;
- bathoom is inconvenient to bedrooms;
- cross-ventilation is possible only through open doors.

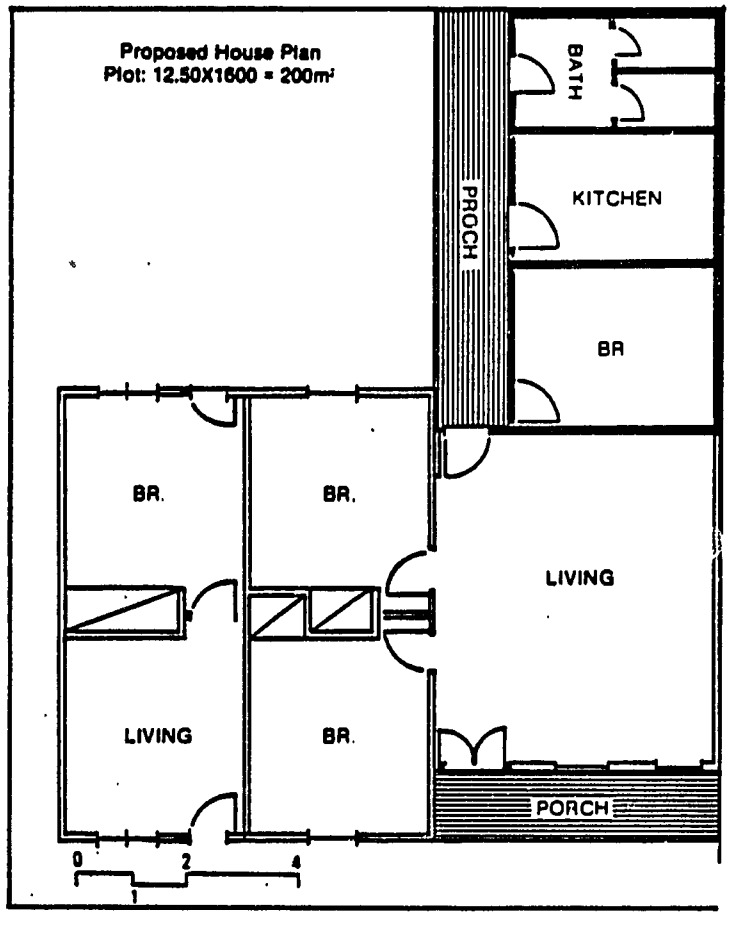


Pro:
- core is tightly laid out;
- bathroom is convenient to bedrooms;
- good cross-ventilation.

Con:
- central location of bathroom may generate odors;
- division of bathroom is costly (but perhaps sympathetic to cultural traditions);
- shop has poor access unless used only for storage.

SOURCE: Core House and Expansion Plans Cameroon Low-Income Housing Project USAID/PADCO, 1981

FIGURE E.3



COMMENTS

Pro:

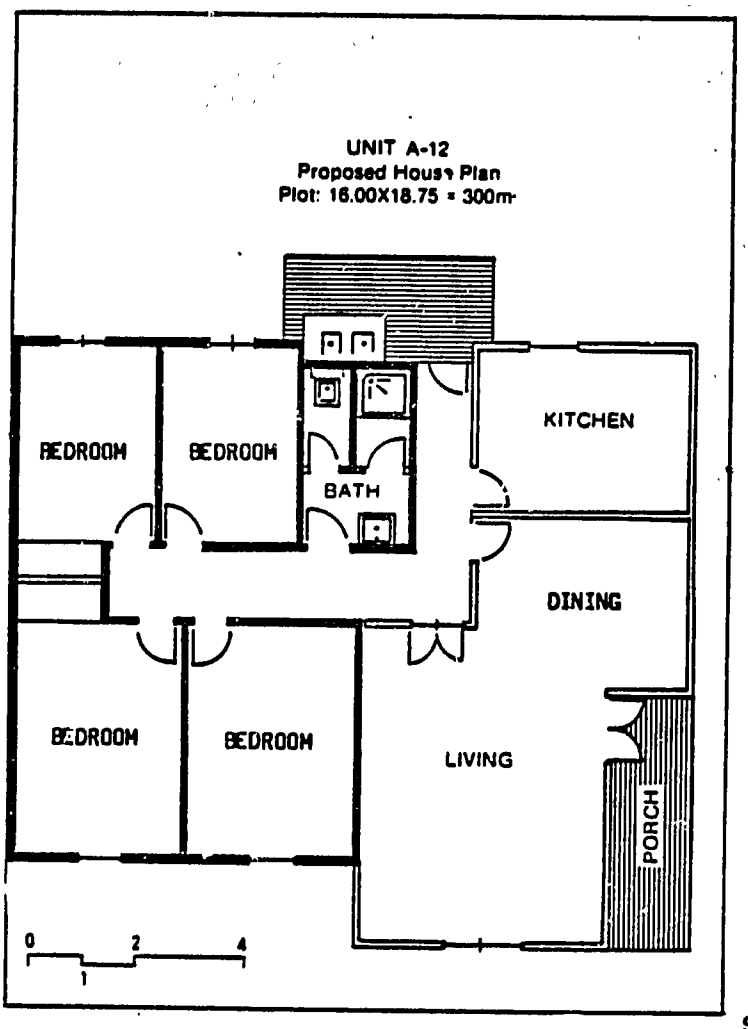
- core placement allows for cost-effective quadraplex layout;
- appropriate for rental unit
- good storage in bedrooms.

Con:

- bath division is costly (but perhaps sympathetic to cultural traditions);
- bath and kitchen at rear of plot requires long service lines from street mains;
- rental unit has poor access (through bedroom to bath and kitchen);
- poor cross-ventilation in bedrooms.

SOURCE: Core House and Expansion Plans
Cameroon Low-Income Housing Project
USAID/PADCO, 1981

FIGURE E.4



COMMENTS

Pro:
- good laundry facilities are provided at rear of bathroom.

Con:
- corridor space is very extensive;
- bedrooms have poor cross-ventilation unless doors are open;
- division within bath is costly (but perhaps sympathetic to cultural traditions);
- living and dining areas have excessive separation from corridor space.

SOURCE: Core House and Expansion Plans
Cameroon Low-Income Housing Project
USAID/PADCO, 1981

ANNEX F

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ANNEX F

BIBLIOGRAPHY/SELECTED REFERENCES

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