PHYSICAL GUIDELINES
FOR POPULAR URBAN SETTLEMENTS
IN DEVELOPING COUNTRIES

by

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SUBMITTED IN PARTIAL FULFILLMENT
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THESIS ABSTRACT

PHYSICAL GUIDELINES FOR POPULAR URBAN SETTLEMENTS IN DEVELOPING COUNTRIES

GEORGE ROBERT PARKER JR.
COURSE IV JUNE, 1970

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CONTEXT

Rapidly expanding world population and migration to urban centers has placed an ominous burden on governments, institutions, and private developers to provide housing which meets accepted standards. The impact within developing countries is especially critical as the vast majority of new families in urban areas have very low incomes and consequently are generally unable to procure adequate shelter on the private market. Adequate shelter for these peoples . . . the popular urban sector . . . must be, to a large degree, subsidized and provided for by the public sector.

The intent of this thesis is to set forth specific guidelines and approaches to the physical layout of new urban residential subdivisions. They are to serve as a framework for preliminary site investigation as well as detailed site planning. But it is important that they be viewed as guidelines within a range of alternatives for each specific site element. Based on the author's experience, the study has been directed toward the Latin American countries of Colombia, Peru, and Venezuela.

The elements which are covered in the text of the thesis are:
SITE CHARACTERISTICS
CLIMATE
CIRCULATION
PARKING
OPEN SPACE
COMMUNAL FACILITIES
COMMERCE, BUSINESS, AND INDUSTRY

The study outlines specific physical elements which are critical to the planning of site utilization. And within each element the relative priority of importance that each element has to the whole. While the guidelines may find application to private

developments, they are primarily intended for public or institutionally sponsered and financed developments.

It has been determined that the most important element in the land subdivision process is the layout of the circulation pattern and the dwelling lot distribution. Once this is accomplished, the elements of open space, communal facilities and commerce can be treated as a subtractive process from the overall lot subdivision pattern. Many of the spatial needs for these elements can be achieved by subtracting multiples, or whole blocks of residential lots.

The other critical factor to all of the elements is their location with respect to adjacent land uses and the proposed service population.

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TITLE: PROFESSOR OF ARCHITECTURE

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The other critical factor to all of the elements is their location with respect to adjacent land uses and the community as a whole.

SITE CHARACTERISTICS

LOCATION

Site location with respect to other elements of the metropolitan environment is usually expressed in terms of distance. Depending on the element proximity may be termed in kilometers of separation, travel distance in kilometers or time, by either driving or walking. Proximity of the site to specific elements will establish the need to include or exclude these elements in development plans:

Commerce, Business, Markets
Social, Religious Facilities
Health, Education, Welfare Facilities
Transportation, Municipal Services
Infrastructure
Recreation

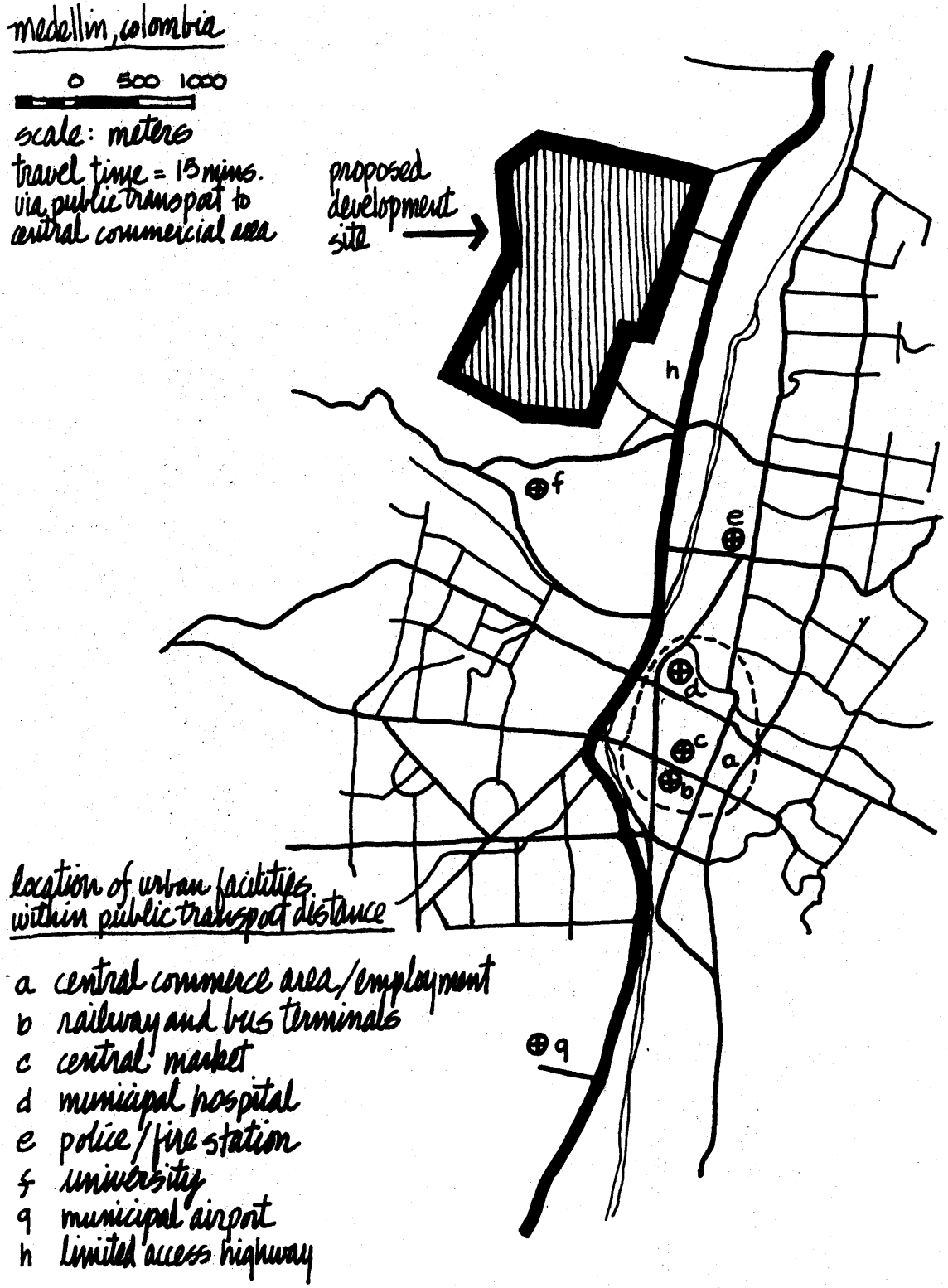
Improvement policy weighs heavily on the ability of the planned development to make use of existing facilities. Notwithstanding the size of the development, if an urbanization is located in close proximity, either walking or transport distance to all or some of the above facilities, it may not be necessary to provide for these facilities within the development.

ill 1

SITE LOCATION MAP

The site location map at a selected scale, i.e. 1:500 or 1:1000, should provide the following information: Local or municipal

ill 1
SITE LOCATION



planning offices should be contacted for sources of required information.

1. Location of the site with respect to existing and proposed circulation, access points, and easements or setbacks.
2. Adjacent land uses, lot lines and structure heights and outlines of the surrounding area.
3. Routes and form of public transport.
4. Location and type of all public or private communal facilities such as schools, parks, health, welfare and religious centers in the surrounding area.
5. Existing and proposed zoning classification of surrounding areas.
6. Location of railroad right of ways and crossings.

AREA

The site area in hectares or square meters, determines the form of community which can be developed. Given gross population densities it is possible to estimate the support population and in turn the type of community which can be developed. In small developments the community may be part of adjacent urbanizations, whereas large developments such as Cuidad Kennedy, in Bogota, (250,000 people) is not only a single large community but also numerous sub-communities or neighborhoods.

Parallel to this is the question, can the initial site area expand in the future as demand increases? A small urban site becomes more

of an infill project, whereas a large peripheral urban site may be capable of expanding development.

BOUNDARIES

BARRIERS

"There are many man-made and natural barriers that affect traffic and land use within the city."[1] Barriers which form site boundaries are either expressed in terms of lines or areas. Their influence on the site varies in relation to the type of barrier. Natural geographic barriers such as mountains, ravines, rivers, lakes, or other dynamic changes in the land form, can have either positive or negative influence on the site. These natural barriers generally prohibit or limit the development in terms of visual or physical links with other developments.

ill 2

For example, hills or mountain barriers will affect the microclimate of the site in terms of prevailing winds, sun exposure, precipitation and temperature influence. Lakes or rivers can have very positive influence by providing visual relief in contrast to the man-made environment.

Man-made barriers which form adjacency constraints to the site development are also of either a negative or positive influence. Perhaps the greatest man-made barrier is the limited access highway. Its effect limits not only visual continuity with adjacent

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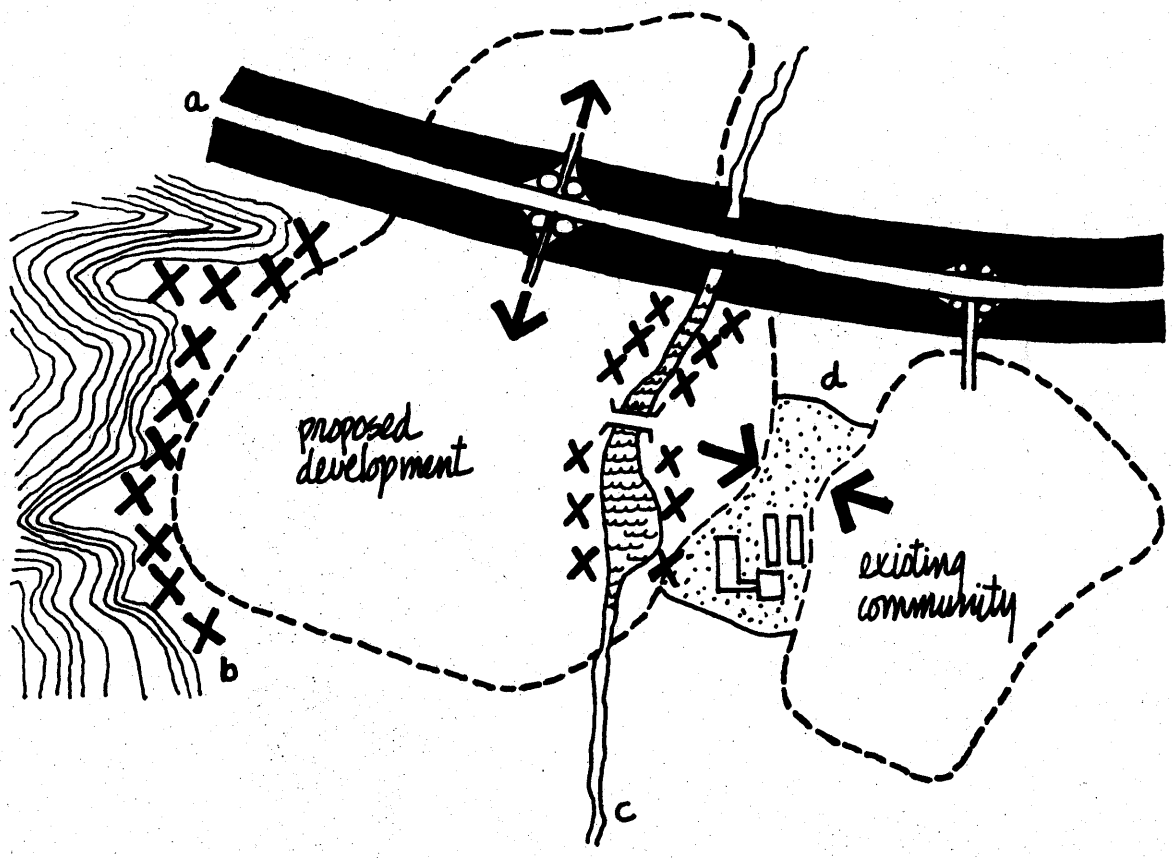
[1] Halprin, L., HENNEPIN AVENUE AREA REPORT, Lawrence Halprin and Associates, 1969, p. 7.

ill 2
SITE BOUNDARIES



boundaries

barriers man made
- a limited access highway

barriers natural
- b mountains, ravines
- c rivers

meshing boundaries
- d community park and school

communities, but restricts physical and social communication. The path and width of the highway inevitably causes corners or pockets on the site which do not lend themselves to homogeneous land-use development. Often these areas become un-used open spaces because of the incompatibility of residential land-use adjacent to the highway. The limited access highway is then truly a barrier between communities for which linkage is nearly impossible. For residential urbanizations perhaps the only homogeneous land-use adjacent to the highways are planned buffer areas of maintained open space, or transitional uses such as light industry or commerce.

A policy of boundary land-uses must be determined during initial planning if the above discussed problems are to be avoided.

MESHING BOUNDARIES

Of a less severe nature, are the site boundary conditions for which a meshing or homogeneous land-use can be planned. Artificial boundaries such as political divisions do not really inhibit the social continuity between one community and another. Public land uses such as parks, schools, communal facilities, or minor streets do not really limit the physical continuity between communities but rather can be a positive force in linking adjoining communities. The activities at each of these areas can be shared and thereby facilitate social bonds between different developments.

ill 2

TOPOGRAPHY

The physical shape of the site surface known as the site topography determines in a major way the layout of circulation networks, the

size and orientation of lots, and the economies of the development. Moderately (6-10%) sloping sites which are well drained are preferable to either very steep or very level land. The cost of developing very steep land is usually prohibitive, while drainage of sewage and storm water requires special attention on very flat sites. Flat sites (0-5%) also have the inherent disadvantage of monotony produced by the lack of visual relief or vistas.

On steep slopes over 10 to 15%,[1] except where special treatment for hillside or mountainous areas can be accomplished very cheaply, heavy site grading unless properly done, creates major settlement and erosion problems. The supposed tradeoff of low land purchace costs, is most often offset by high development costs for streets, infrastructure and lot terracing. Special treatment is also needed to preserve natural terrain, vegetation, and other features.

On relatively flat sites (under 10-15% slope), one construction method may be utilized for dwelling foundations whereas on steep slopes the construction of foundations will be quite different. Lots which are oriented up or down the slope have to be either terraced or provided with platforms for dwelling construction. Lots oriented parallel with the slope contours have the advantage of allowing for more conventional foundation techniques and dwelling layouts.

ill 3

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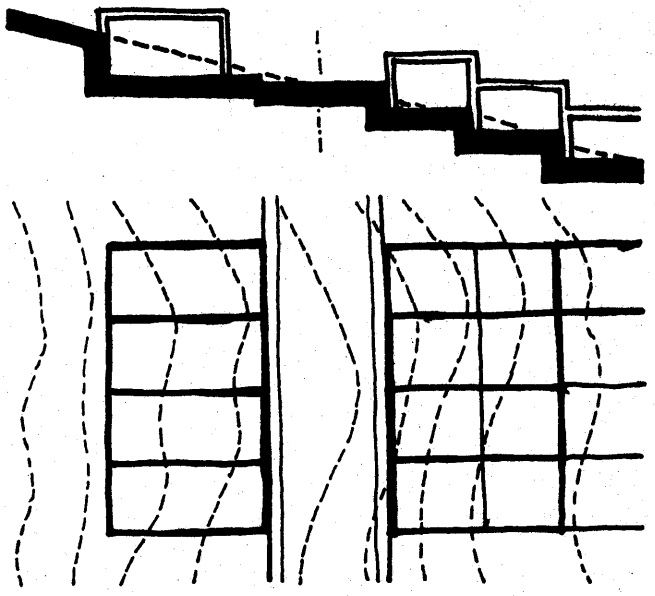
[1] Urban Land Institute, COMMUNITY BUILDERS HANDBOOK, 1968, p. 40.

ill 3
STEEP SLOPE
LOT ORIENTATION



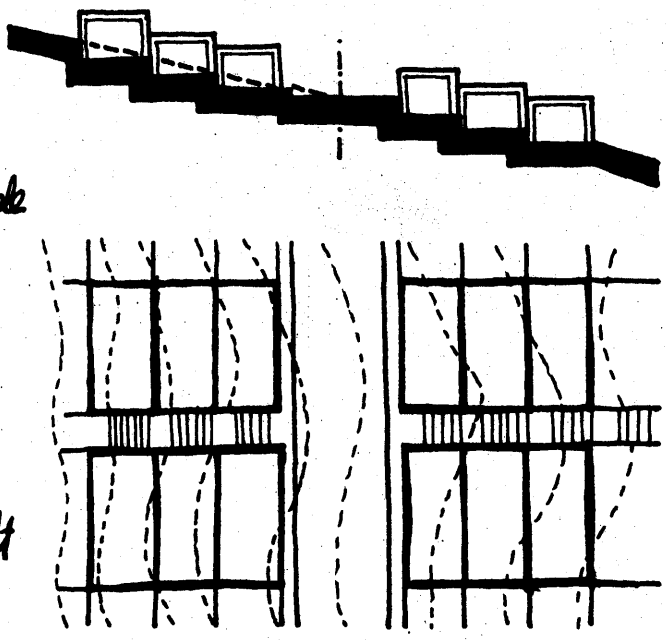
Lots perpendicular to contours

advantages

1. vehicular access to all lots no future parking problem
2. no need for service-trash collection points
3. ease of horizontal movement

disadvantages

1. many lots may have to be multi-level and may be unserviced by infrastructure (sewer) especially the downhill lots.
2. survey and lot layout difficult



Lots parallel to contours

advantages

1. majority of lots on single level
2. survey and lot layout is simple

disadvantages

1. lots adjacent to main roads may require multi-level buildings.
2. very limited vehicular access to majority of lots - inherent parking problem in future
3. service-trash removal difficult
4. horizontal movement for pedestrians is difficult & limited
5. stairs may be required on steep slopes

TOPOGRAPHIC SURVEY

For all but the smallest and simplest of developments, a topographic survey should be undertaken. The local or municipal planning offices, or municipal land survey offices should be consulted for topographic information. The topographic map for the site should delineate:[1]

1. Contours at intervals of:
   a. 35 cm. intervals for slopes averaging less than 3%.
   b. 1 m. intervals for slopes between 3 and 10 %.
   c. 2 m. intervals for slopes greater than 10%.
2. All existing buildings and other structures such as walls, fence lines, culverts, bridges, roads, with spot elevations indicated.
3. Location and spot elevations of rock outcroppings, high points, water courses, depressions, ponds and marsh areas with previous flood elevations.
4. Boundaries of flood plain zones subject to periodic inundation.
5. Delineation of vegetation and wooded areas, size species and location of all major trees.

ill 4

6. Boundary lines of property, easements, right of ways, etc.
7. Location of test pits or borings for sub-surface exploration.

Sufficient accuracy and economy can be achieved by using a stadia, planetable, or aerial survey, rather than the profile cross section

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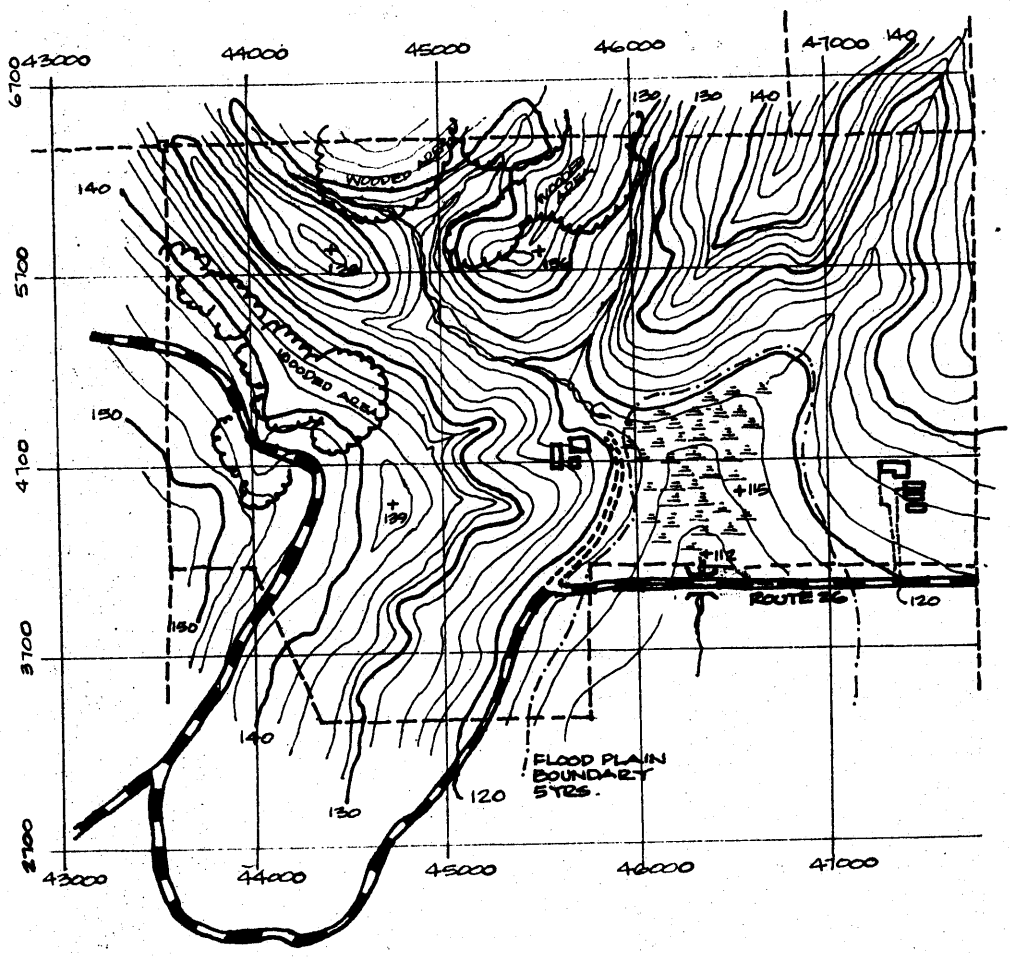
[1] Ibid, Urban Land Institute, p. 86.

ill 4
TOPOGRAPHY MAP



0 250 500 1000 meters

north

contours at intervals of 2m for slopes greater than 10%.
location of all existing structures, fences, culverts, bridges
spot elevations of rock out croppings, marshes
boundary of flood plain zone
delineation of wooded areas, major trees
property boundary lines, right of ways, etc.
location of test pits, borings, subsurface features

survey. For the purposes of a site utilization or feasibility study, municipal mapping reproduced at the desired scale may provide sufficient topographic data without having to engage a thorough survey as outlined above.

SOIL CONDITIONS

Knowledge of the site's specific soil condition is particularly important for the determination of:

1. Foundation system of structures
2. Surface and sub-surface drainage, and erosion characteristics.
3. Nature and type of vegetation which can be sustained.

Bearing capacities for foundation systems are expressed in Kilos/cm^2. Drainage characteristics are expressed in permiability of the sod, depth of the water table, and location of drainage channels, ravines, etc. The form of vegetation capable of being sustained relates in part to the type and depth of topsod.

Inadequate bearing capacity for a specified foundation system will mean that special foundation treatment is required and may preclude development of the site due to prohibitive cost. The preservation of the natural drainage patterns while possibly decreasing the total amount of developable land can in part eliminate special or man-made drainage systems requiring costly site preparation. Undisturbed topsoil is the greatest protection against erosion. If topsoil has to be removed from substantial areas, its replacement should follow immediately after construction.

SOIL SURVEY AND MAP

The purpose of the soil survey is to find out which soil properties are important, classifying these properties by soil type and locating the areas of these types.

The soil map (often available on a district or regional basis from municipal authorities) shows the distribution of soil types and defines their characteristics by:

1. kinds and numbers of layers
2. texture (amounts of stones, gravel, sand, silt, and clay)
3. kinds and amounts of minerals present

The municipal soil survey may provide sufficient information by interpolation for residential development and eliminate the need for a specific site soil survey and map.

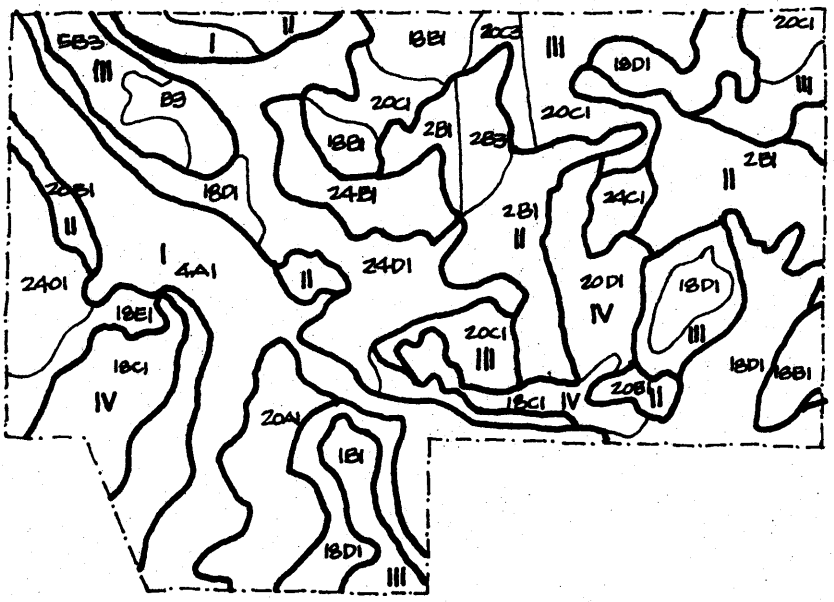
ill 5

INFRASTRUCTURE

In the initial feasibility analysis of the site the determination of all existing municipal or private utility networks must be undertaken. The location, capacity, and extension possibilities of the nearby networks for service to the development must be known. Wherever possible, public systems should be extended to service the site as the provision of community or closed processing systems are not only extremely expensive but require sophisticated maintenance programs to keep them operating properly. Because of remoteness, though, or non-existant municipal systems, there may be no other choice than to provide a community system or individual

ill 5

SOIL SURVEY AND SOIL MAP



symbols refer to type of soil,
steepness
degree of erosion
example
2B1 refers to type of soil
2 = type of soil
B = steepness of slope
1 = degree of erosion
IV refers to capability of soil for cultivation and landscaping
heavy lines on map are the boundaries of the capability area.

lot systems. In this situation very careful analysis must be given to each form of infrastructure: sanitary sewage disposal, storm sewage disposal, potable water supply, and electrical power.

SANITARY SEWAGE

Sewage disposal, by septic tanks and drain fields for each individual or small cluster of dwellings should be resorted to only if a community or public system is not possible. Besides the long-term maintenance problems, these individual systems require lot sizes considerably larger than either the row house lot (i.e. 6 X 20 meters) or the average single family suburban lot (i.e. 20 X 30 meters) for an adequate drain field area.[1] In addition, there are the problems of permiability of the soil which relates to specific soil types, pollution of adjacent sites, restricted areas to be kept free from planting, and the required sloping of the drain field away from the dwelling.

Septic tanks require a doubling of capacity for garbage disposal, require periodic maintenance and cleaning. Effluent from disposal fields located on hillsides has been found coming to the surface at considerable distance from its origin.[2]

As an alternative to individual lot systems or community disposal plants, the sewage lagoon may serve as a temporary solution until public trunk sewers can be extended to the development. It should

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1 Ibid, Urban Land Institute, p. 177.

2 Ibid, Urban Land Institute, p. 178.

be cautioned though that sewage lagoons require a considerable area and specific soil conditions, and are therefore not applicable to all conditions.

Minimum pitch of sewer lines is 1% and maximum trench depth is usually limited to 2 meters. Interceptor basins may have to be used when depth of trench would exceed 2 meters. The buried sewer lines usually occur within street or path R.O.W.'s. They should not be located beneath hard surface materials such as concrete due to difficult and costly maintenance procedures. Sewer utility lines which depend on gravity flow will necessitate a topological and hydrological analysis of the site.

STORM SEWAGE

Because of the high cost of installing a separate underground storm drainage system, the inadvisability of combined sewage systems, it is recommended that storm drainage be handled by a surface network. Such a network of open drainage channels and periodic collection basins (if no natural drainage ravine is nearby) can greatly reduce infrastructure investment. Storm drainage is usually relatively minor.

WATER SUPPLY

As with sewage systems, the preferable policy is to connect up to the municipal system. Where this may not be possible due to distance, a community well and distribution system can be provided. Depending on the development budget these alternative distribution methods are possible.

1. piped distribution (underground) to each dwelling lot
2. piped distribution (underground) to grouped lots, or communal facilities, i.e. one point source for each cluster of dwellings
3. periodic tank truck distribution to each dwelling: Water is stored in small tanks or barrels within the dwelling

ELECTRICITY, TELEPHONE,

Underground distribution for electricty and telephone is desirable from a visual and lower maintenance cost standpoint. However, the greater investment required for the underground versus the exposed overhead system, limits its applicability to low cost residential urbanizations. The visual problem can be partially resolved by locating the poles along rear lot lines, providing that access for these locations is not encumbered in case of emergency. This may be a problem for rowhouse developments, unless an access easement can be provided.

GAS

Gas as a source of fuel is only provided if there is an existing public distribution network within the immediate vicinity of the development. Gas mains are usually placed within the street R.O.W. underneath the sidewalk portion.

INFRASTRUCTURE PRIORITY

Infrastructure requires a major portion of the development budget. Studies carried out at CINVA,[1] of six planned projects in Central America indicate that the infrastructure investment, for sanitary

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[1] CINVA, NORMAS MINIMAS DE URBANIZACION, CINVA, Bogota, 1968, p.26, Insert

sewer, storm sewer, and water range from 35% to 72% of the total urbanization costs.

	PERCENT OF URBANIZATION COSTS	
	Low	High
SANITARY SEWER SYSTEM	10	34
STORM SEWER SYSTEM	3.6	24
WATER SYSTEM	12.6	17

A survey carried out in Lima, Peru[1] indicates the following priorities as determined by the residents of the areas.

PROBLEM	TO THE FAMILY	TO THE BARRIO
1. Water and Sewer	56%	51%
2. Paving	13	19
3. Electricity	9	13
4. Education Facilities	4	2
5. Comm. Services-Markets	2	2
6. Medical Services	1	-
7. Police/Fire	6	5
8. Other	6	5
9. No Problems	3	3

No. of Cases - 631

Note: Paving may supercede electricity as a priority because of the dust problem in the extremely dry climate of Lima.

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[1] Ministerio de Trabajo y Comunidades, LIMA-CALLAO SURVEY, Lima, Peru, 1967.

the following is suggested as a priority for infrastructure investment when development funds are extremely limited and complete or all permanent systems can not be provided initially.

ill 6

UTILITIES MAP

When the amount of utility information will make the site location map confusing, a separate utility map at the same scale should be provided showing by type:[1] The local or municipal public works or utility companies should be consulted for source information.

1. all utility right of ways or easements with dimensions of width, length, etc.
2. location and size of existing water, gas, electric mains, and underground conduits
3. location, size and invert elevations of existing sanitary sewers, storm drains, or open drainage channels, catchbasins, and manholes, within the vicinity of the site
4. location of existing overhead telephone and electric service, trunk lines, street lighting, and all pole locations
5. location of police and fire-alarm call stations

MUNICIPAL REGULATIONS

MASTER PLANNING, METROPOLITAN GROWTH

Prior to final site selection, and together with other preliminary investigations, the projected use and development for the entire site should be planned. It is important for the developer to

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1 Ibid, Urban Land Institute, p. 87.

INFRASTRUCTURE	INVESTMENT PRIORITY BY STAGES		
	FIRST	SECOND	THIRD
Electricity [1]	Permanent Distribution to Service all Lots		
Water [2]	Tank Truck Distribution	Piped Distribution to Communal Taps	Extend Distribution to Service all Lots Connection at Owner's Option
Sanitary Sewage [3]	Pits and/or Privies on Individual Lots. Chemical Service	Piped Distribution to Communal Toilet, Bathing, Washing Facility	Extend Distribution to Service all Lots. Connection at Owner's Option.
Storm Sewage	Open Surface Channels and Collection Basin		
Telephone and Gas	—	As Required	—

[1] Electricity designated as first priority for distribution to all lots. Serves as fuel source, lowest cost utility to install. Minimal street lighting can serve as deterent to crime.

[2] If no fire hydrants are planned (this practice is increasing) then 3" maximum diameter pipes for distribution network.

[3] Highest investment costs. Also requires water supply to operate by gravity flow. Pitor privy solution should be only temporary solution.

determine the impact his subdivision will have on adjacent communities and the overall region or city. Regardless of the amount of development in the first stage, the site should be planned for ultimate saturation. As a guideline, these factors should be included in a comprehensive community plan.

1. The physical, social, and economic relationship to the urban or regional master or comprehensive plan of the governing municipality
2. land utilization plan for the entire site indicating amount and location of land to be set aside for; residential, commercial, industrial, communal facilities, open space, transportation, circulation and other activity nodes.
3. circulation, parking, and utility distribution networks. The reader is referred to the specific sections dealing with these topics. It is particularly important to ascertain the relationship and probable impact these factors will have on adjacent communities and the region.

The visual form of this information consists of a correlated set of maps or drawings graphically presenting the pertinent information together with required notes in a development document.

ZONING

Zoning was originally developed as a public method of protecting existing property values from depreciation due to intrusion of non-compatible land uses into established areas.[1] Some communities

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[1] Ibid, Urban Land Institute, p. 68.

still regard zoning in this singular purpose for preserving status quo. But its real function should be that of a tool directed toward controlled development consistent with an up to date urban or regional comprehensive plan. It should be capable of being changed consistent with changing demands and directions of overall urban growth patterns.

Zoning as a state or municipal police power provides for the division of a politically governed region into different land-use classifications. The principal ways in which zoning control subdivision layouts are:

1. Population Densities
2. Minimum Lot Sizes
3. Minimum Open Space Requirements
4. Maximum Building Coverages
5. Maximum Building Heights
6. Front, Rear, and Side Lot Setbacks
7. Minimum Parking Requirements

Population density is a relatively recent way of controlling developments. It obviously relates to minimum lot sizes which in turn reflect zoning designations such as:

Single Family Lots

Two Family Lots

Multi-Family Lots

Unfortunately, most zoning is established on a lot by lot basis and therefore bears little relationship to community-wide or large

tract development. Density zoning does away with the lot size as the key control by setting a maximum number of dwelling units which can be developed per hectare. This flexibility allows for a variety of different lot, cluster, or block formations within a given area as long as the maximum overall density is not exceeded.

Planned Unit Development is a relatively recent zoning concept whereby a large parcel of land may be developed in a variety of different ways. The controls for this type of development are based more on performance criteria rather than on dimensional criteria. This usually implies design development review by the local or municipal planning authority during the initial and preliminary stages of planning. Within one area, various forms of housing, circulation patterns, commerce, and communal facilities may be intermingled without regard to specific lot configurations. The emphasis is on the physical development as a whole rather than fragments of land development.

It can be presupposed that this is the only rational way of planning on a neighborhood or community-wide basis, especially so for large development tracts. Most of the recent new town and neighborhood cluster developments in England and the United States have utilized planned unit development zoning. Planned Unit Development may incorporate a mixture of housing types, non-uniform arrangement of buildings, shared open space, and other departures from uniform lot by lot zoning regulations.

Zoning on adjacent sites must also be related to the zoning controls of the site. Obsolete or non-compatible zoning between the

site and adjacent areas may require zoning variances of the local authorities in order to carry out the planned unit development.

BUILDING CODES

Building codes are publically administered controls concerned primarily with the structural components, mechanical requirements, material specifications and grouping of structures for public health and safety. Building codes for a particular site location may be under local, state or provincial, or national jurisdiction. The codes may relate to site considerations and the location of buildings with regard to building heights, required exits, and fenestration requirements. As with zoning regulations, many building codes are obsolete and prevent new materials and construction techniques from being utilized. This has the effect of raising development costs, based on outdated materials and techniques. In some localities, there is a trend toward adopting new building codes, based on performance standards rather than testing specific materials and techniques to be used. This has had a positive effect in allowing designers and developers to explore new construction techniques and to effectuate lower building costs.

PRIVATE REGULATIONS

EASEMENTS

Easements are a form of private protective covenants, set up by the developer or homes association, which may guarantee access and use of particular spaces within a development for shared or common use.

Scenic or open space easements within a development grant to the home owners a right to the preservation of these open spaces for use by all.[1] Such easements prevent construction over these areas in the future and hence guarantee the original intact of the open spaces. Easements impose restrictions against penetration of physical development onto the easement, or in extreme conditions may serve as a physical or social barrier to the development.

Utility easements guarantee the developer, home association, or the concerned utility company the right to access for maintenance of specific utility lines. Such lines and their accoutrements may be either above ground or below ground and run through private or communal property. The easement is usually specified in terms of a strip of land of a certain width on which no permanent structure can be built.

Access easements guarantee to the concerned party the right to cross over common or private property to gain access to his property . This is a very common device used in court or cluster type housing subdivisions. Often these easements are maintained by a homeowners' association, or community group, especially when they form a link with the open space network.

DEED RESTRICTIONS

Deed restrictions, another form of protective covenant, are private contracts between the developer and the home owner. They do not necessarily overlap public zoning regulations which are subject to

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[1] Ibid, Urban Land Institute, p. 194.

arbitrary change, but do guarantee that built-in amenities of the development will be protected on a long term basis. Some covenants are drawn up with a definite termination date, with options to continue if majority action is not taken against them. The legal form of covenants varies with different regions and countries, therefore the local municipal title authority should be consulted for advice applicable to a specific site.[1]

The covenants primarily control; use of land, and architectural design with restrictions as to type of design for dwellings, and all structures such as fences and walls. The enforcement of the covenant must be through a long term governing body such as a homes association and it usually exercises it's jurisdiction by plan review of the proposed development a homeowner wishes to make.

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[1] Ibid, Urban Land Institute, p. 195.

CLIMATE

In South America the majority of the continent is in a tropical climate, generally mild, and nearly always sunny. Two types of climate prevail:

Hot and Humid

Hot and Dry

Accordingly, one of the main objectives in design is the capturing of summer breezes and protection from intense sun heat.

This section will discuss the effects and consequences of these climates on the design of shelter and land subdivision. Climatological factors affecting man's physical comfort are essentially the sun's rays, air temperature, winds, precipitation, and humidity. In low-cost urbanizations, the intelligent use of climate is important when mechanical climate control is not possible because of technology or cost.

The effects of climate for a particular region and site will primarily be determinants for room dwelling, and lot orientation. Additionally, climate will determine choice of building materials, whether they are to be transmitting, absorbing, filtering, or repelling. The choice of a specific set of materials forms the design basis of exterior walls and roof construction, as exposure to climatological factors is most critical in these portions of a dwelling which are exposed to all combinations of sun, wind, temperature, and precipitation.

Therefore, the choice of room, dwelling, and lot orientation will be based on a considered compromise of the effect produced by

conflicting climatic factors. Orientation as determined by sun will be different than orientation as determined by wind. However, priorities may be established. For example orientation might be established by the following priorities:

1. maximum use of natural lighting
2. indoor utilization of prevailing summer breezes
3. minimizing the effect of summer solar radiation
4. utilization of winter sunshine to heat interior spaces and exterior walls

SUN

Sun=solar radiation=heat gain. When considering solar radiation, which is likely to be the limiting factor in most areas, it should be borne in mind that the amount of radiant heat received by a surface is governed by the angle of impingement of the rays. Maximum radiation is received by a surface when the sun shines directly on it. For a horizontal surface, the radiation intensity increases from sunrise until noon and decreases to sunset. A west wall, however, does not receive direct radiation until early afternoon, and the intensity increases until late afternoon. It follows that when feasible, walls and roofs should be so oriented as to allow the sun's rays to impinge obliquely. Where orientation and/or masking fail to produce the desired results, consideration should be given to varying the degree of insulation with respect to orientation. For example in hot climates walls exposed to sun might be provided with greater insulation than other walls to reduce heat transmission. In colder climates, walls which are not exposed to the sun, or those exposed to cold prevailing winds,

might be given the greatest insulation. This is especially applicable to low-cost urbanizations which cannot afford mechanical environmental control.

SUN - ORIENTATION

The more one proceeds toward the equator, the more east-west can a building be oriented in order to have a complete sweep of the sun during the day. However, in such locations, it is usually desirable to avoid the sun. Thus in Colombia, which is almost on the equator, the long axis of the dwelling may be oriented with its long axis from north to south. Again this orientation may

ill 7 vary from one city to another due to varying degrees of sun obstructions such as clouds, topography and artificial barriers.

SUN - ORIENTATION CHART

It is possible to be more specific in the determination of orientation based on sun radiation, utilizing the yearly direct average radiation received at the underheated (Ru) and overheated (Ro) periods. Ru, and Ro are expressed in B T U per square meter required to maintain a desired interior temperature for the corresponding

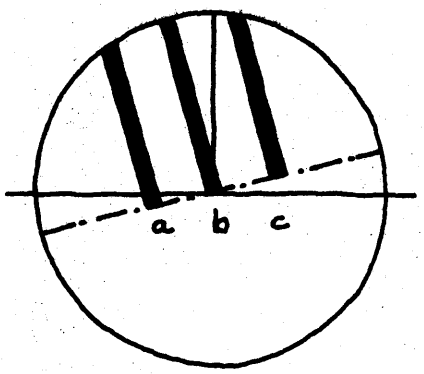
ill 8 period.

SUN-EXPOSURE

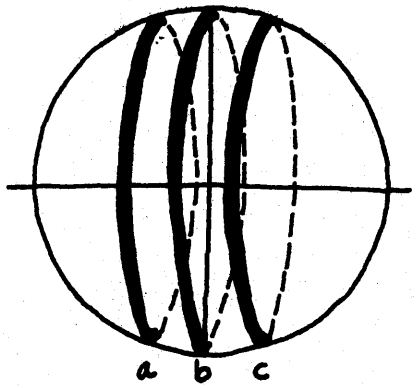
Once Dwelling orientation has been ascertained, the amount of sun-exposure a particular room within the dwelling receives may be determined. This determination is a factor of the primary room function and the design treatment of the exposed facade. In addition to solar radiation (the exclusion or inclusion of it into a room) the sun may be used for lighting of the spaces. The

ill 7
SUN ORIENTATION

sun orientation charts

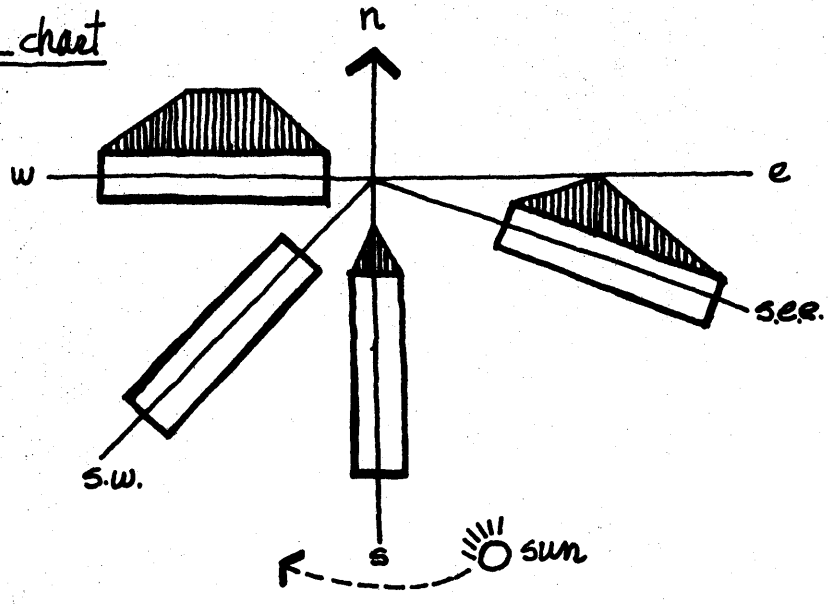


section
a winter
b fall/spring
c summer



plan
a winter
b fall/spring
c summer

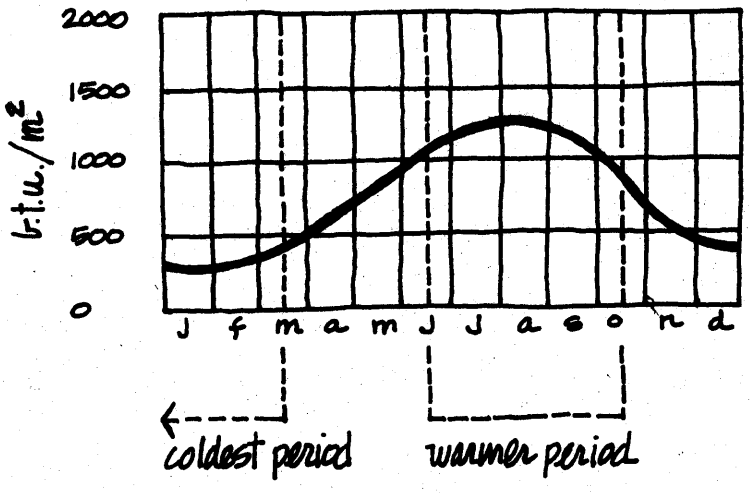
building orientation chart



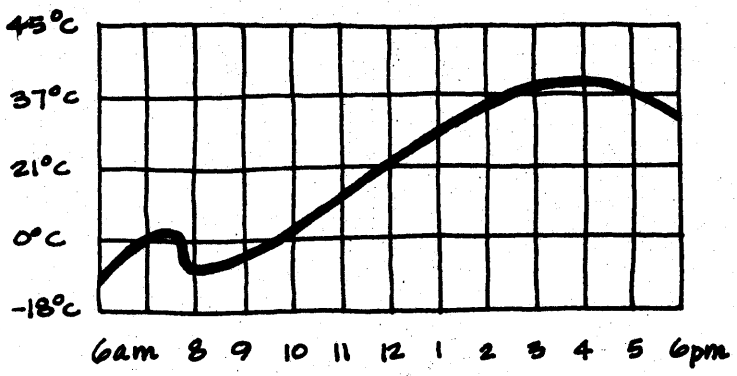
ill 8

TEMPERATURE AND SUN ORIENTATIONS

monthly b.t.u. chart

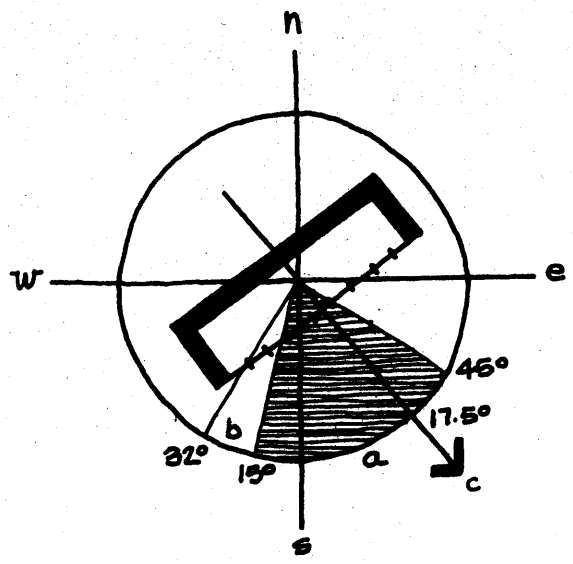


daily temperature chart



sun orientation chart

a good orientation
b satisfactory orientation
c optimium orientation



lighting can be both direct or daylight depending on placement, design and transmittance of the sun's rays through to the interior.

Given a particular region and the known period, amount, and angle of impingement of the sun it is possible to establish priorities for room exposure dependent on orientation. The chart below is a hypothetical example.

PRIMARY ROOM FUNCTION	N	NE	E	SE	S	SW	W	NW
LIVING SPACES		•	•	•	•	•		
SERVICE SPACES	•	•					•	•
CIRCULATION SPACES	•							
OPEN SPACES	•	•	•					•

Room orientation within a portion of the dwelling may be accomplished by locating the axis of the room so as to expose or exclude the exterior facades from a maximum or minimum amount of the sun's rays. Given a specific room orientation, penetration of the sun's rays against the exposed surface may be controlled by the design of the roof and/or other masking devices. Sun utilized for natural lighting of interior spaces is once again dependent on the specific region and amount of sunlight desired to reach the interior spaces.

ill 9

WIND

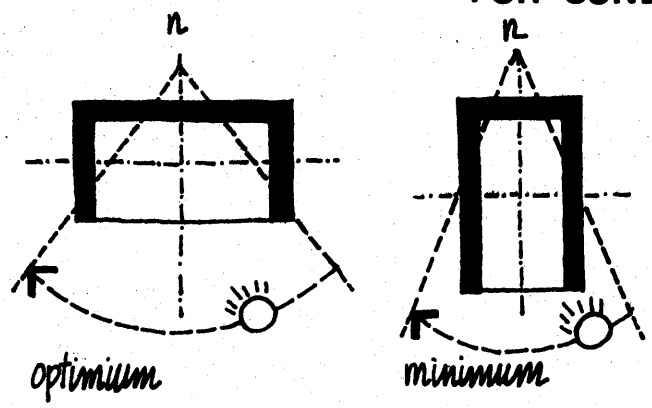
ORIENTATION - SEVERE PREVAILING WINDS

Orientation of rooms, dwellings and lots to protect against severe winds is determined by seasonal dominant wind directions and maximum velocities. In cold climates with severe winter winds, the

ill 9

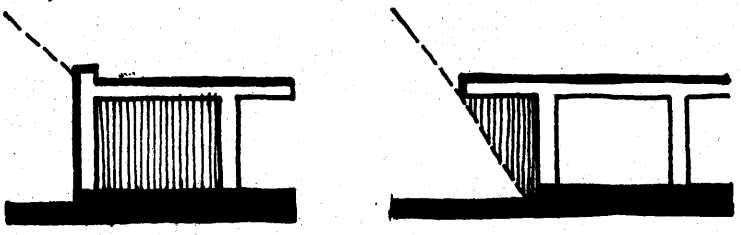
ROOM ORIENTATION FOR SUNLIGHT

room orientation for sun penetration



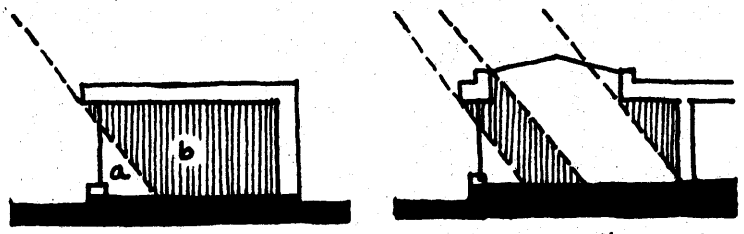
optimium minimum

sun exposure on facades

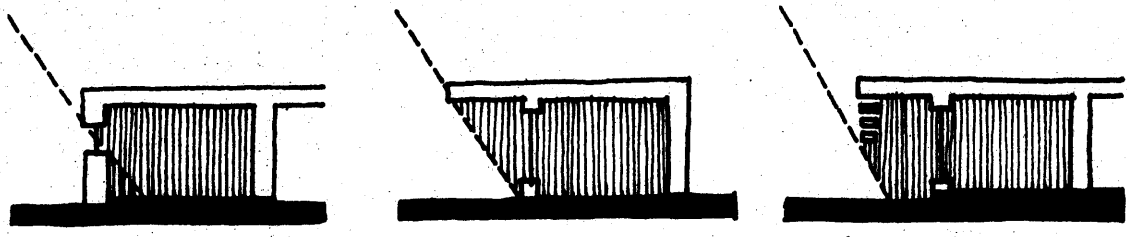


optimium minimum

direct sunlite penetration
a direct sunlite
b daylite



maximum maximum with skylite



minimum minimum minimum

dwelling should be protected so as to minimize cold air infiltration from door openings, windows, and cracks due to change of materials. Many sites will require assessment of local wind directions due to topography, and artificial obstructions. Locating access to the dwelling on the lee side will minimize the cold air infiltration.

ill 10

ORIENTATION - LIGHT BREEZES

In hot humid tropical climates, the advantages of light breezes should be incorporated into the design of the shelter for maximum natural cooling. The orientation of the dwellings with respect to each other, location of windows or ventilators, the facades of the dwelling, and the local topography each require consideration if full advantage is to be taken of these local breezes for cooling.

WIND - VENTILATION

Ventilation of rooms must necessarily take into consideration air paths within the dwelling both in terms of horizontal and vertical movement. Spaces for food preparation, bathing, sleeping, and working should receive maximize priority for location in allowing for natural through ventilation.

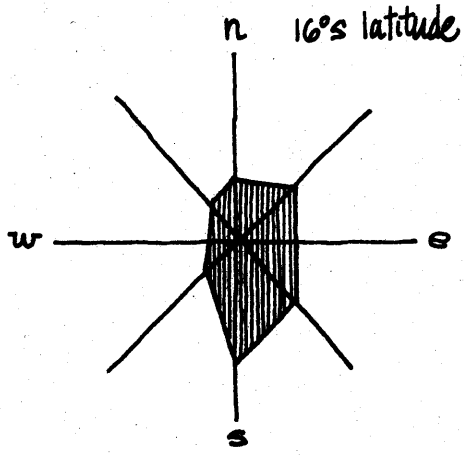
ill 10

TEMPERATURE

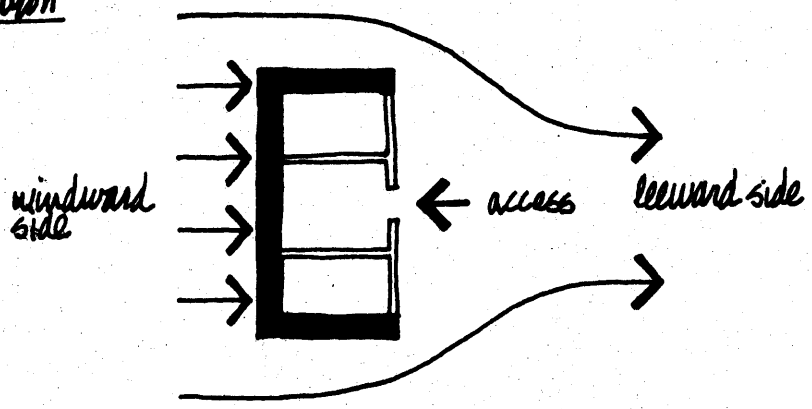
Temperature is principally a function of incoming solar radiation, and this is in turn a function of latitude. The elevation of a specific latitude is an additional factor which delineates a particular temperature pattern. Temperature as a design factor is concerned with the temperatures derived from air layers close to the ground, hence microclimatic air. Yearly averages in temperature

ill 10
WIND DIRECTION AND BUILDING ORIENTATION

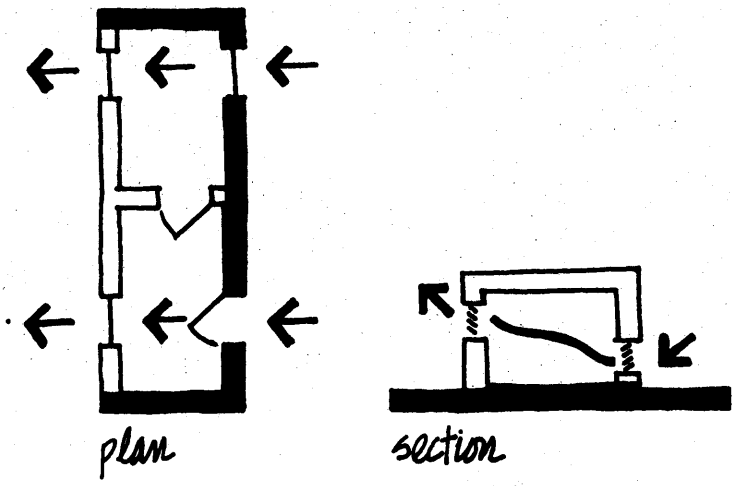
dominant wind direction / intensity



building access orientation



optimium cross ventilation



for different regions may be equal, but the effects of design for different regions must be based on the seasonal minimums and maximums of both dry bulb temperature and relative humidity. Daily minimums and maximums within specific periods are also determinants for design. For example, the choice of exterior materials and method of ventilation, controlling heat transfer, will vary for regions which have prolonged daily and hourly periods of very high temperatures versus a region in which the above condition only occurs infrequently. It is necessary then to ascertain the

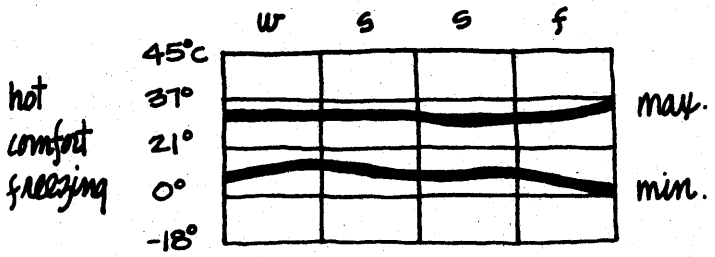
ill 11 average or probable maximum length of heat or cold waves.

In cold climates, the average dates of last and first frost can be used for a variety of purposes. Frost and its depth usually determine type and depth of foundations. Building foundations and underground utilities must go below the frost-line to obtain stability. The number of frost changes in turn indicates the amount of freeze-thaw action that may be expected from materials which come into contact with the ground and dissimilar materials on the exterior of a dwelling. Surfaces, roofs, horizontal facades, and adjacent ground surfaces all reflect or absorb varying amounts of radiation depending on the material chosen. Dark colored, dense materials such as asphalt can be expected to absorb and retain heat for longer periods of time than say light colored low density materials. The location of surface materials can be expected to effect the temperature curve in its own locale as well as effecting adjacent

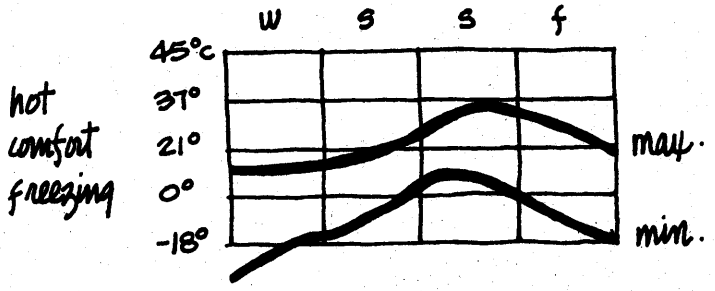
ill 11

TEMPERATURE CHARTS

warm climates



colder climates



surfaces or spaces due to radiation. In hot humid climates the placement of dense heat absorbing materials such as an asphalt walkway adjacent to interior living spaces would be undesirable. Roof materials can have similar effects unless large amounts of insulation are provided.

Exterior wall and roof materials and the total dimensional thickness of materials will in part determine the amount of heat transfer into interior spaces.

ill 12

Radiation from roofs and walls exposed to strong tropical sun is the cause of more discomfort than just hot air which may enter the dwelling. Maximum provision for ventilation in the design of these surfaces is essential to facilitate natural cooling. Entrapment of hot air as it rises to the ceiling of rooms can be overcome with proper location of windows and ventilators.

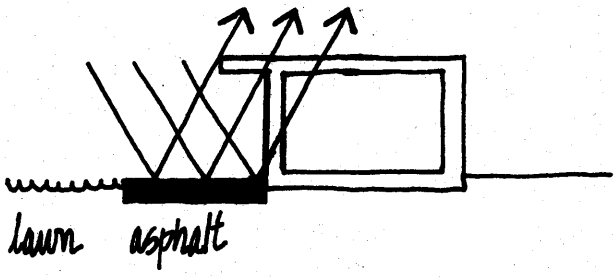
HUMIDITY

Humidity (amount of contained water vapor within the air) is primarily a concern for the choice of materials, and their combination with each other, than it is of room or dwelling layouts. Humidity within an interior space cannot usually be altered to a significant degree without mechanical means. Natural ventilation, though, can bring indoor humidity (due to presence of contained human evaporation) within tolerable limits for unsustained periods of time.

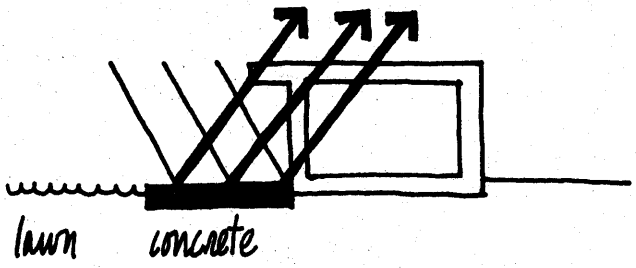
The main concern with humidity is in cold climates during the winter season. The entrapment of vapor and hence condensation within

HEAT TRANSFER

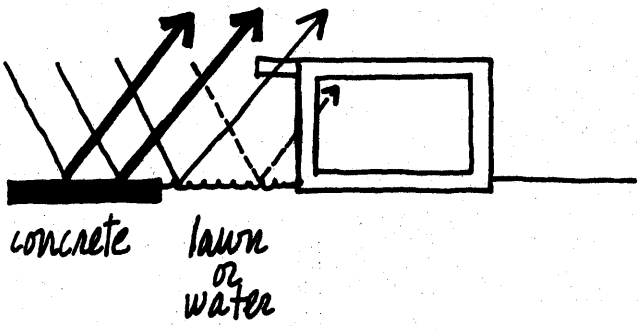
maximum heat transfer to interior spaces



maximum heat transfer to interior spaces



minimal heat transfer to interior spaces



the interior spaces and on exterior surfaces can lead to deterioration or damage of materials. Adequate water-proofing, insulation, and vapor barriers can usually prevent such damage. Rapid evaporation of vapor pressure from entrapped spaces will also reduce potential damage. Vapor pressure is highest at the equator and decreases toward the poles. It is also highest during the summer season.

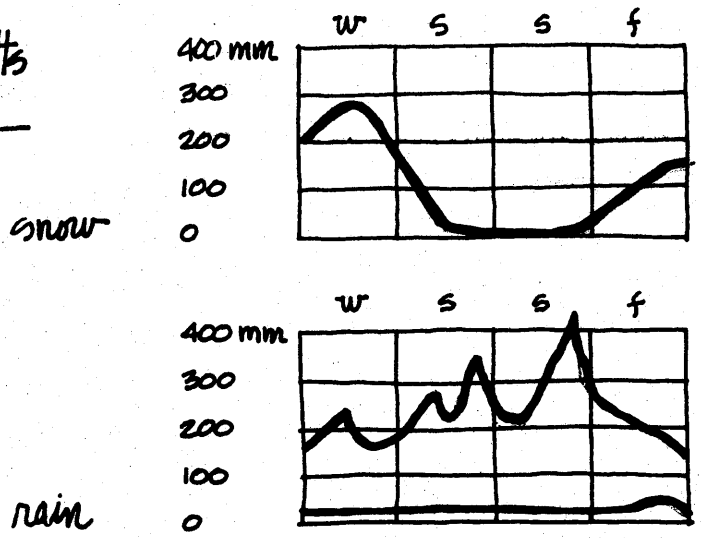
PRECIPITATION

In cold climates, snow and its annual average maximum accumulation figures are probably the more significant form of precipitation to be reckoned with in dwelling design. In warm tropical climates seasonal average maximum rainfall with its problems of drainage will likely be the most significant factor to control by design.

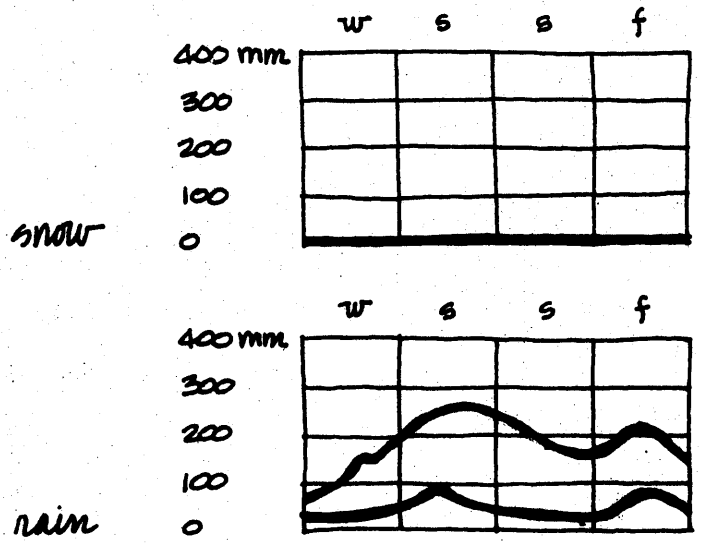
ill 13 The designer needs to ascertain whether it is desirable to retain or do away with moisture in the environs of the dwelling. In some instances, there are advantages of retaining accumulated snow for insulation, and rain for use as a cooling agent, washing away dirt, and reflecting radiation.

In situations where it is desirable to do away with precipitation, soil conditions and site topography must be analyzed. Sods which are sandy or loamus can absorb large amounts of water without serious erosion or surface runoff. The amount of runoff to be expected is also conditioned by the probable duration of rain for a specific period. In addition to the two natural factors, the amount of impervious surface in the dwelling's environs will also determine runoff volumes. In climates with heavy seasonal rainfall

boston, massachusetts
cold climate



medellin, colombia
warm climate



it is desirable to retain as much as possible of the ground surface in pervious materials such as courts, gardens, parks, plazas, etc. When the dwelling environs are largely impervious to water absorption, artificial means of drainage must be employed which can incur high costs.

Orientation with respect to precipitation should be based on the slope of the land, prevailing wind, and the sun. Dwellings placed on steep slopes in the path of excess runoff will have to be provided with retaining walls and other earth stabilization devices. Sun and wind in determination of dwelling orientation will control the rates of evaporation for either rain or snow. In the winter it is desirable to achieve as much evaporation of moisture during the morning as possible. In the summer it may be desirable to retain moisture as long as possible for its potential cooling effects. Roofs are probably the most significant design factor with regard to precipitation. The flatter the roof angle the more retention of precipitation, while the steeper a roof angle is, the quicker runoff is achieved. Roof overhangs in climates of heavy precipitation offer people the advantage of protected outside movement.

Damage to building materials may result from precipitation in the form of heavy snow accumulation, resultant freeze-thaw action, or driving rains penetrating crevices or joints of walls and roofs. The juncture of dissimilar materials in an exposed surface should be designed as to prohibit precipitation from penetrating.

CIRCULATION

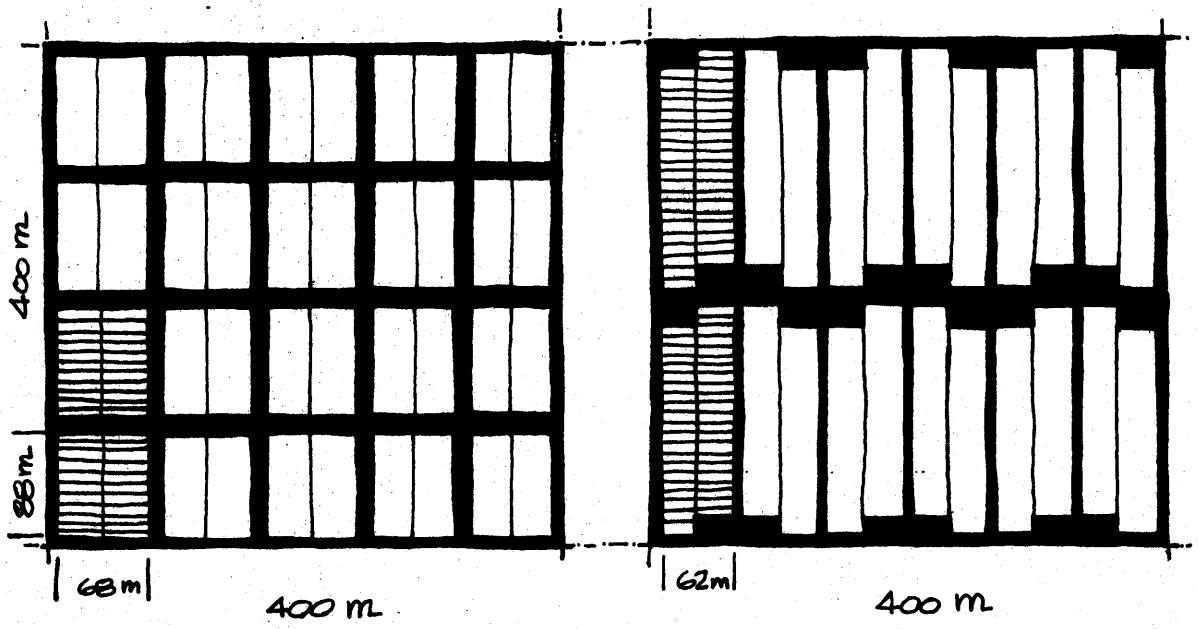
Land utilized for circulation may be thought of as right-of-way land under public ownership providing for paths of movement, both pedestrian and vehicular. The total amount of land set aside for circulation, including parking, varies between 15 and 30% in most residential urbanizations. Historically, this land was under private ownership in the form of controlled access roads, post roads, and toll roads. In modern subdivision practice, the municipal authorities, in granting individuals the right ro subdivide land, require that circulation which gives access to property be dedicated for public use. It may be deeded to the municipality in "fee simple" for control and maintenance.

Of primary concern in residential developments is the distinction made between different circulation modes, the degree of separation between pedestrian and vehicle, and the physical characteristics of these modes.

Mode and physical characteristics should relate to factors of; traffic density, character of traffic, and assumed design speed. Circulation is a "fix" or permanent entity within the physical environment. Its development and utilization therefore are long term investments not easily altered to meet changing demands. Costs for developing 15-30% of the land for circulation demand that the system provide for maximum R.O.W. widths and minimum overall lineage of surface. This applies to the system whether it is a gridiron pattern or curvilinear. Vehicular access to all

ill 14

CIRCULATION COMPARISON



100% access by streets

streets - assumed all residential
12 meter r.o.w.

blocks - 68m x 88m

dwelling lots - assumed 8m x 34 m
- tot. 440

area of circulation
- 40,320 m²
- 25% of tot. area

combined system

max. walkways, min. street access

streets - assumed all residential
12 meter r.o.w.

blocks - 62m by 188 m

paths - 4m wide for service vehicles

dwelling lots
- 8m x 26m typical
- 10 x 34 m end lots
- tot. 504

area of circulation
- 31,916 m² (incld. paths)
- 20%

plus advantage of 11% more dwelling lots.

parking - communal lots
18 x 72 m
46 cars/lot
ratio - 1 space/lot

residential lots or property maximizes the total amount of street lineage, whereas selective access to some lots by a combined system of streets, pedestrian paths, and communal parking can substantially reduce the total land required for circulation.

ill 14

It should be noted that the combined circulation system has to be evaluated in terms of social and cultural constraints which may preclude user acceptance of such a system. Also, the initial cost savings achieved with reduced direct lot access may be offset in the future by demand for increased amounts of parking or direct lot access.

VISUAL AND SPATIAL RELATIONSHIPS

"The spatial-time relationship, in a fast moving vehicle makes discernment and appreciation of detail impossible. The rhythm of any route, the punctuation and events placed along it, must be, in size and frequence, in scale with the speed. Similarly, the appreciation of detail while walking makes the consideration of this particularly necessary."[1]

The actual nature of design of each movement system relates to the tempo of movement, its purpose and characteristics. Expressway movements require free flowing forms and curves and articulations widely spaced in accord with the rhythm of fast vehicular movement. On the other extreme, pedestrian movement systems require interest

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1. Ritter, Paul, PLANNING FOR MAN AND MOTOR, MacMillan, New York, 1964, p. 14.

and variety in spaces producing impressions of rapid change under slow foot movement. The system requires frequent punctuation by focal points and symbolic objectives, usually consisting of a series of short sections at different angles with definite visual termini to produce the conditions desired."[1]

These two observations directly relate to perception. The driver, seldom able to correlate driving speed with perception time of surrounding objects is at opposition to the pedestrian whose movement speed is compatible with himself and the time required for satisfying perception of adjacent objects. "Partly for this reason, the driver tends to be less considerate, more aggressive and foolhardy. He is not really involved with his fellow man outside his own box. As speed increases:"[2]

1. concentration increses
2. the point of concentration recedes
3. peripheral vision diminishes
4. foreground detail fades increasingly
5. space perception becomes impaired

SEPARATION OF VEHICLES AND PEDESTRIANS

Besides possible economic advantages from a combined street and path circulation system, there are other reasons for separating pedestrians and vehicles. In the process of developing a physical

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[1] Bacon, E.M., THE SPACE BETWEEN BUILDINGS, Reprint of lecture, Harvard, 1962

[2] Ibid, Ritter, p. 58

environment, the one problem the designer cannot solve is presence of poisonous carbon monoxide fumes. This plus other factors, such as danger to children playing in the street, and the ecological and sociological factors lead to the conclusion that pedestrian and vehicular traffic should be separated in so far as possible. "This traffic separation can be achieved in a number of ways."[1]

ill 15
16
17

1. Horizontal Segregation
2. Vertical Segregation
   a. pedestrian above vehicles, pedestrians on ground or on deck
   b. vehicles above pedestrians, cars on ground or on deck
3. Segregation by Time
   a. vehicles (or pedestrians) allowed at certain times only

Of the three principle alternatives, the horizontal segregation, given a planned development is the least costly and most easy to achieve. This assumes that the time separation alternative usually only works in high density existing urban areas and then only as a temporary measure. In existing situations, horizontal separation may be achieved by the closing of selected streets to vehicular traffic, giving the entire R.O.W. width over to the pedestrian. This is particularly suitable where the width of the street is minimal or in small market towns where only one principal street may exist and it is possible to divert the through traffic around the periphery.

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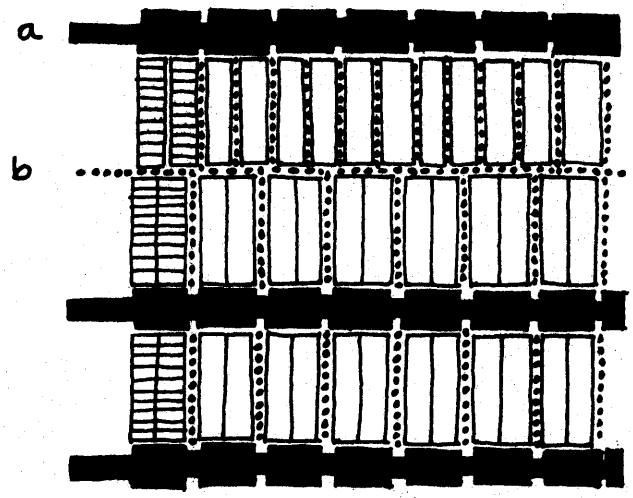
[1] Ibid, Ritter, p. 34.

ill 15

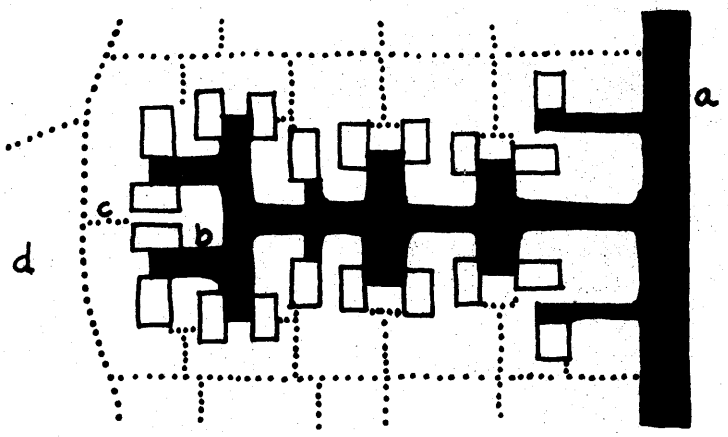
HORIZONTAL SEPARATION PEDESTRIAN AND VEHICLES

a collector streets
b path network



proposed german sub-division model
parking ratio 1:1
combined system: walkways, parking streets

a distributor
b service
c paths
d common park

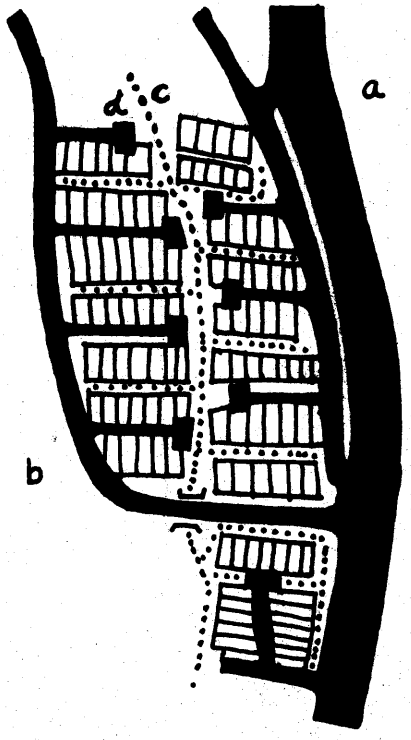


radburn subdivision - early example of pedestrian system as a corrolary to vehicular access. paths used primarily for leisure activity

ill 16
HORIZONTAL SEPARATION
PEDESTRIAN AND VEHICLES

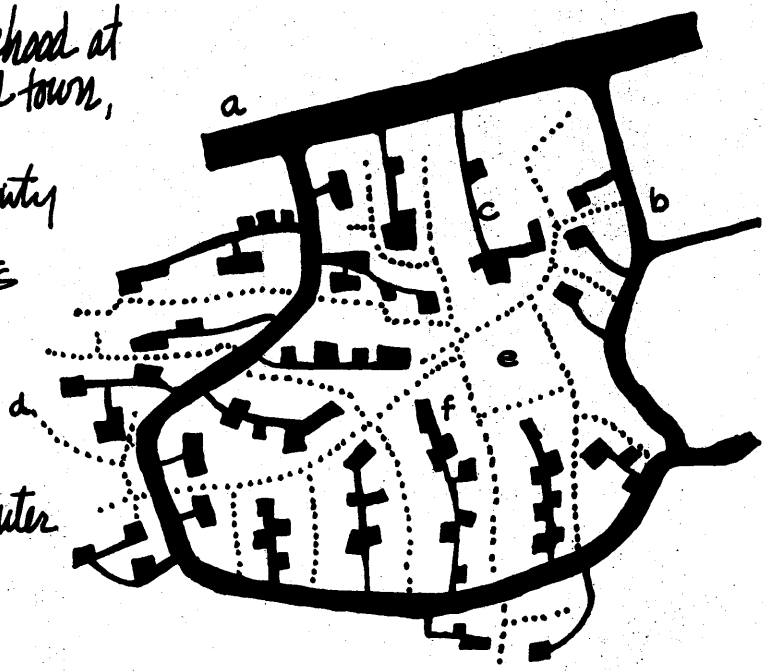
caversham, reading, berkshire england

a limited access highway
b collector streets
c pedestrian path network
d parking



clements neighborhood at haverhill, expanded town, england

a intra-community access
b collector streets
c residential streets
d pedestrian paths
e community center and schools
f residential lots



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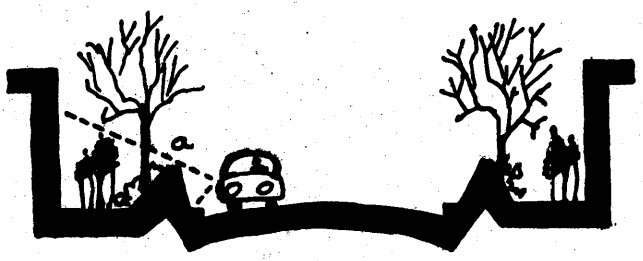
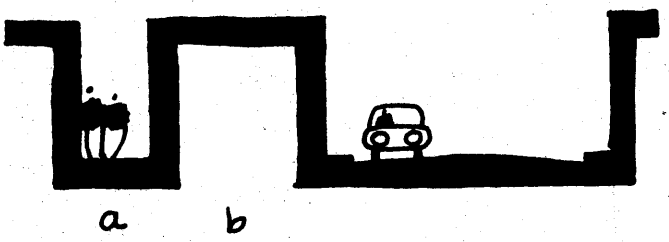
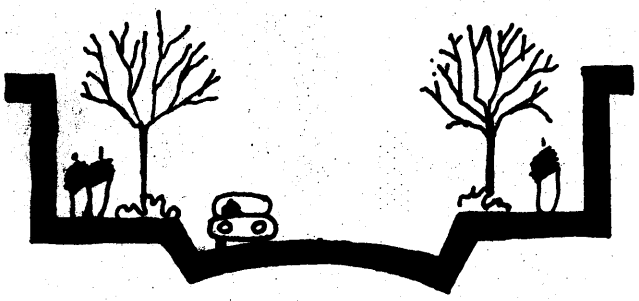
SEPARATION DEVICES



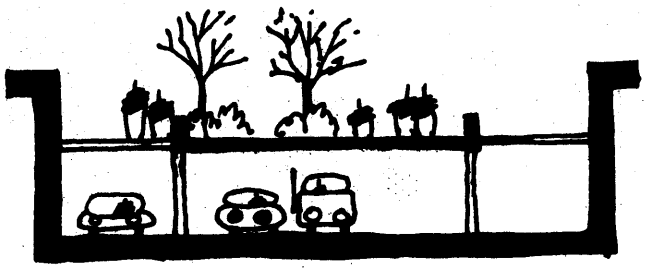
horizontal separation
minimal
a line of sound



horizontal separation
maximum
a pedestrian path
b building mass



vertical separation
minimal
depressed roadway



vertical separation
maximum
overhead walkway or
deck

Vertical segregation because of its high costs and use only in large urban centers is not felt to be appropriate to the developing country context, except when an overpass or underpass may serve to separate pedestrian from vehicular traffic.

TRAFFIC FLOW

The capacity and speed of traffic is related to the width of pavement, individual lanes, and the length of non-interrupted travel. Wider streets provide for larger and faster traffic flows, but this is not always desirable as in the case of residential streets. Fast traffic through residential areas is undesirable and should be discouraged by discontinuity of street pattern, stop signs, and other means.

Possible capacities of a two-lane highway may reach 2000 vehicles per hour given these constraints; that the highway is a level tangent, two-lane surface, 7.3 meters wide, free from lateral obstructions within 2 meters of its edges, and with no major intersections at grade.[1]

A single lane of a collector street will handle 300 cars per hour, and ordinarily not over 40 cars per 100 families will enter or leave during peak hours.[2] This assumes a minimum lane width of 2.5 meters, 50 kph, that the street is on a level tangent, free from

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1 U.S. Department of Commerce, HIGHWAY CAPACITY MANUAL, Washington, D.C., 1956

2 Ibid, Ritter, p. 174

lateral obstructions, and no intersections within the measured capacity length. These conditions also indicate the highest rate of flow where a pedestrian may still cross the street in safety if not on the crossways.[1]

Traffic speeds usually adjust themselves to driving conditions. Equation wider streets, with both travel and parking lanes, to the micro-freeway is open to question. The design of lanes 3.5 to 4 meters wide is inviting higher travel speeds and should be reserved for streets where rapid movement of through traffic is desired. Chatham Village in Pittsburg has two lane streets generally 5 meters wide and the Department of Public Safety reports that there have been no accidents on these streets within the last few years.[2]

Many elements control the capacity of vehicular movement on streets, and their effects can vary from zero to 100%. When any one element reduces the capacity by 100%, then the effects of other elements is meaningless. Relating the elements in the diagram to travel speeds, these figures have been observed.[2]

ill 18

Speed kph	Total Flow for Street Widths of: (Vehicles Per Hour)[3]					
	6m	9m	12m	15m	18m	21m
32	-	350	700	1000	1350	1700
24	250	700	1200	1700	2150	2650
16	450	1100	1700	2350	2950	3600

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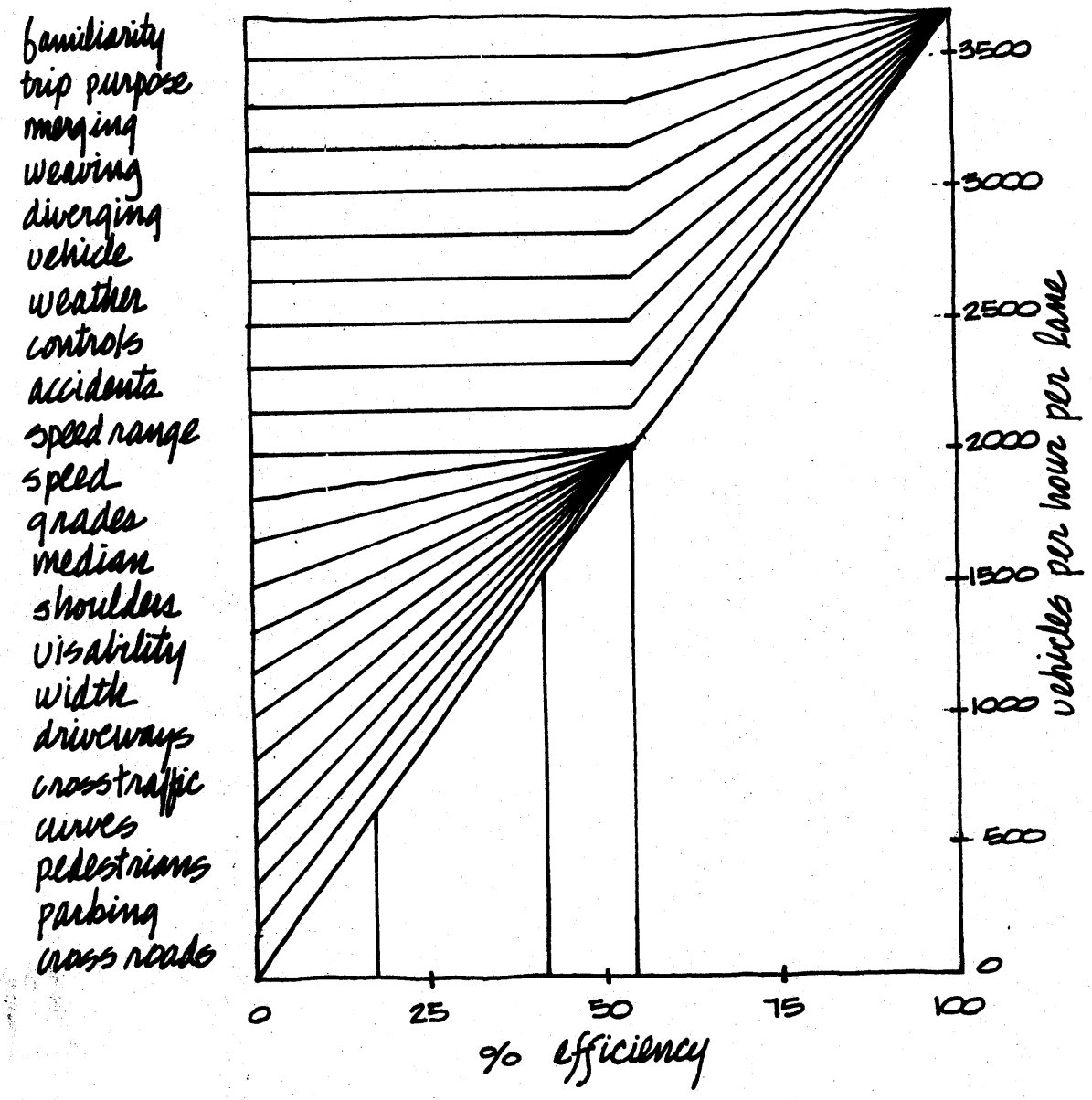
1 Ibid, Ritter, p. 174

2 Ibid, Ritter, p. 71

3 Unlike U.S. figures the British figures indicate increased flow at slower speeds.

ill 18

CAPACITY OF VEHICULAR MOVEMENT



Case studies of traffic flow capacities in English urban centers during the peak hours have indicated the following figures:[1]

Mode of Movement	Maximum Capacity Per Hour	Average Speed	Area Required Moving for Each Item
Pedestrian	16,000 pers/hr	4.0 km/hr	0.75 M^2/pers
Private Car	1200 pers/hr 1 pers/car	15.0 km/hr	6.7 M^2/pers
Bus			
32 seat	5600		
55 seat	8300		
80 seat	11,000	10.0 km/hr	
150 seat	18,000		

Roads, however, are most efficient and have the greatest flow capacity when marked lanes are used evenly at something like 30 mph or 50 kmph. As stated earlier the average capacity at this speed is about 300 vehicles per hour per lane. This is of course a theoretical capacity assuming uninterupted flow.

DISTRIBUTION NETWORK

A heirarchy of circulation modes usually is derived from an existing pattern of circulation which is adjacent to the proposed urbanization. The layout of the circulation network within the development is determined by the size and proportion of lots forming a typical block, maximum desirable travel distances to major through streets, and the interplay of movement between the pedestrian and

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[1] Ibid, Ritter, p. 14

vehicle. The physical form of the peripheral circulation controls the degree of meshing, access, and compatibility with adjacent land uses.

There is also a certain correlation between varying scales of the urbanization and the dominant circulation mode within a particular scale. The following is offered as a classification of circulation modes, together with synonomous terms.

External to the Development

1. Limited Access Highway, Freeway, Thruway, Toll Road, Interstate Highways
2. Intra-Community Highway, Expressways, Major Arterials

Internal to the Development

3. Inter-Community Access, Minor Arterial, Distributor, Primary Street, Main Spine Road
4. Collector Streets, Secondary Street, Connector Street
5. Residential Streets, Neighborhood Street, Minor Street, Local, Tertiary, Culde Sacs
6. Service Streets, Alleys
7. Paths, Walkways, Lanes, Pedestrian Ways, Vias, Paseos

Limited Access Highways and Intra-Community Highways may serve for the same function in specific cases. Also Intra-Community Highways and Inter-Community Access may serve overlapping functions.

LIMITED ACCESS HIGHWAY

This mode, the largest in a circulation system, usually links regional areas, and forms a physical barrier for an urbanization due to the limited number of intersections or access points.

STREET CLASSIFICATION CRITERIA

ELEMENT	MODE					
	LIMITED ACCESS HIGHWAY	INTRA-COMMUNITY HIGHWAY	INTER-COMMUNITY ACCESS	COLLECTOR STREETS	RESIDENTIAL STREETS	PATHS
Movement	Primary	Primary	Primary	Equal	Secondary	Secondary
Access	None	None	Secondary	Equal	Primary	Primary
Principal Trip Length	Over 5KM	Over 5KM	Over 1KM	Under 1KM	Under ½KM	Under 150 Meters
Use By Transit	Express	Express	Regular	Regular	None Except in Dense Urban Areas	None
Linkage	Region	Localities	Localities	Neighbor-hoods	Individual Sites Within Blocks	Individual Sites Within Blocks
Spacing	1-5 KM	1 5 KM	300 - to - 1000 Meters			
Percentage of System	0-8	0-8	20-35	65 - 80		
Minimum R.O.W. Widths, Including Sidewalks			24	13	10	3-4 M

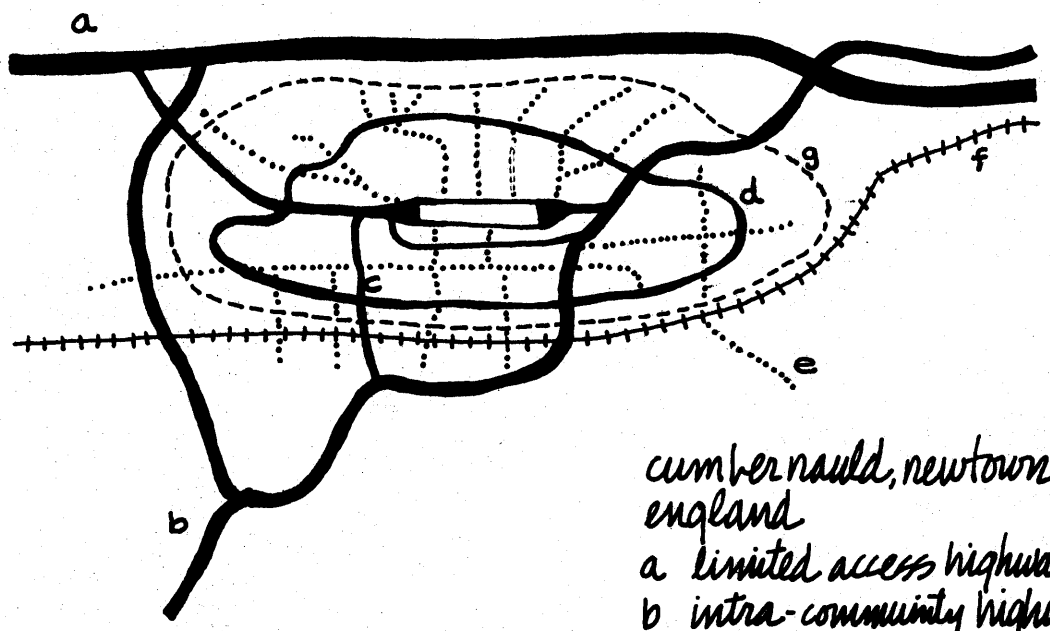
Maximum[1] Desirable Grades	2-4%	4%	5%	5%	15%	
Speed KPH	100	60-80	60	50	40-50	
Maintenance by Sector	Public-Community	Ditto	Ditto	Ditto	Ditto or Private	Ditto or Private

[1] see specific sections for additional conditions.

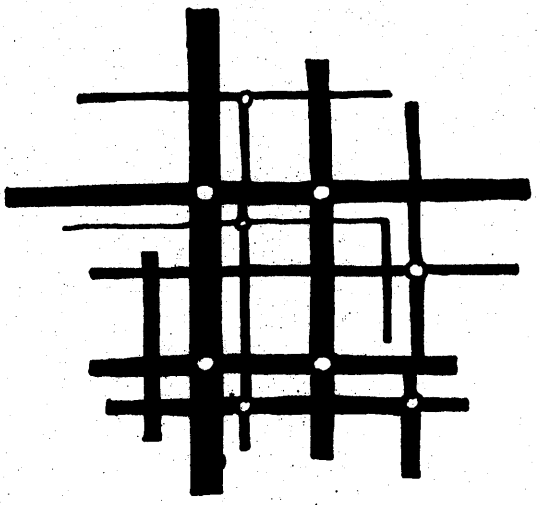
REF. National Committee on Urban Transportation, Public Administration Service, STANDARDS FOR STREET FACILITIES AND SERVICES, Procedural Manual, 7A, 1958 p.11.

ill 19 cont'd

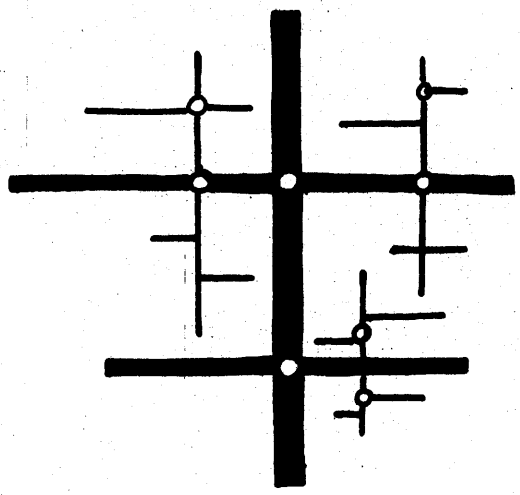
ill 20
CIRCULATION HEIRARCHY



cumbernauld, newtown
england
a limited access highway
b intra-community highway
c inter-community access
d collector street
e pedestrian path
f rail
g town boundary



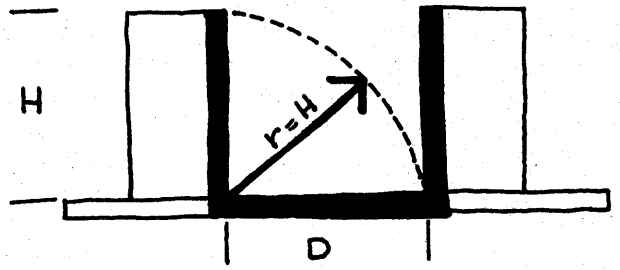
open ended system



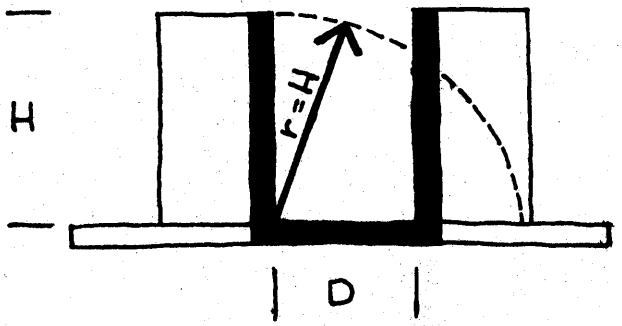
heirarchial system

ill 21
CLIMATIC EFFECT ON STREET SECTIONS

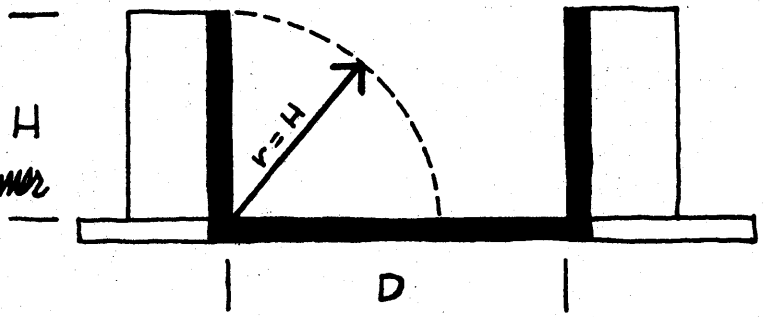
H=D
R=1:1
hotter summer
colder winter



H>D
R=1:0.5
cooler summer
warmer winter

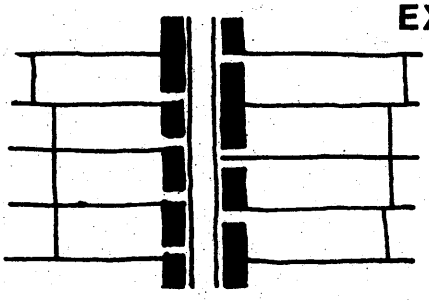


H<D
R=1:2
cooler summer
normal winter

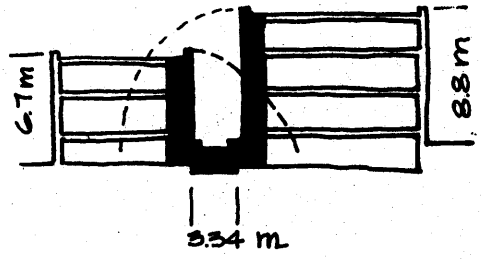


ill 22

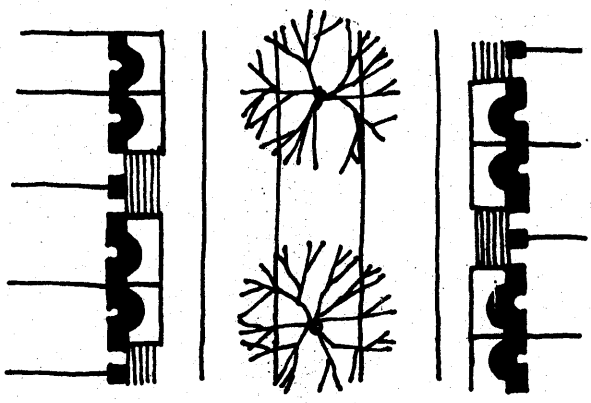
EXISTING URBAN STREET SECTIONS



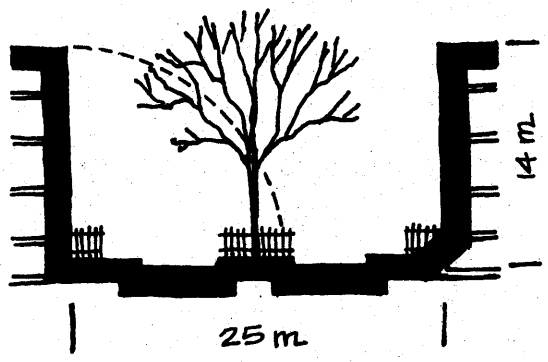
panama street - philadelphia
1850's



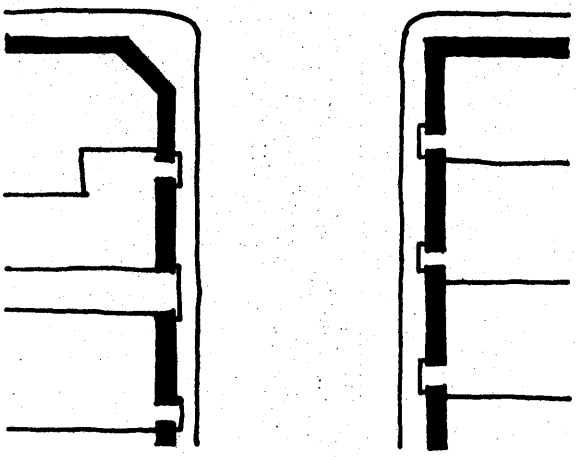
R = 1:0.5 ; 1:0.38



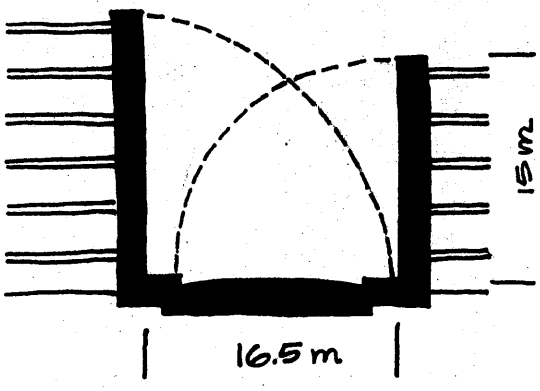
rutland square, south end
boston - 1810's



R = 1:1.8



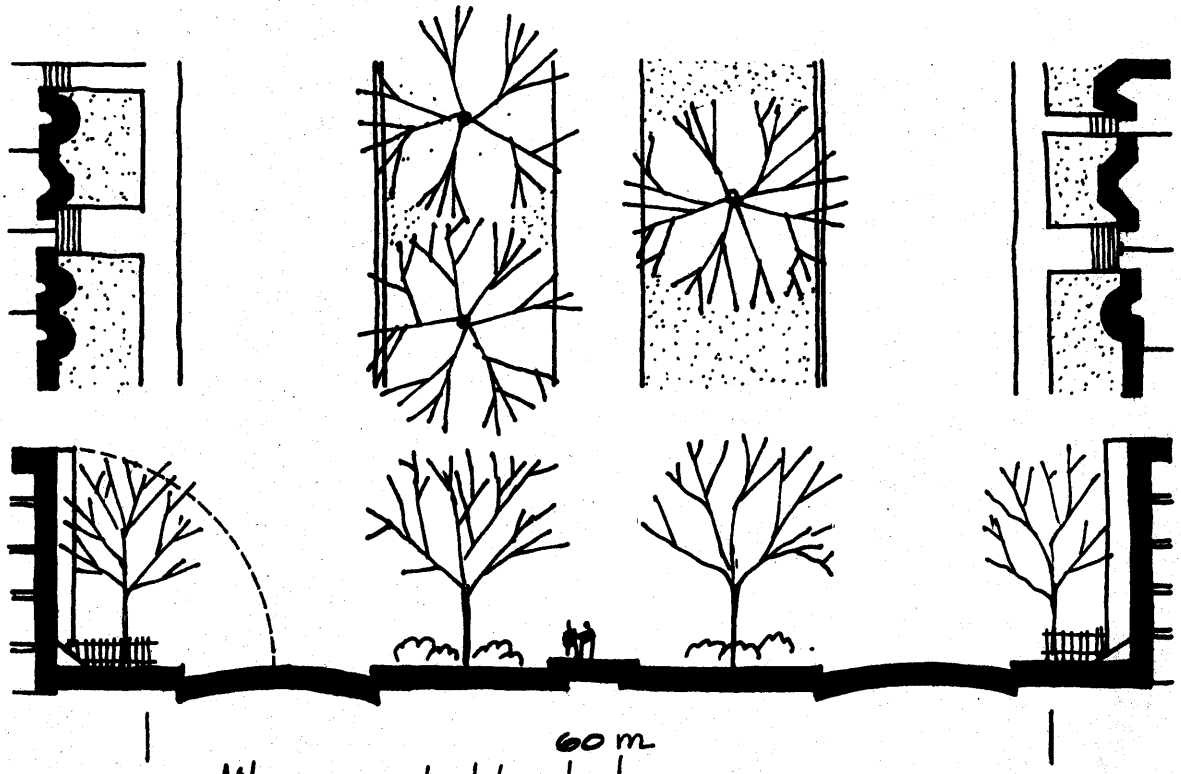
salem street, north end
boston, 1830's



R = 1:1

ill 22 cont'd

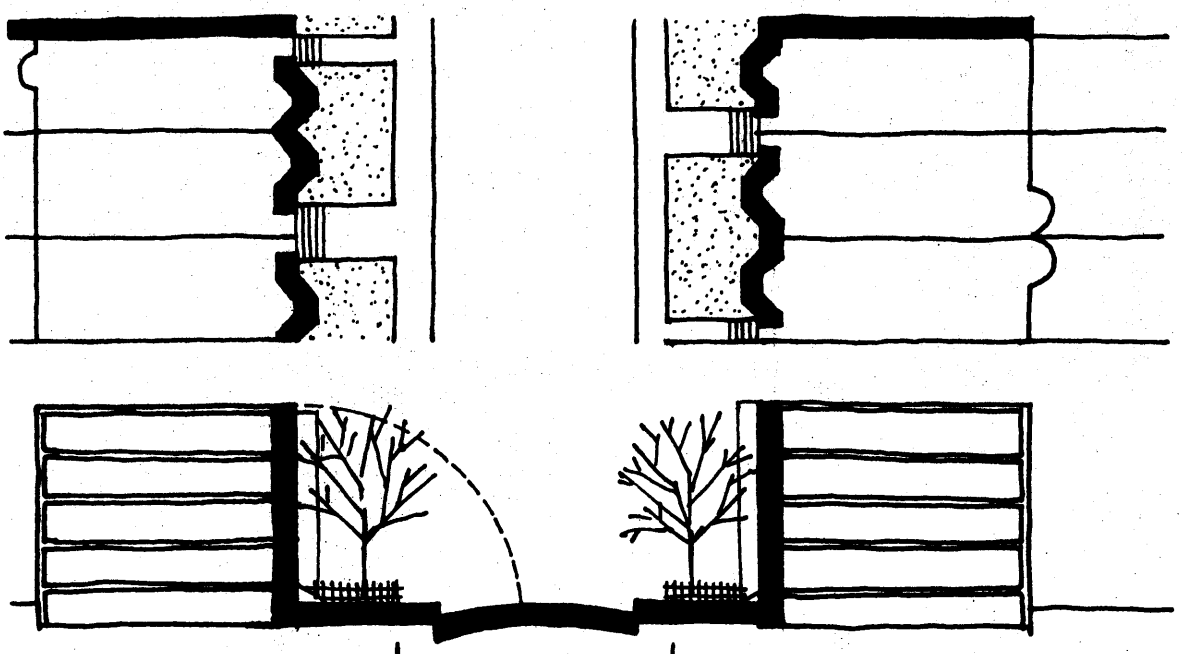
EXISTING URBAN STREET SECTIONS



60 m

commonwealth avenue - back bay, boston R = 1:4

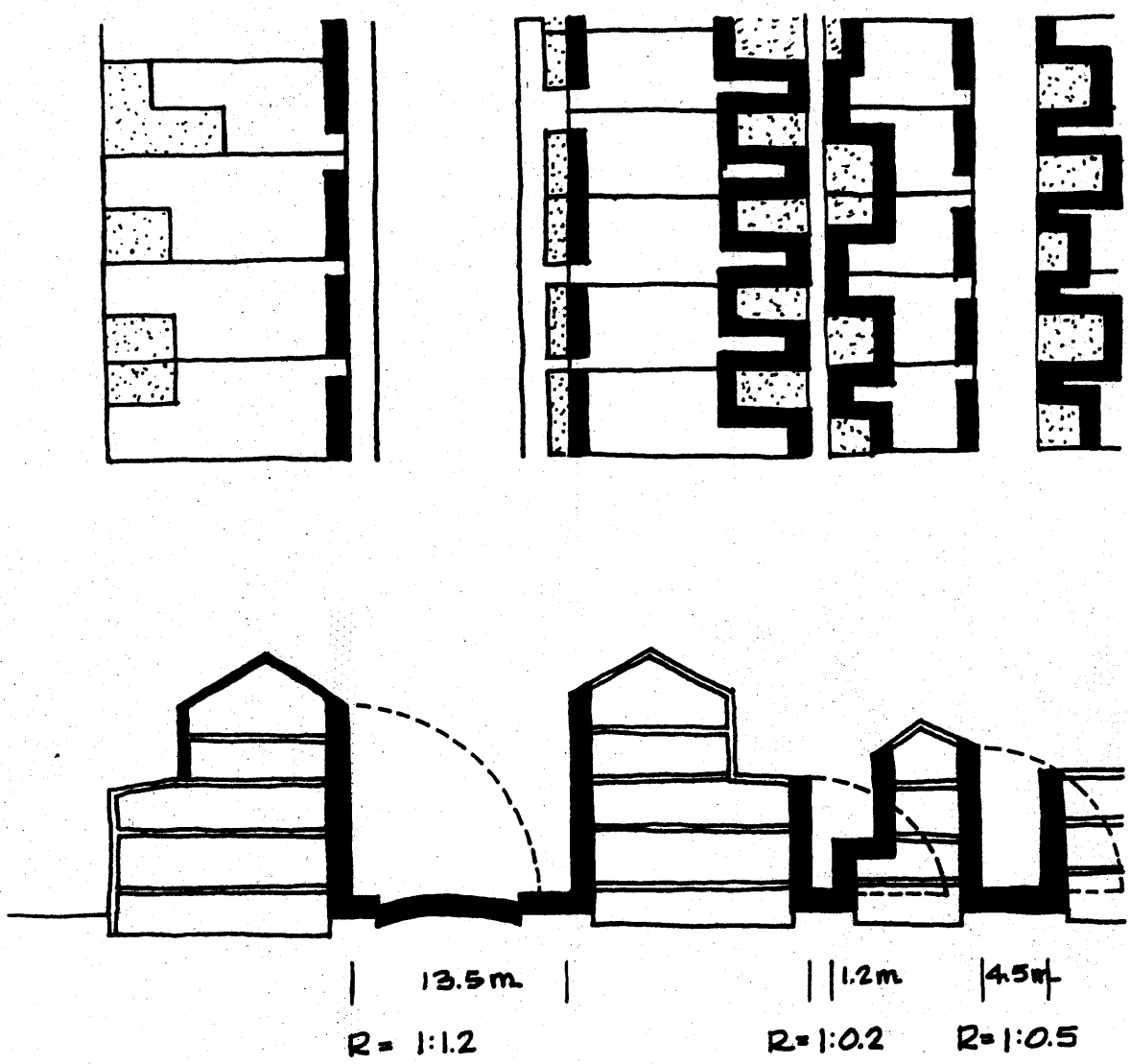
1880's



18 m

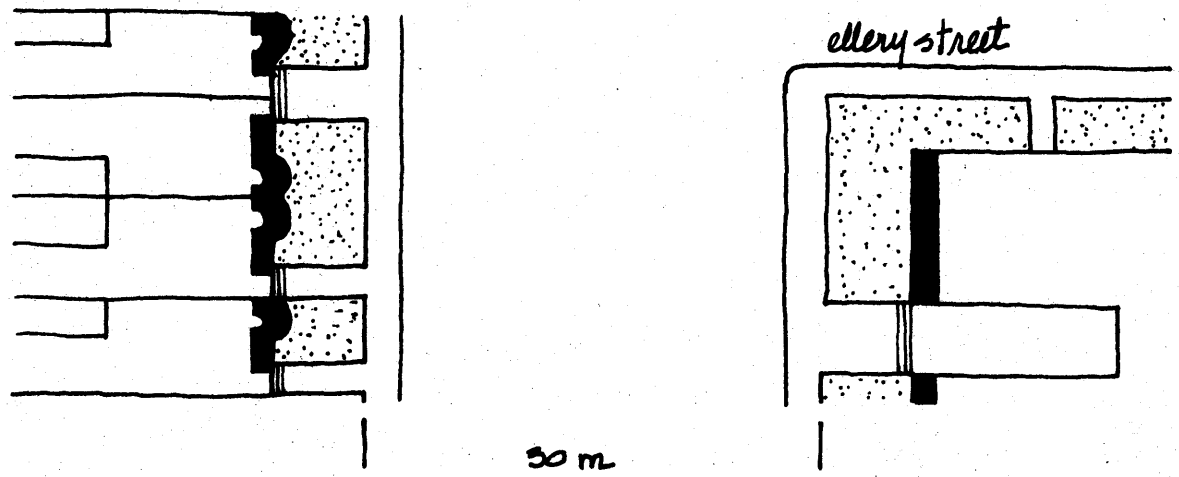
marlborough street, back bay, boston R = 1:2

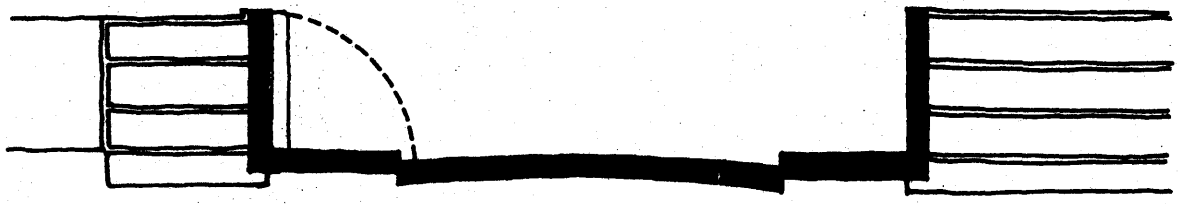
ill 22 cont'd
EXISTING URBAN STREET SECTIONS



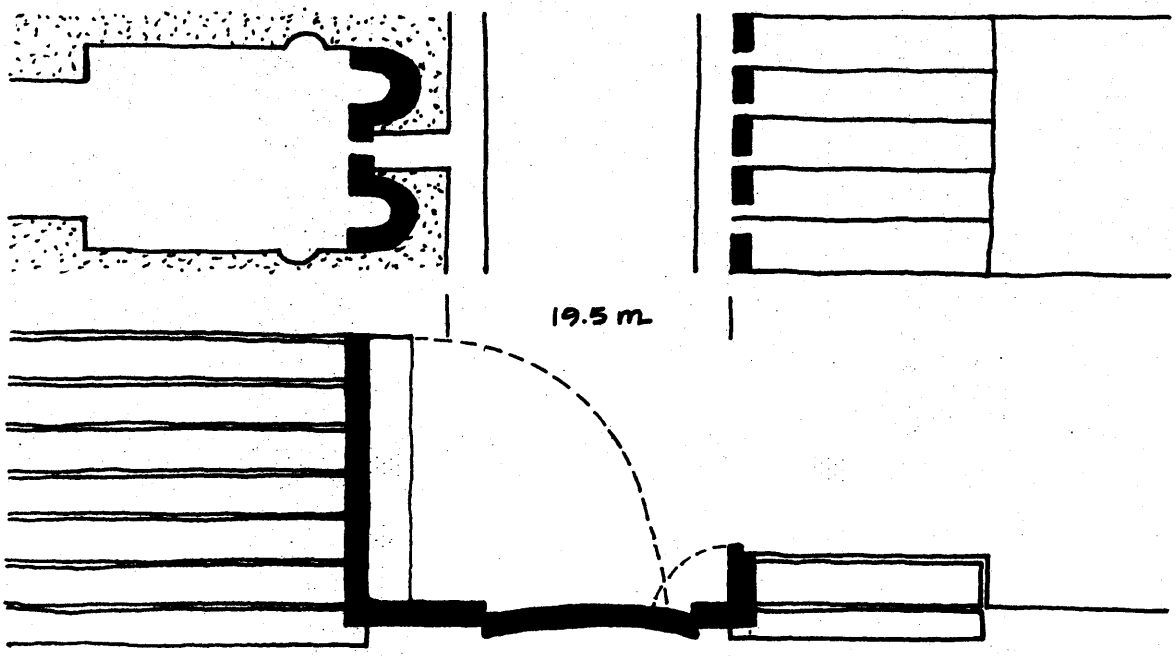
chestnut street - beacon hill, boston
1800's

ill 22 cont'd
EXISTING URBAN STREET SECTIONS



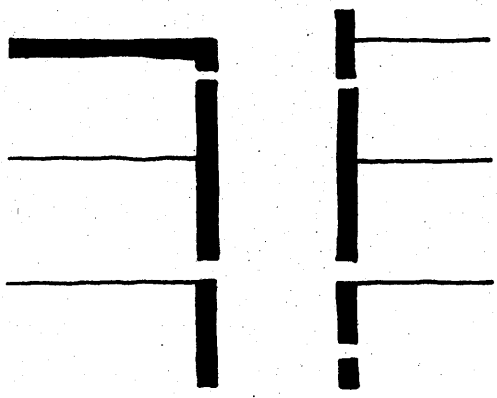


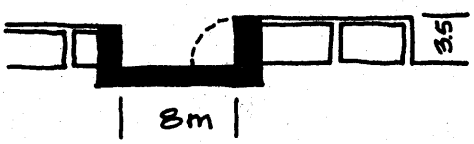
massachusetts avenue - cambridge R = 1:4



massachusetts avenue - cambridge R = 1:1.2 ; 1:5

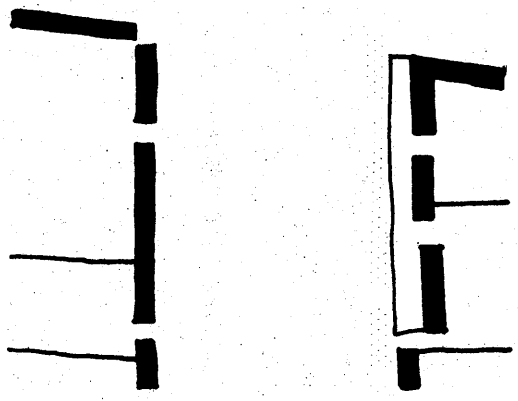
ill 22 cont'd
EXISTING URBAN STREET SECTIONS

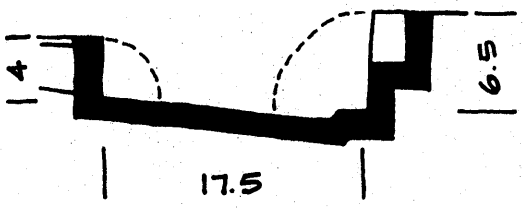




el ermitaño, lima peru
1962

R = 1:2.3





mariano melgar, arequipa, peru
1950

R = 1:2.7 ; 1:4.4

TRAVEL AND TRAFFIC FLOW

It is characterized in use by high speed (100 KPH) travel of mixed vehicular traffic: automobile, trucks, and buses. Specifically the traffic is composed of heavy and light transport vehicles, taxis, minibuses, buses, commercial supply vehicles, and private automobiles.

SPACING

Distances between reoccurring limited access highways are not specifiable as these highways are determined at the regional or city scale.

GRADES

For substantial speeds of travel for trucks and buses, a maximun desirable grade of 2-4% is recommended.[1]

DETERMINANTS

The presence of an existing limited access highway and its access points will be one of the principal determinants for the urbanization internal circulation grid. If the location of existing access points are not desirable, a service road from the access points to the internal circulation system may be provided.

Design determinants are established from the nature of use controlled by the overall R.O.W. width. This includes a minimum of two travel lanes each direction, median strips, turning and ramp access lanes, and shoulders. No parking other than for emergencies is permitted.

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[1] Iowa Experimental Station PUBLIC ROADS, vol. 23, No. 3 and BULLETIN GS, Ames, Iowa, 1948

Public transport on these highways is of an inter-regional nature.

Where the development is bordered by limited access highways or intra-community highways, dwelling lots should not face or be entered directly from such highways. A parallel service road may

ill 23 provide access.

INTRA-COMMUNITY HIGHWAY

Intra-community highways link localities, and may form the second heirarchy of a circulation grid. These highways may serve much the same function as limited access highways but are differentiated in the following ways. Access points are generally more frequent

ill 23 and capable of being adjusted for a proposed development.

TRAVEL AND TRAFFIC FLOW

Traffic is mixed vehicular, but at medium speeds (60-80 KPH). Specifically, the traffic is much the same as on limited access highways.

SPACING

Distances between reoccurring intra-community highways is usually between 1 Km and 5 Km, but may not be specifiable if an existing network prevails.[1]

GRADES

Maximum desirable grades are 4% for sustained travel speeds.[2]

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[1] National Committee on Urban Transportation, Public Administration Service, STANDARDS FOR STREET FACILITIES AND SERVICES PROCEDURAL MANUAL 7A, Chicago, Illinois, 1958

[2] Ibid, Iowas Experimental Station, p. 6

DETERMINANTS

As with limited access highways, intra-community highways are a principal determinant in the physical layout of the developments internal circulation.

The overall R.O.W. widths include a minimum of one travel lane each direction, parking lanes (permissible when the highway passes through congested urban areas), median strips, shoulders or sidewalks (depending on rural or urban location).

Public transport on these highways is of an inter-city or inter-regional nature.

INTER-COMMUNITY ACCESS

Inter-community access roads are for the benefit of the proposed development as are also the remaining circulation modes. They provide access to the locality from intra-community highways or limited access highways and also usually determine major transpor-

ill 23 tation routes within the locality.

TRAVEL AND TRAFFIC FLOW

It is characterized in use by through traffic of a mixed vehicular nature. The streets are used by pedestrians and certain types of transportation uses, for example: Fire trucks, Police Patrol Vehicles, Ambulance Service, Taxis, Minibuses, Commercial Supply Vehicles, Government Vehicles, and Private cars.

SPACING

Its grid, the largest within the development varies between a minimum of 300 meters spacing, and 1000 meters,[1] depending on circulation at the neighborhood and block scales. The inter-community access road may delineate the boundaries of a neighborhood within the locality.

GRADES

Maximum desirable grades are limited to 5% for sustained travel speeds, but unique conditions may warrant grades up to 15%.

DETERMINANTS

The inter-community access road usually forms the principal focus or spine of the development. By the nature of its use, it allows for adjacent mixed use development including commerce, industry, institutions, and residences. The R.O.W. widths provide for a minimum of two travel lanes each direction, parking lanes, sidewalks and optional median strips and planting strips.

COLLECTOR STREETS

Collector streets, as its name implies, are streets into which residential streets feed. They provide for through traffic, may delineate a neighborhood, and should serve traffic only with an origin or destination within that neighborhood. Additionally, they give access to communal parking lots, pedestrian paths, service streets, and are used for secondary transport routes.

ill 23

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[1] Goethert, Reinhart, CIRCULATION GRIDS, MIT., course IV 1. 61C 1968 - Minimum spacing - Case Studies - 300 meters: Adams - 900 meters: Urban Land Institute - 800 meters: Doxiadis - 1000 meters

TRAVEL AND TRAFFIC FLOW

Collector streets are characterized by mixed vehicular and pedestrian traffic, and travel speeds are low in the range of 50 KPH to allow for a maximum number of intersections with residential streets.

SPACING

Spacing is not specifiable as it is based on the spacing of the inter-community access roads.

GRADES

Maximum desirable grades are usually limited to 5% for sustained travel speeds, but unique conditions may warrant maximum slopes of 15%.

DETERMINANTS

One approach to circulation design at the neighborhood scale is to minimize the amount of through traffic on collector streets by locating these streets on the periphery of the neighborhood where they may also serve adjacent neighborhoods. These streets bound rather than penetrate the area. This can also be a help in controlling the maximum travel speed desired, and capacities of traffic volumes. In this approach it is necessary to also minimize the number of travel situations from residential streets, else these residential streets will assume the function of collector streets.

The R.O.W. width includes a minimum of one travel lane each direction (unless one-way), optional parking lane(s), sidewalks, and optional median and planting strips.

RESIDENTIAL STREETS

Residential streets are local streets designed to give access to residential property and should be located to prevent continuous

ill 23 or unobstructed flow of traffic through a neighborhood.

TRAVEL AND TRAFFIC FLOW

Travel is limited to private automobiles, emergency and service vehicles, and pedestrian movement, except within very dense urban areas, where high priority vehicles such as commercial supply vehicles, taxis, and buses will use these streets. Maximum travel speed is around 40-50 KPH.

SPACING

The frequency of a residential street grid is determined by the width and depth of the blocks. The streets may abutt a minimum of one side of the block or a maximum of all four sides. This depends on the amount of direct lot access by vehicles desired and topographic conditions.

GRADES

Maximum desirable grades are usually limited to 15%, but unique conditions may warrant grades of 25-30%.[1]

DETERMINANTS

Residential streets except within very dense urban areas, should be designed to discourage through traffic in order to sustain

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[1] Ibid, Iowa Experimental Station, p. 6

their primary use. The overall R.O.W. widths include one travel lane each direction, sidewalks, and optional planting strips. Residential streets which form cul de sacs are usually limited in length to 100-150 meters[1] based on fire control and emergency vehicle access. Cul de sacs should terminate in a turning circle, not less than 23 meters in diameter, or communal parking lots.

ill 24

PATHS

Paths or walkways serve primarily for pedestrian access to interior lots and communal parking facilities. Secondary uses of paths are for limited and controlled access of service and emergency vehicles such as fire trucks, police patrol cars, ambulance service, doctors' cars, moving vans, garbage collection, and service delivery. Paths utilized as a principal means of circulation and access to the block interior usually implies that their use relates to steep slope conditions or other considerations. This in turn implies that it is not desirable or necessary to provide major amounts of vehicular access to all lots. Paths may occur on one side of the block or up to four sides of the block. Paths are usually designed in correlation with communal parking facilities providing parking for those lots without direct access. The length of these paths are limited to a subjective judgement based on a maximum desired walking distance from the lot or street to the most remote dwelling.

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[1] Institute of Traffic Engineers, TRAFFIC ENGINEERING HANDBOOK AND HOME BUILDER'S MANUAL FOR LAND DEVELOPMENT of the National Association of Home Builders

This dimension can vary from 50 meters to 150 meters depending on climate conditions, and site topography. Walking times of ½ to 1½ minutes are considered desirable based on 4 KMH.

Paths can be left un-paved excepting very steep slope conditions where soil stabilization is necessary and this may require a

ill 23 combination of surface paving and stairways.

INTERSECTIONS

The discussion of street intersections will be limited to intersection types found within the development and will therefore exclude intersection designs for limited access or intra-community highways.

Intersections between inter-community access streets and collector streets, both major traffic carriers, should be at right angles to each other and are usually four-way intersections.

The use of the "T" intersection between collector streets and residential streets with at least a 35 meter separation between opposing intersections offers a device to reduce through traffic and improves safety conditions. Intersections should, withstanding topographic conditions, be at right angles to each other. Angled intersections unless excessively wide limit sight distances of oncoming traffic. 90 degree intersections are preferred; less than 75 degree intersections are considered unduly hazardous.[1] "For

ill 25 safety, as well as simplicity, T-intersections should be used wherever

---

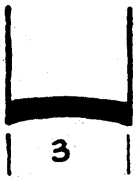
[1] Urban Land Institute, COMMUNITY BUILDER'S HANDBOOK, Urban Land Institute, Wash. D.C., 1968, p. 158.

ill 23

STREET SECTIONS – R.O.W. WIDTHS

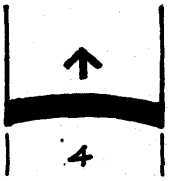
pedestrian path only

3 meters minimum



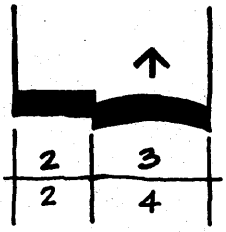
pedestrian path & emergency & service

4 meters minimum



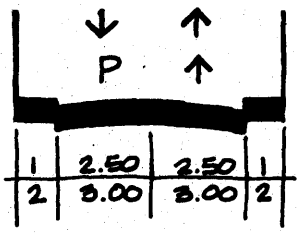
one-way service street

5 meters minimum
6 meters maximum



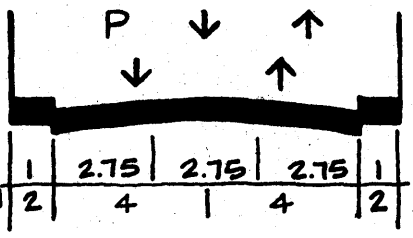
residential street minimum flexibility

7 meters minimum
10 meters maximum



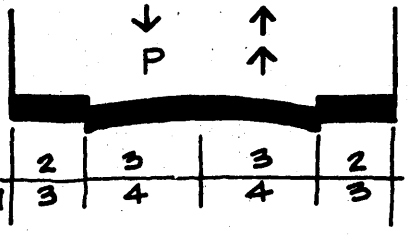
residential streets maximum flexibility

10.25 meters minimum



residential streets maximum flexibility

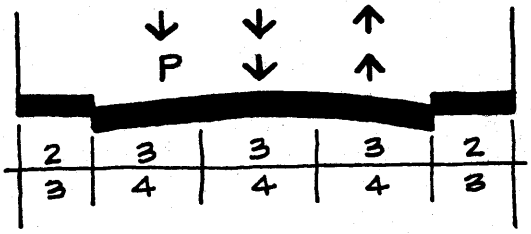
10 m. minimum
14 m. maximum



ill 23 cont'd
STREET SECTIONS R.O.W. WIDTHS

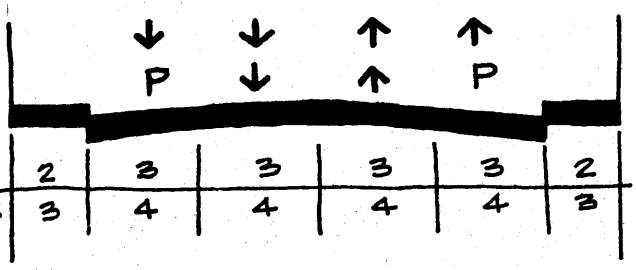
collector street

13 m. min.
18 m. max.



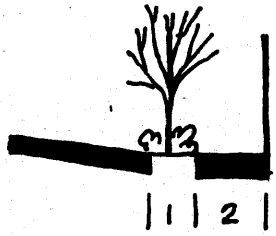
collector street

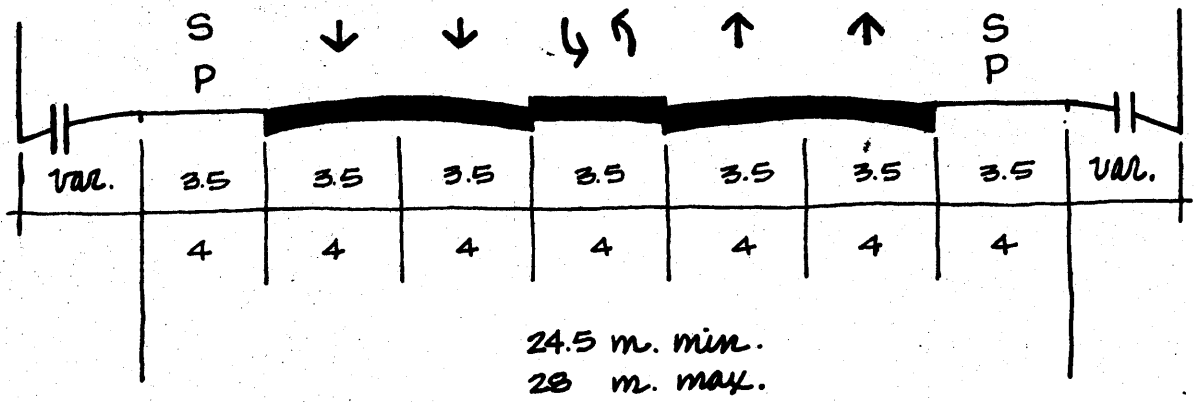
16 m. min
22 m. max.



limited access highway or intra-community highway or inter-community access

optional planting strip





notes: limited access highways may have 3 travel lanes each direction and no parking lanes, median strip may range from 3.5 meters to 10 meters wide. it also serves as turning lane within urban areas. the shoulder may also have turn-off lanes or aprons of greater than 3.5 widths depending on local conditions.

ill 24

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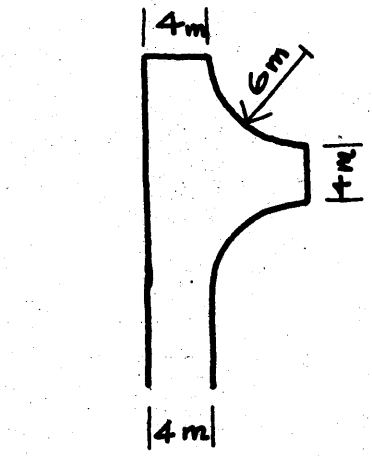
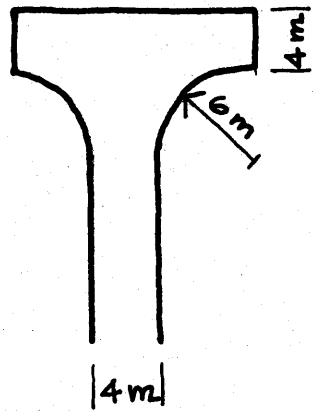
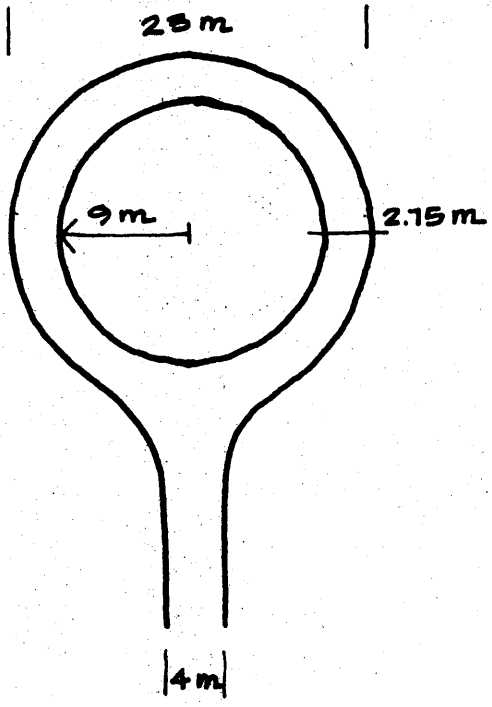
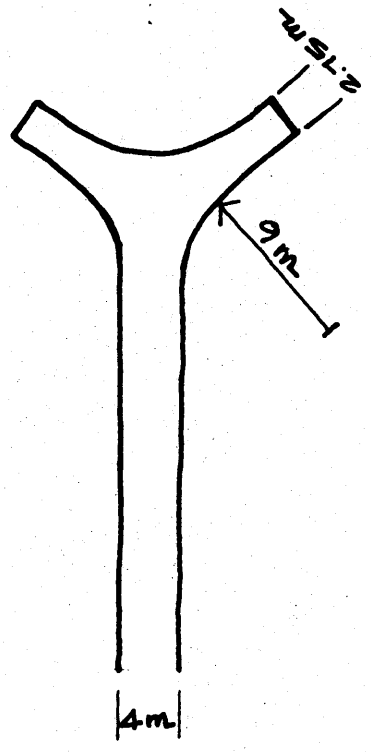


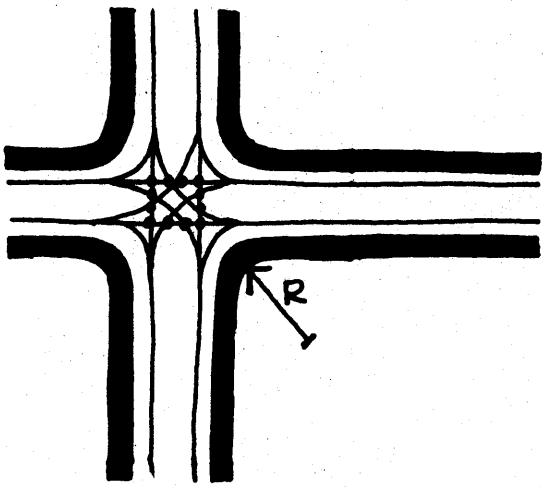




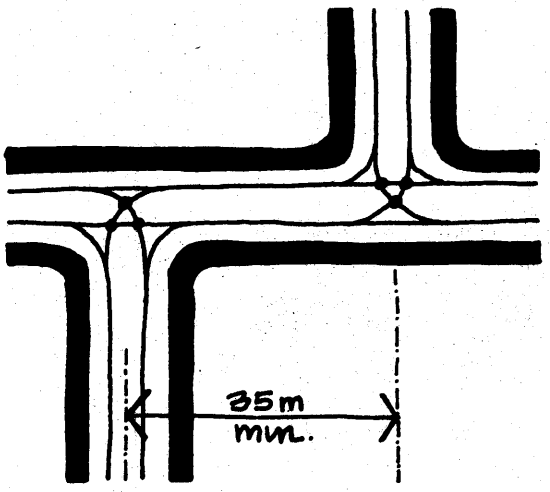


INTERSECTIONS

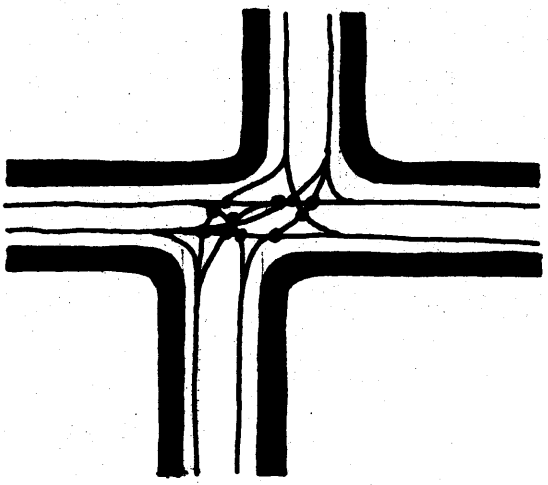
4 way intersection
16 collision points
R = 4.5 meters - collector and residential streets



3 way intersection
only 3 collision points

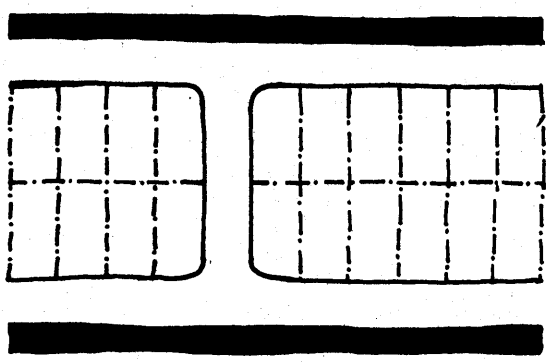


jog intersections
12 collision points
dangerous traffic pattern

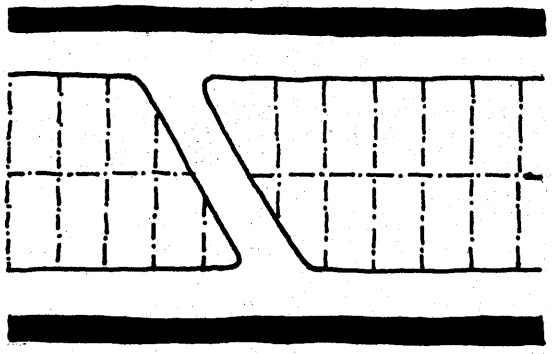


ill 25 cont'd
INTERSECTIONS

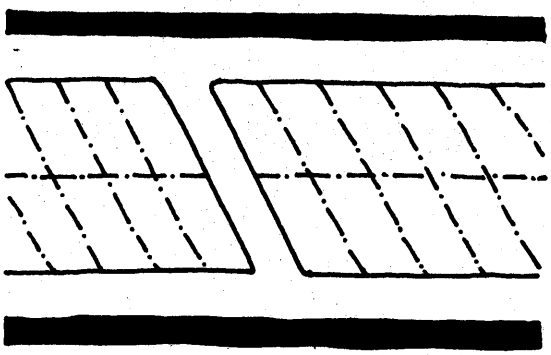
intersection at right angles
maximum sight distances
for driver



intersection at acute angles
minimal sight distances
poor lot relationships



intersection at acute angles
minimal sight distances
poor lot layout and lot
utilization



possible. The accident rate is 14 times greater than the rate at three-legged T-intersections in subdivisions with limited access to arterial streets".[1]

Light distances should be such that each vehicle is visible to the other driver when each is 25 meters from the intersection, for 40 KPH maximum speed.[2]

Grades should be flat within the intersection, and a 6 percent maximum grade between 30 and 50 meters of the intersection.[3]

MATERIALS

Because of varying climate soil conditions and municipal codes, it is not feasible to provide a full range of construction system and materials specifications to meet all conditions of pavement and subsurfaces. But given several assumptions, minimum specifications for differing paving surfaces can be set forth as a guideline. The goal of choosing a particular paving material should be to stabilize the surface at a minimum initial cost commensurate with the projected traffic volumes and weight carrying capacities.[4] Therefore, those materials which are difficult to obtain, require a sophisticated technology to manufacture, or install have been eliminated from these recommendations: pre-cast

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1 Urban Land Institute, THE HOME ASSOCIATION HANDBOOK, Technical Bulletin, No. 50, 1964, p. 176.

2 Ibid, COMMUNITY BUILDER'S HANDBOOK, CINVA, p. 7

3 Ibid, AID, p. 70

4 American Association of State Highway Officials, A Policy on Highway Types, Wash., D.C., 1945, p. 3.

concrete sections, cut stone, or specially tooled bituminous concrete sections which require special equipment.

Also related to development costs: minimum surface treatment for certain streets (collectors, residential and paths) may be provided as long as they are compatible with the climate and topographic conditions and are recognized to be non-permanent. This in turn will require more frequent re-surfacing and maintenance. The specifications are limited to internal circulation modes:

Inter-community access roads
Collector Streets
Residential streets
Paths

There is also a relationship between circulation design and infrastructure which will help to determine the type of surface paving. Two criteria are recommended:

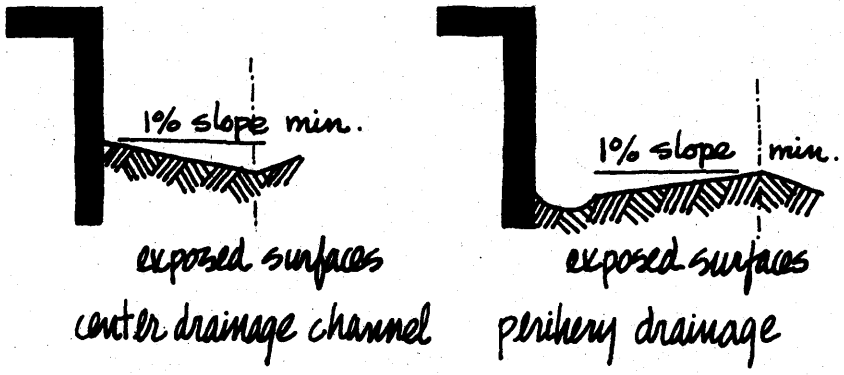
1. Underground infrastructure should not be located beneath very impervious or permanent surfaces within circulation R.O.W.'s. For example, water and sewer (sanitary and storm) lines should not be buried beneath concrete paving or sidewalks as accessibility for maintenance is costly, difficult and very time consuming.

2. Storm water drainage should be located on the surface (open) in low-cost urbanizations in order to reduce infrastructure development costs. This necessarily implies that curb and gutter design must be related to surface drainage channels and pavement edging.

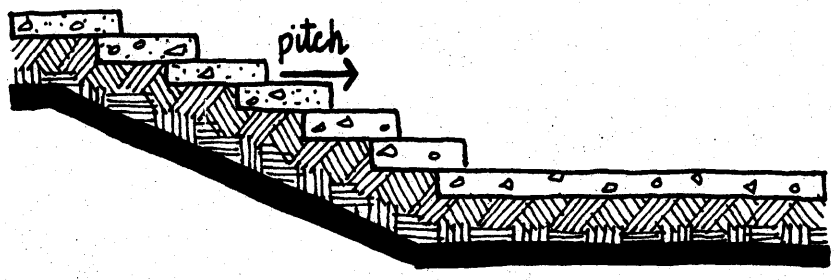
CIRCULATION MODE	WEARING SURFACE	SUBSURFACE	USES	INITIAL COSTS	MAINTENANCE COSTS	DURABILITY	FEATURES
Paths Service Streets Residential Streets	Earth Levelled and Graded	None	Walkways Travel Lanes Parking	None Except Grading	Low	Depends on Climate	Adequate for Dry Climate Areas not Subject to Erosion or Heavy Traffic
All of Above and Collector Streets	Oiled Macadum	Compacted Crushed Stone Base	All of Above	Low	Low	5 Years Moderate Traffic	Same as Above Used for Collector Streets as Temporary Surface Only.
All of Above And Inter-Community Streets	Bituminous Concrete	Same as Above	All of Above and Curbs	Moderate	Moderate	5-10 Years	Surface is more Permanent - Should be Reserved for Conditions of Heavy Traffic and in Wet Climates.
All of Above and Stairways	Concrete	Same as Above With Wire Mesh Reinforcing	All of Above	High	Moderate	20 Years	Most Expensive surface but Most Permanent. Use only when other Materials are not Adequate as for Curbs, Sidewalks, and Stairs.

PATH AND STAIR SECTIONS

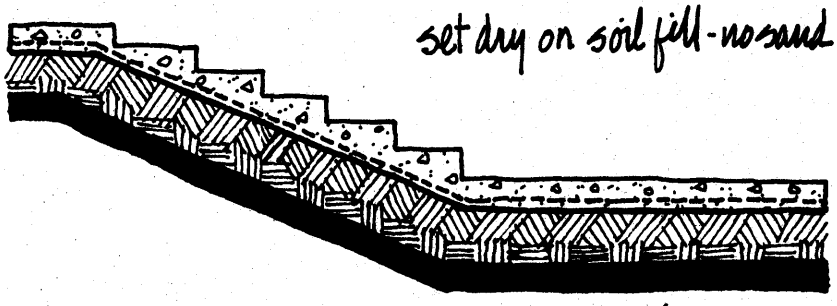
paths



stair paths for steep slopes

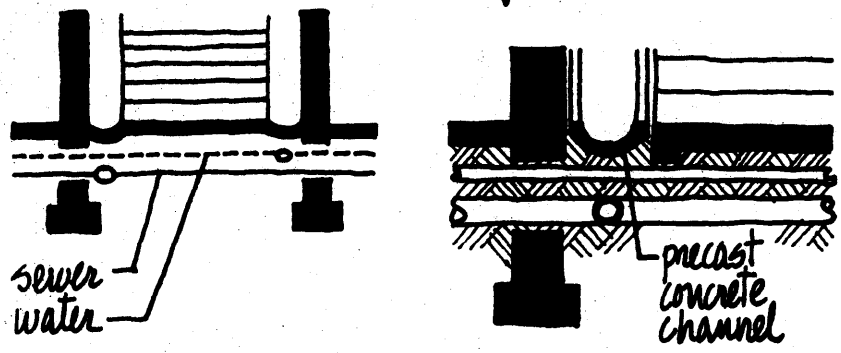


set dry on soil fill - no sand



more permanent, but more costly - requires reinforcing and footwork.

open storm drainage channel for concrete stairs on steep slopes

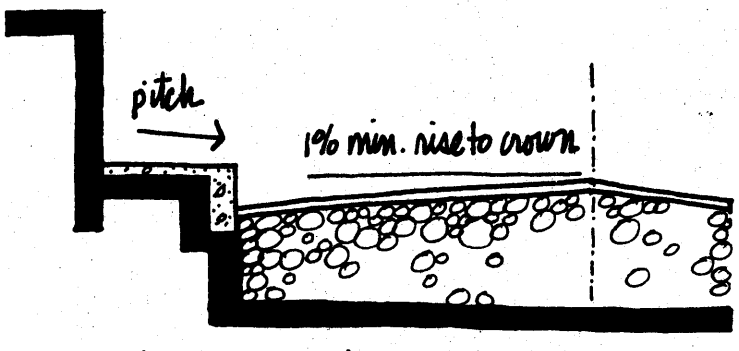


STREET SECTIONS

graded earth
1. residential streets
2. service streets

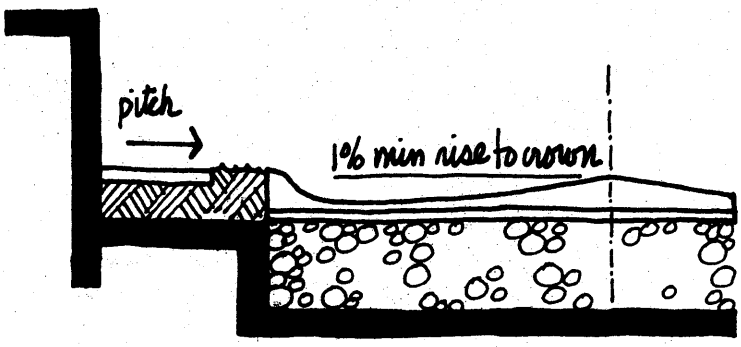
graded and compacted earth base
7-12 cm deep - sand, clay, or gravel

oiled macadum base
1. paths
2. residential streets
3. collector streets



oiled crushed stone wearing surface
compacted gravel or crushed stone base
7-12 cm thick

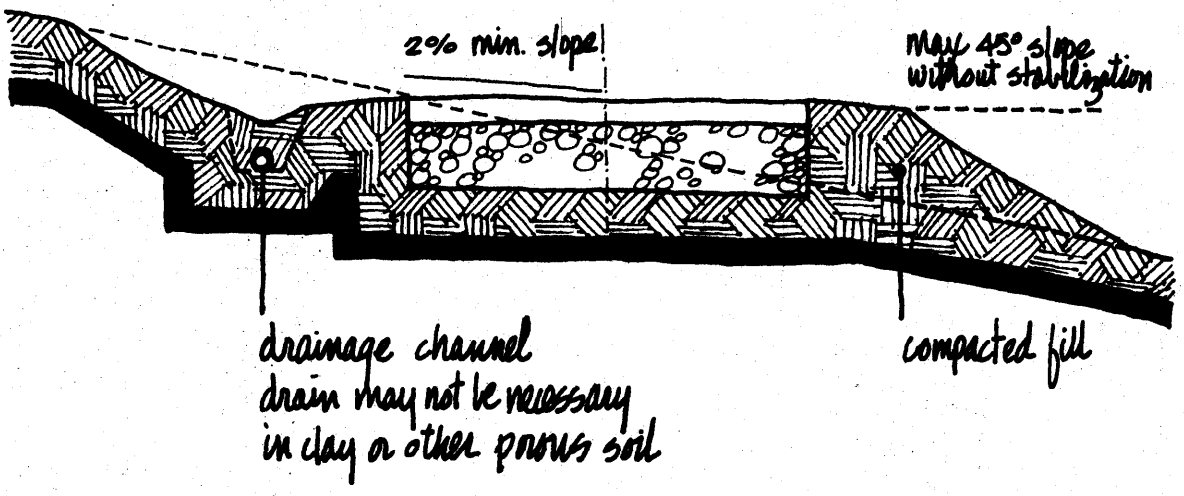
bituminous concrete
1. residential streets
2. collector streets
3. inter-community access

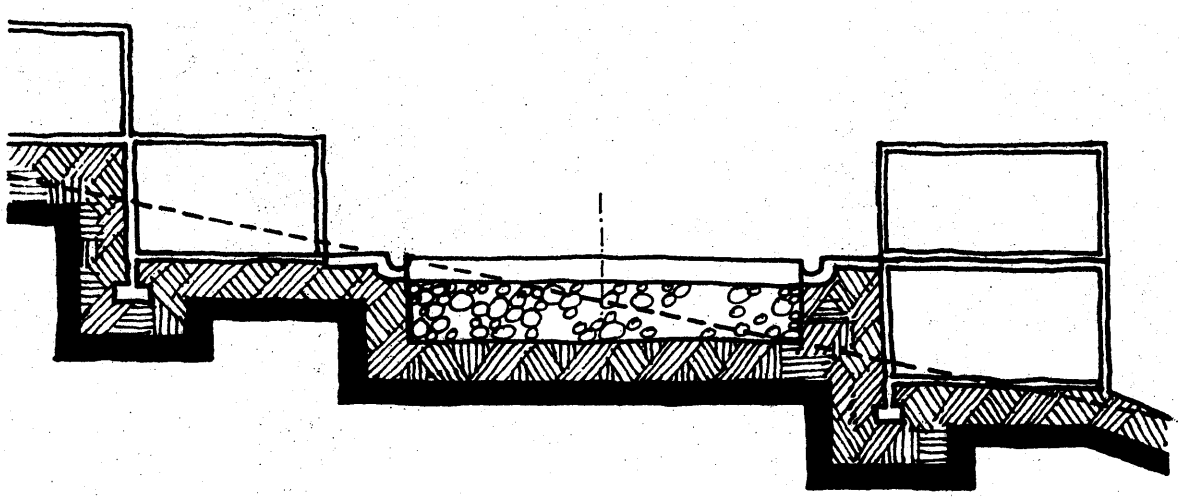


bituminous wearing surface 5-7 cm.
bituminous base or compacted gravel
7-12 cm base

ill 29

STREET SECTION ALTERNATIVES
STEEP SLOPES





STAGING OF CIRCULATION DEVELOPMENT

In low cost residential urbanization developments, the construction of the entire circulation system initially is usually prohibitive. As a trend, this will become even more dominant, because of the extreme pressures of urban migration in developing countries. One of the biggest costs municipalities and developers face is provision of infrastructure and circulation for expanding urbanization.

Priorities for circulation development must therefore be established which relate to initial and projected population densities. Only minimum amounts of circulation and infrastructure which will allow the community to function at a particular stage of development should be provided. In staging the circulation development, there must be coordination with the staging of infrastructure. Water, sewerage, storm drainage, electrictiy, and telephone has to expand with expanding densities and new development. Since most utility easements are within circulation R.O.W.s, the development of both should be concurrent.

In the planning and initial occupation of the development, land needs to be set aside for all of the proposed R.O.W.'s and infrastructure easements. But initially only those circulation modes which provide for public transit routes and access to individual lots need be developed. Collector streets, and Inter-community access roads which are likely to become major traffic carriers and transit routes need to be paved, but residential streets,

paths, and service streets can remain unpaved. As densities increase, commerce develops, and the use of secondary circulation increases then they can be developed and surfaced in relation to the nature of the traffic they carry. Of course, there is the possibility that the climate, topography, or other site conditions may demand that all streets be developed and surfaced in the initial stage.

PARKING

Requirements for parking will vary according to the structure of travel habits including walking distances and existing and projected availability or private automobiles. Automobile ownership rates due to a particular country's economic degree of industrialization and trade relation context, may alter the demand in future years for increased amounts of parking space.

There are through certain guidelines which begin to emerge within the context of low-cost urbanizations. Parking requirements are usually designated as either off-street or on-street. This section will concern itself with semi-public or communal parking and will not attempt to discuss private parking on individual dwelling lots.

STANDARDS

Standards for parking are generally derived from zoning regulations which specify parking ratios for different land-use categories. In residential land-use the ratio is stated as the number of parking spaces per dwelling unit or family.

Standards for provision of off-street facilities in the United States vary from a maximum of 2 spaces per single family dwelling, 1 space per multi-family dwelling (one bedroom unit), and 2 spaces per multi-family dwelling (3 bedroom unit). Parking for various commercial and business facilities vary from 5 to 10 spaces per 100 meters square of gross floor area.[1] Parking ratios for developing countries are deficient in specifications but most sources

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[1] Ibid, Gallion and Eisner, p. 217

suggest a minimum of 1 space per 10 dwelling units,[1] to a maximum of 1 space per 1 dwelling unit.[2]

In an urbanization which does not provide for direct vehicular access to all lots, it is necessary to provide remote off-street facilities. Since these facilities do not produce income from the land set aside for parking, it is recommended that land with potentially low economic value be reserved for this purpose. Of course this decision has to be cognizant of location based on convenience. The motorist wishes to park as near his destination as possible.

This reflects concern for both security of the vehicle and to minimize walking distances and a basic instinct for freedom and choice of movement, whatever the consequences.

Parking in conjunction with commercial properties for the purpose of shopping is dependent on the maximum distance a person is willing to walk to reach his destinations. The length of stay at a destination further complicates the picture.[3]

LENGTH OF STAY	MAXIMUM DISTANCE FROM DESTINATION
less than ½ hour	200 meters
about 1 hour	300 meters
more than an hour	400 meters

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1 Ibid, CINVA, p. 7.

2 Ibid, A.I.D., p. 70.

3 Gallion and Eisner, THE URBAN PATTERN, Van Nostrand Co., Inc., New York, 1963, p. 304.

Communal parking primarily for residential purposes is a function of: climate, site topography, walking times, market factors, and distances related to the hand transporting of goods. Recommended distances vary between maximums of 60 meters and 150 meters from the parking facility to the most remote dwelling unit.[2] These distances are subjective decisions, and should serve as a guideline only.

ON STREET PARKING

Major amounts of on-street parking should be restricted to streets which are local in nature including residential and service streets. The costs of providing additional lanes for on-street parking and thereby increasing the overall amount of land for circulation must

ill 30 be compared with streets providing no parking and grouped parking in off-street lots.

The reliance of on-street parking for the single solution of parking must necessarily respond to the consequences that curb parking impede the flow of traffic and can render the street obsolete as a channel of movement. When residential lots fronting on streets are less than 9 meters wide, there is very little on-street parking space available and should be utilized as extra space

ill 31 only.

On street parking lanes vary in width from 2.5 meters to 3 meters and by 6.5 meters per car length for parallel parking. This amounts to 20 meters square per vehicle.

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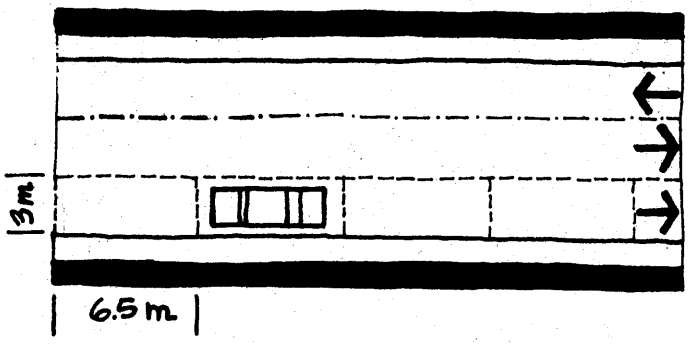
1 HUD, CINVA, NORMAS MINIMAS DE URBANIZACION, Bogota, Colombia, 1968, p. 8.

ON - STREET PARKING

parallel parking

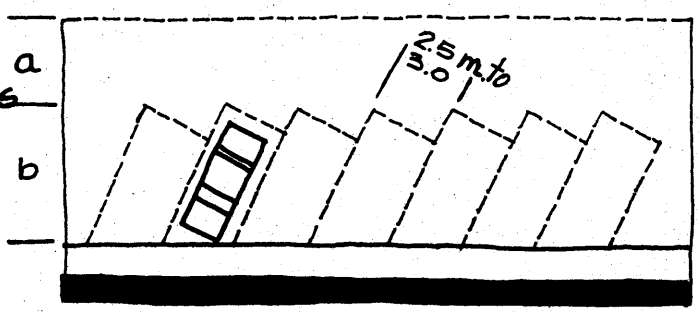
one lane width - 3 m = 20 m²/veh.
- 4 m = 26 m²/veh.

if street is designed with optional parking lanes, the width should be sufficient for travel lane.

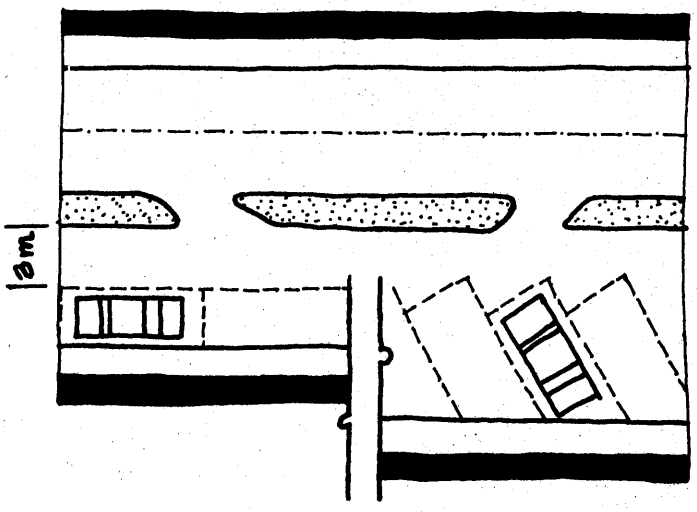


angular parking

a - maneuvering lane 3-6 meters
b - lane depth
- 30° - 4.7 meters
- 45° - 5.1 "
- 60° - 6.0 "
- 90° - 5.6 "



service lane parking



number of spaces (estimating)

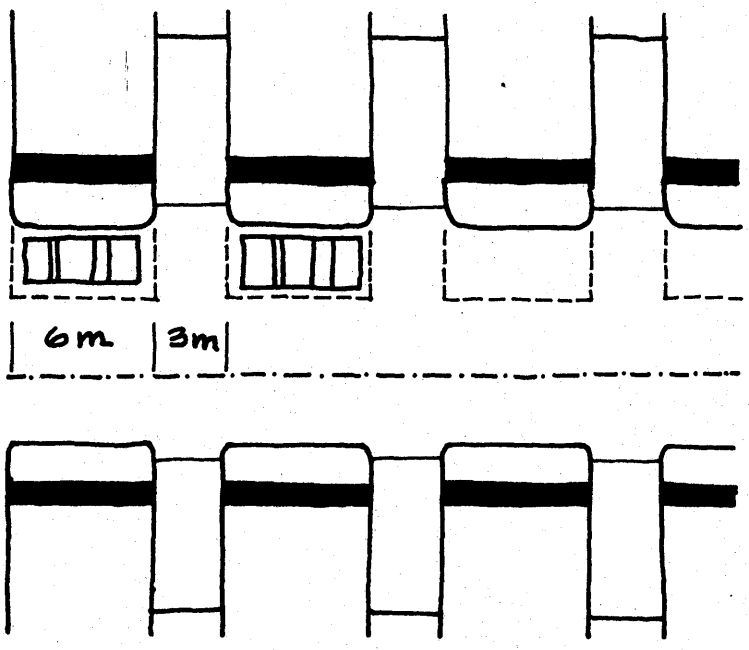
1. parallel N = L/6.5
2. 30° N = L-0.8/4.8
3. 45° N = L-1.9/3.4
4. 60° N = L-1.8/2.7
5. 90° N = L/5.6

L = length of street

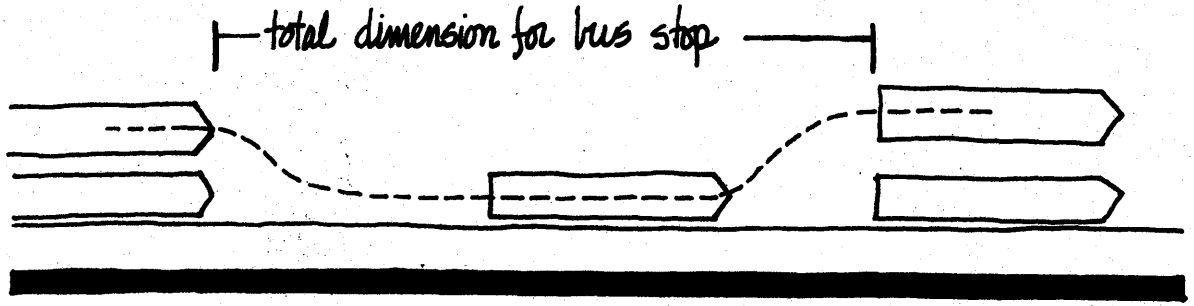
ill 31

ON - STREET PARKING
LOT WIDTHS AND BUS PARKING

parking on residential and collector streets requires minimum 9 meter wide lots if vehicular access is provided onto lot.



on street bus parking



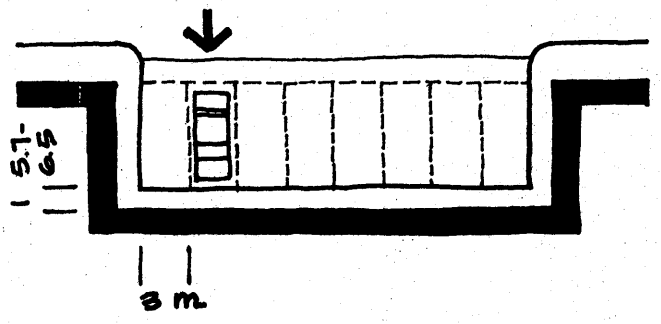
				capacity
collection	4.90	4.90	2.5	10-15
small bus	7.70	7.70	3.5	30-40
medium bus	9.30	9.30	4.2	40-50
large bus	11.00	11.00	5.0	50-90(1)

(1) double decker

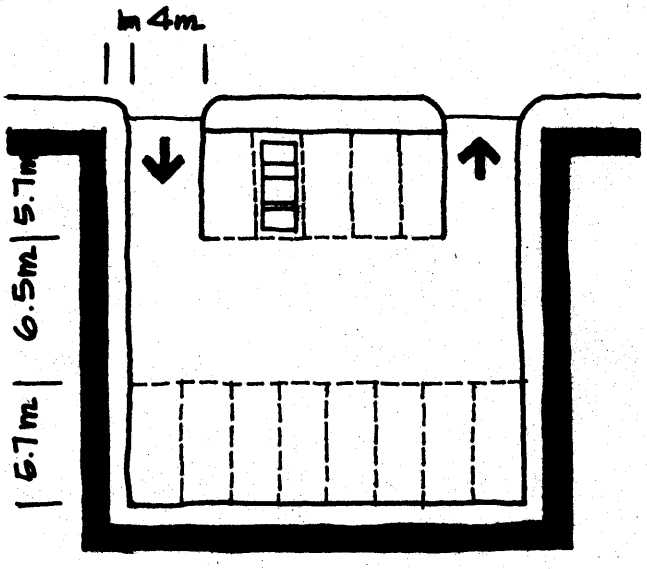
OFF STREET PARKING

Off-street parking requires about 300 meters square per vehicle including internal lot circulation. Communal parking lots which are designed for the storage of private vehicles in conjunction with residential use should provide for some form of security either by controlled lot access or continuous surveilance.

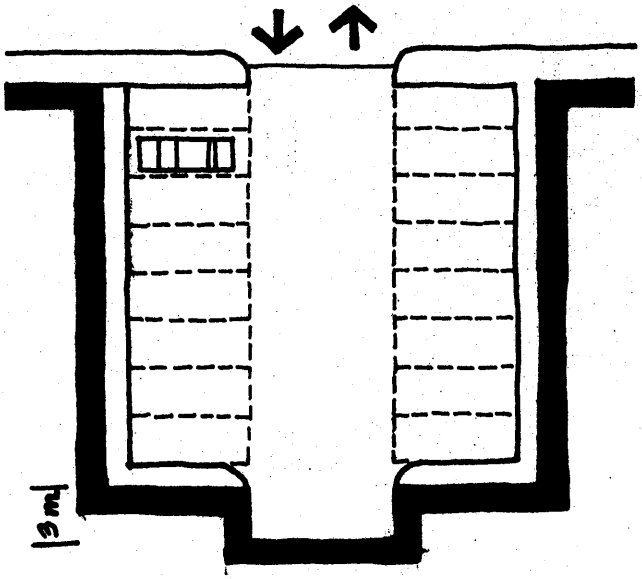
Single lane pull off lot
efficiency achieved by using street for circulation



two lane lot
double efficiency of internal lot circulation



two lane lot
double efficiency of internal lot circulation
least amount of internal circulation for two lane lots



ill 32 cont'd
OFF - STREET PARKING

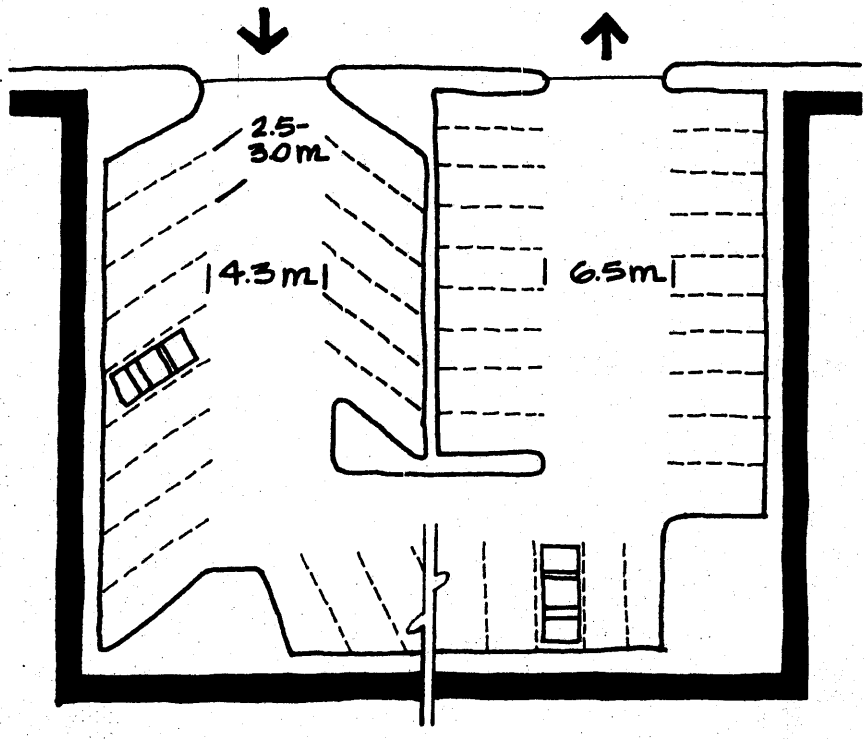
Large off street parking lot

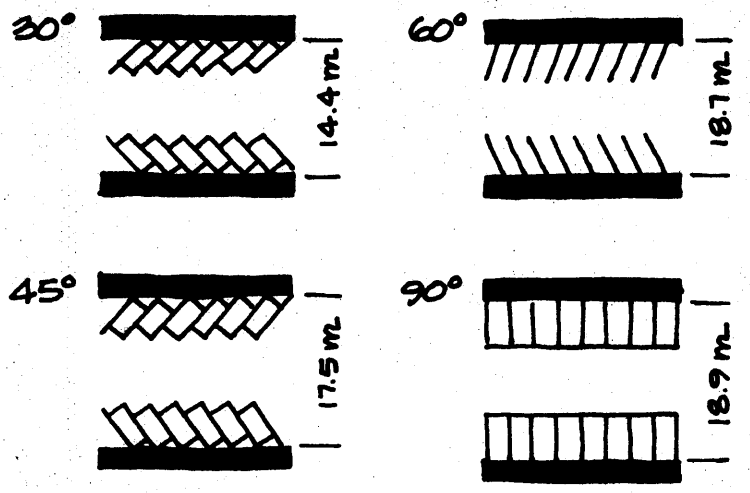
angular parking requires lanes to be marked to maintain efficiency requires impervious surface to retain lane marks.

Lane depths

30°	4.1 m
45°	5.1 m
60°	6.0 m
90°	5.6 m

summary of spacing dimensions -minimums





OPEN SPACE

Open space forms the visual subsystem of the community in that it operates as the negative of spaces, is generally unbuilt upon, unobstructed, and accessable by the public for many purposes. Its framework gives access to major views, the distribution and use of vacant land, recreation land, and relates to the initial and planned population distribution.

In planned communities it is possible to initially set aside land for a variety of open space functions, but existing communities find it almost impossible to expand or create new open spaces for the needs of increased population. Existing structures, established land values, and use patterns are major deterants to acquisition of additional open space. Even though open space land may not be fully utilized initially, it should be set aside as reserved land for anticipated population densities. The quantities of open space for recreation, vacant land, reserved land, and agricultural land should be established initially based on saturation densities. It's always possible to re-subdivide unused open space for other uses in the future. As with land for communal facilities, open space land should relate in function, size, and location to the service population. Certain small scale open space functions should be located in dispersed parcels, while others because of use should be adjacent to education facilities, or in an aggregated cluster in one location serving the entire community.

Location of open spaces in part relates to use based on maximum walking distances and/or those uses for which vehicular access is permissable or desirable.

Aside from the purely functional aspects of open spaces, they provide various visual and social amenities. Many of the reasons for open spaces are embodied in the provision of cleaner air in balance to polluted air caused by adjacent land uses, automobiles, or burning of trash.

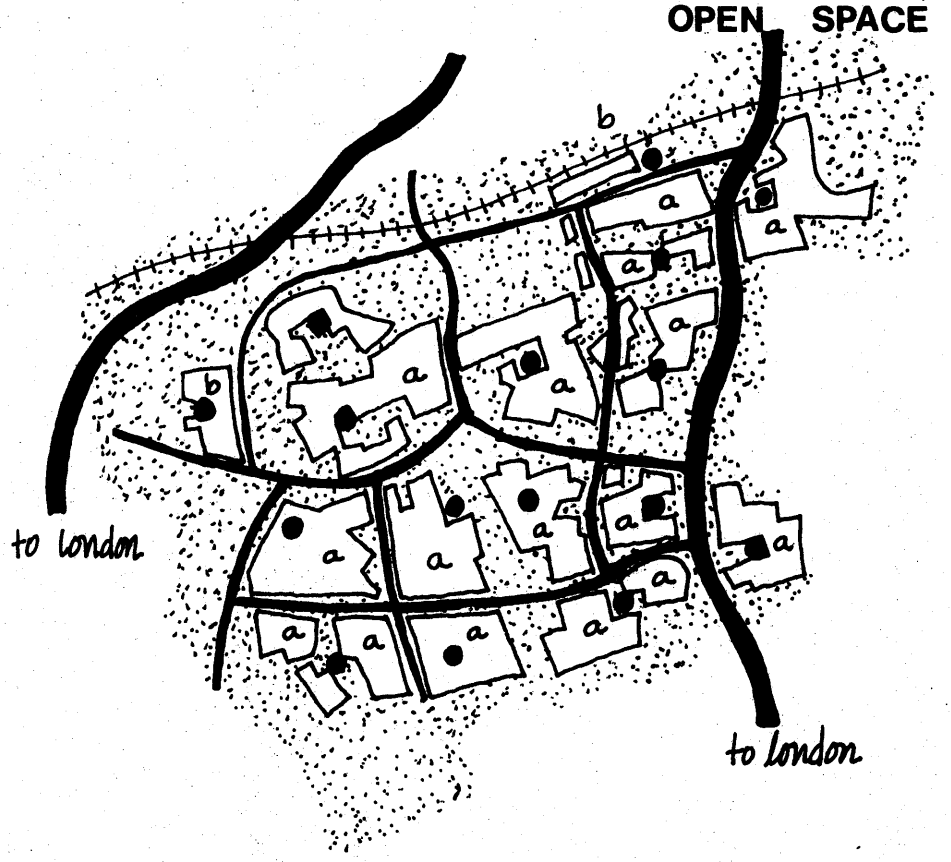
Visually, open spaces open up vistas and relieve the monotony of a densely built community. Characterized as small and large parks and plazas, and linked by pedestrian path networks, and as a backdrop for adjacent structures they often form the identity of
ill 33 the community.
34

The physical access points and linkages of open spaces can form the potential social and psychological linkages of the community's population. Potential for contacts and interactions between adults and especially between children are dependent to a large degree on the open space structure of the community.

Open spaces are most often publically or communally owned and maintained. As the land is non-income productive, and usually is of low economic value there is often pressure to push open space locations to the periphery or away from population centers. There are certain open space functions which because of their nature can be placed semi-remote to the population. But as the potential exists for open spaces to become the social and physical linkages

ill 33

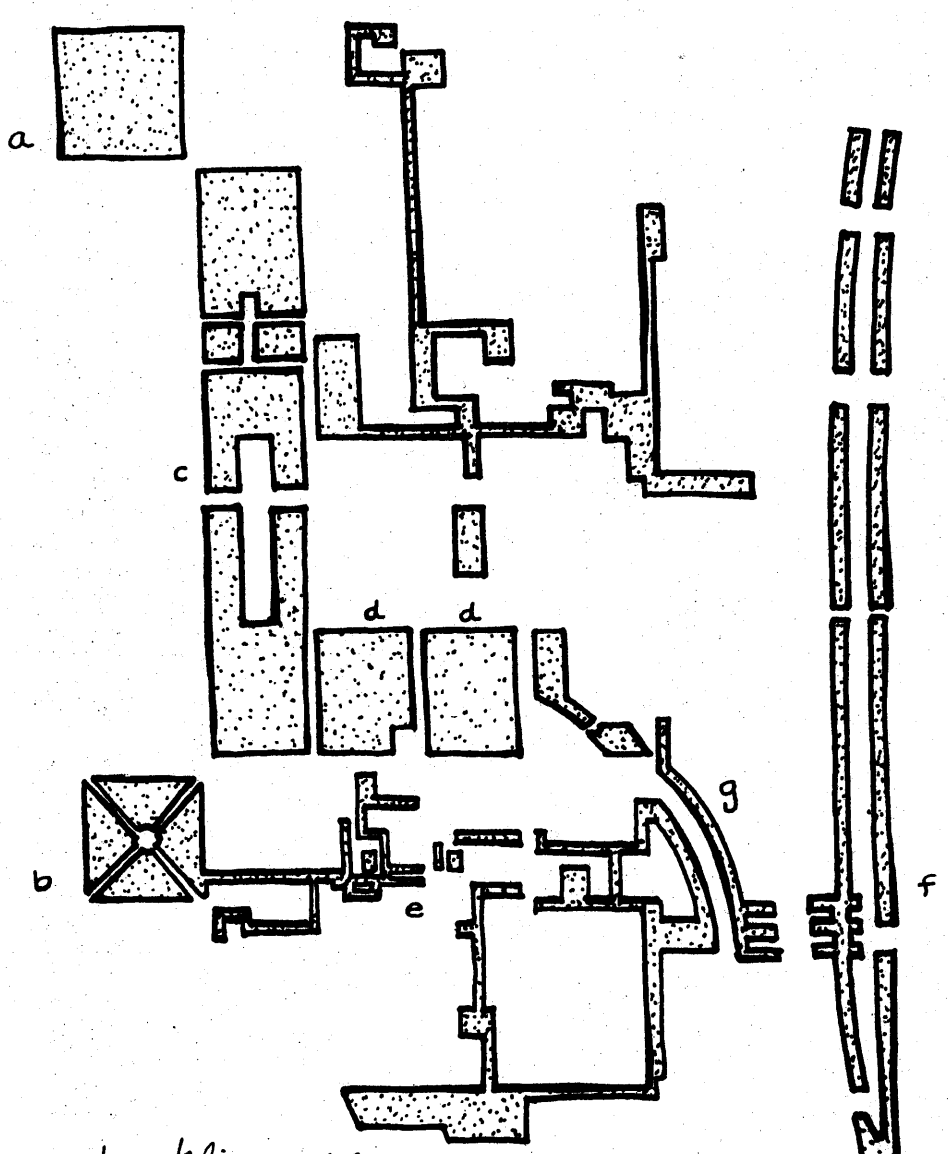
OPEN SPACE STRUCTURE



harlow, newtown, england

a residential districts
b industrial districts
● neighborhood "town" centers
⁘ open space structure

ill 34
LINKED OPEN SPACE NETWORK - PHILADELPHIA



a franklin square
b washington square
c independence mall
d historic open spaces
e society hill
f delaware river and expressway
g dock street area

of the community, their locations should not be subservient to economics of land values at the sacrifice of their purposes.

Requirements for open spaces will be discussed under three headings:

Recreation
Reserved Land
Vacant and Agriculture Land

RECREATION

Structured open spaces for recreation purposes will be developed on the neighborhood scale as the largest increment of the service population. Exceptions to this are open spaces for large scale recreation such as major parks, plazas, and sports areas, where it is not economical or where the support population would be deficient to provide such facilities on a neighborhood increment.

Open spaces for recreation can be classified under two categories:

Active Recreation
Passive Recreation

Both categories can be located either separately or in conjunction with each other. They can also co-exist with education facilities and have a double use role. The trend in most Latin American countries is to locate active recreation facilities adjacent to schools and passive facilities on separate sites or in conjunction with the pedestrian movement network.

There are numerous advantages of planning active recreation facilities in conjunction with school sites. Multiple-use of the

same facility, lower land and development costs, option for facility supervision and maintenance, and reinforcement of the social and functional identity places in the community, are a few of the advantages.

Active portions of an outdoor recreation facility should be oriented to take advantage of the sun's warming and drying capabilities, whereas passive recreation spaces in hot climates may be oriented away from major sun exposure and designed to take advantage of prevailing winds. The opposite would hold true for colder climate locations.

DEFINITIONS

Play lots, infant parks, or young children's playgrounds: A small social and active recreation area designed for the safe play of pre-school children. It is usually designed to relate to a block, cuadra, or manzana and is capable of being controlled by the residents of the immediate area.

Neighborhood Playground, Neighborhood Recreation Park, Playfields, Sportsfields: This outdoor recreation unit is the principal unit in the planning of active recreation facilities. It may be located adjacent to the elementary school site and share combined facilities. The neighborhood playground can serve all residents but primarily elementary school age children.

Neighborhood Park, Plaza: Land set aside for the neighborhood park is primarily for passive recreation and can be incorporated with the neighborhood playground. Its use is for all age groups within the neighborhood.

Community Park and Playfield: It is designed to provide a variety of passive and active recreation facilities not generally provided by the neighborhood facilities. It may serve several or more neighborhoods.

Facilities include space for soccer fields, basketball courts, a recreation building (may be combined with other social/religious facilities) and areas for passive recreation such as walking or picnicing. Access may be by both walking or automobile in which case parking facilities should be provided.

Community Plazas: The Plaza is traditionally the center or focus of the community and is the gathering place of all ages for both passive and active social activity. Access is usually by walking.

District or Citywide Park: This facility serves a district of a larger city or a total community of a smaller city and a population range of 50,000 to 100,000. It is designed to serve a wide variety of activities: fields for soccer, softball, courts for tennis and basketball, bicycling, swimming, nature areas, water sports, parking areas, outdoor theater, etc.

STANDARDS

Efforts at establishing impirical planning standards for land to be set aside for all forms of outdoor recreation have generally been summarized in the following manner. The most frequently used standard allows for 4 Ha. of land for all recreation uses per 1000 habitants and decreases as community population increases.

ill 35

Further specification of this standard[1] shows a minimum of 1 Ha. per 1000 population for the neighborhood park and playground, and 1 Ha. per 1000 population for the community wide park and playfield.

The main problem in utilizing such standards is that there is no correlation between size and use to which the spaces will be put; no survey by itself can indicate the answer on the best size and shape of open space for recreation (since what people want is conditioned by what they know, and often excludes real possibil-
ill 36 ities not yet tried or experienced). Surveys of 15 major U.S. cities indicate a wide variation in space for outdoor recreation.[2]

COMPARATIVE STANDARDS

The following charts offer a quantitative survey of minimum standards for public outdoor recreation spaces both passive and active. When source figures were given in terms of a range, the minimum figure was used. Population in terms of people has been converted to families assuming a family size of four persons. These figures must be viewed as a framework for planning recrea-
ill 37 tion needs and not as absolute criteria as very often the stand-
38
39 ards are delinquent in specifying uses, location and nature of
40 residential development. Unfortunately the standards do not reflect changing demands for open space coincident with increasing densities. Abbreviations used in the Source column are:

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1 Natn. League of Cities, Dept. of Urban Studies, RECREATION IN THE NATION'S CITIES, Wash. D.C., Dec. 1968, p. 4.

2 Spokane County Planning Commission, PLANNING FOR PARKS, Spokane, Sept. 1960, p. 24.

The complete source is listed under References.

AI - Athletic Institute

APHA - American Public Health Association

BRPC - Baltimore Regional Planning Council

CINVA - Centro Interamericano - DeVivienda y Planeamiento, Bogota, Colombia

GI - Gallion and Eisner

GN - George Nez

GRH - Goderitz, Rainer and Hoffman

LCC - London County Coundil

SCPC - Spokane County Planning Commission

ULI[1] - Urban Land Institute

ULI[2] - Urban Land Institute after Gallion and Eisner

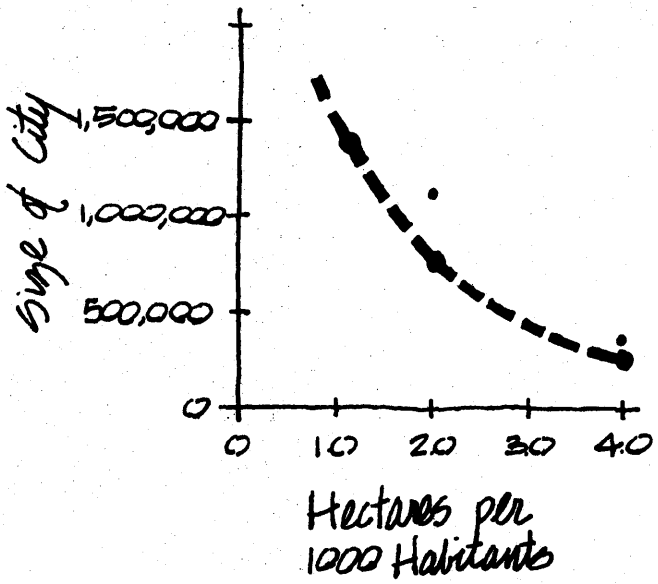
Withstanding the non-specified uses and correlation with densities of the recreation open spaces these are the averages from the above survey:

	M^2/F
1. Children's Play areas, Play lots	3.5
2. Neighborhood Playgrounds	24.0
3. Neighborhood Parks and Plazas	13.0
4. District Parks and Sport Areas	18.0
Total	58.5

ill 41

Location is second only in importance to use of outdoor recreation facilities, and of the three major factors affecting location (population density, availability of land, and method of access) population density is the most important. Facilities should be located in relation to the population centers they serve. The need for recreation facilities increases with increasing

ill 35
OPEN SPACE SURVEY



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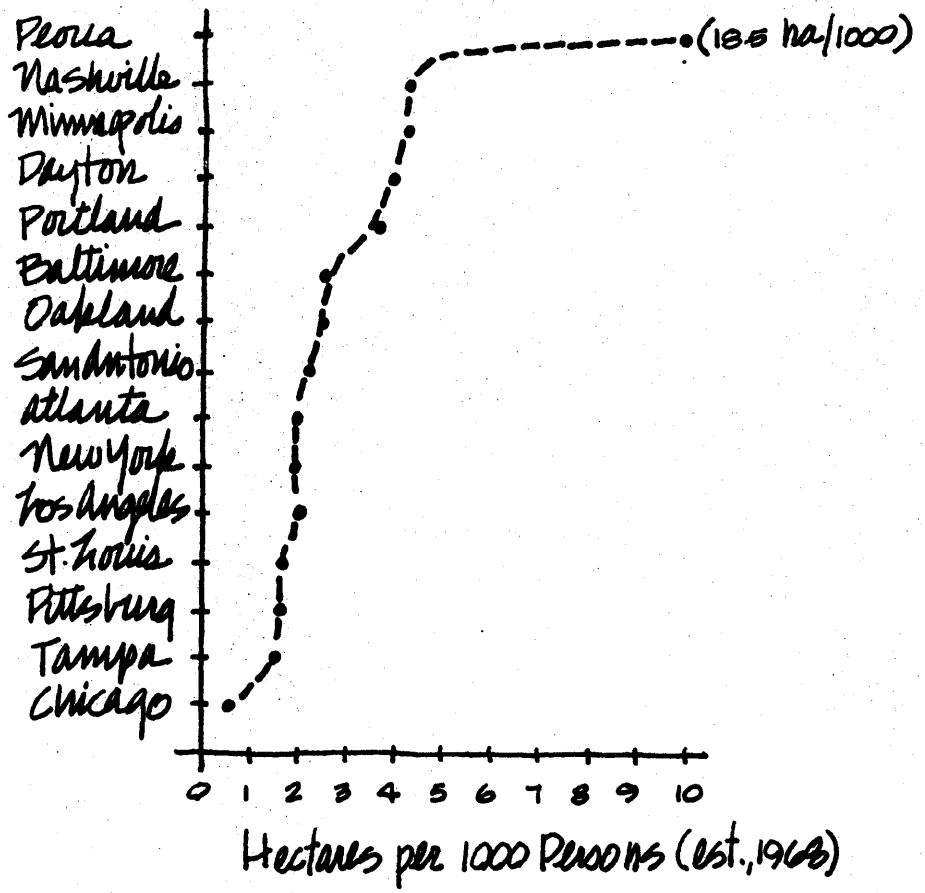
OPEN SPACE SURVEY



MINIMUM STANDARDS FOR CHILDREN'S ACTIVE PLAY AREAS

FACILITY	FAMILIES	AGES	HA.	M^2/F	MAX. DIST.	NOTES	SOURCE
CHILD'S PLAY AREA	4000	Pre-School	0.8	2			GRH
PLAY LOTS	2000	"	0.1	2	400 M		AI
PLAY LOTS	1700	"	2.7	7.5	800 M	Min. 450 M^2 each lot 1 lot per 30-60 families	ULI[1]
CHILDREN'S PLAYGROUND	1000	"	0.2	2			GRH
CHILDS PLAY AREA	415	"	0.2	5	250 M	One area per manzana	CINVA
CHILDS PLAY AREA	165	"	0.08	5	250 M	" " " "	CINVA
AVERAGE				3.5			

MINIMUM STANDARDS FOR ACTIVE NEIGHBORHOOD PLAYGROUNDS

FACILITY	FAMILIES	AGES	HA.	M^2/F	MAXIMUM DISTANCE	NOTES	SOURCE
SPORTS & PLAYFIELD	4000	All	7.2	18			GRH
PLAYGROUND	4000	"	2.0	5		Exclusive of Elementary School Site	ULI[2]
NEIGHBORHOOD PLAYGROUND & PLAY LOTS	3400	"	15.4	36.5	800 m		ULI[1]
PLAYGROUND	3000	"	1.6	5.3			ULI[2]
NEIGHBORHOOD PLAYGROUND	2000	"	3.2	16	800 m		AI
PLAYGROUND	2000	"	1.3	6		But in no Cases, Sites less than 1 Ha.	ULI[2]
NEIGHBORHOOD PLAYGROUND	1700	"	5.0	29	800 m		ULI[1]
PLAYFIELD	1625	"	4.0	25	2.4 km		GN
NEIGHBORHOOD PLAYGROUND	1375	"	2.4	17.5			APHA
SPORTS AREA & PLAYFIELD	1000	"	1.8	18			GRH
PLAYFIELD	1000	"	1.0	10			CINVA
NEIGHBORHOOD PLAYGROUND	1000	"	2.0	18			APHA
PLAYGROUND	825	"	1.6	20			"
PLAYGROUND	550	"	1.3	24			"

MINIMUM STANDARDS FOR ACTIVE NEIGHBORHOOD PLAYGROUNDS (CONT'D)

FACILITY	FAMILIES	AGES	HA.	M^2/F	MAXIMUM DISTANCE	NOTES	SOURCE
PLAYGROUND	275	All	1.0	36			APHA
ADULT PLAYING FIELD	250	Adults	2.4	96			LCC
NEIGHBORHOOD PARKS, ALL PLAYFIELDS, PLAYGROUNDS	250	All	1.6	64	$\frac{1}{2}$ Hour by Auto		BRPC
PLAYGROUNDS	250	"	0.8	32	800 m		GN
COMMUNITY RECREATION PARK	200	"	0.4	20	1.6 - 2.5 km	Minimum 6 Ha. Site Adjacent to Junior High	SCPC
RECREATION PARK	175	"	0.4	23	400 - 800 m	Minimum 2 Ha. Site Adjacent to Elementary School	SCPC
AVERAGE				24			

ill 38 cont'd

MINIMUM STANDARDS FOR NEIGHBORHOOD PARKS AND PLAZAS

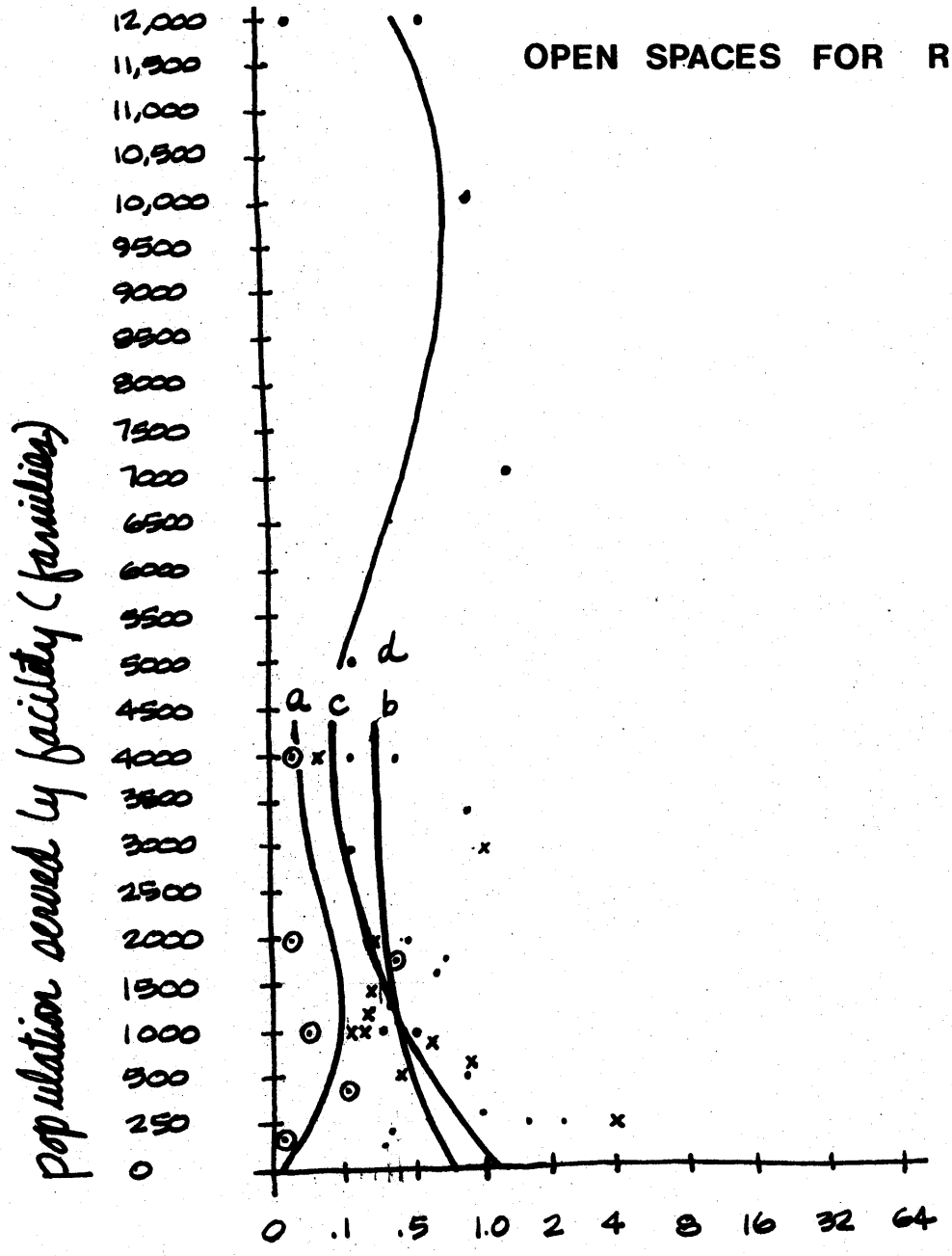
FACILITY	FAMILIES	AGES	HA.	M^2/F	MAXIMUM DISTANCE	NOTES	SOURCE
PARK	4000	all	0.5	1.25			GRH
COMMUNITY PARK	3000	"	1.6	13	3.2 km		GN
NEIGHBORHOOD PARK	2000	"	1.6	8	8000 m		AI
"	1375	"	1.4	10		S.F. development lot less than 1000 M^2 density greater than 10 du/Ha.	APHA
"	1100	"	1.2	11			"
PARKS AND PLAZAS	1000	"	0.5	5			CINVA
NEIGHBORHOOD PARK	1000	"	0.8	8	800 m		AI
"	825	"	1.0	12			APHA
"	600	"	2.0	33	800 m		GN
"	550	"	0.8	14			APHA
"	275	"	0.6	22			"
AVERAGE				13			

MINIMUM STANDARDS FOR ACTIVE AND PASSIVE DISTRICT PARKS & SPORTS AREAS

FACILITY	FAMILIES	AGES	HA.	M^2/F	MAXIMUM DISTANCE	NOTES	SOURCE
DISTRICT PARK	12,500	all	40	32	4.8 km		GN
DISTRICT PARK	12,500	"	20	16			AI
URBAN PARK	12,500	"	12	10	8 km		GI
MAJOR PARK	12,000	"	1.5	1.25			GRH
PUBLIC GARDEN	12,000	"	2.0	1.65			GRH
MAJOR PARK	10,000	"	40	40			SCPC
MAJOR PLAYFIELD AND CITY PARK	7,200	"	43	60	1.6 km		ULI[1]
COMMUNITY PARK & PLAYFIELD	6,000	"	6	10	1.6 km		AI
PLAYGROUND	5,000	"	2.4	4.8			ULI[2]
PARKS, MAJOR SPORTS	5,000	"	2.5	5			CINVA
AVERAGE				18			

ill 41

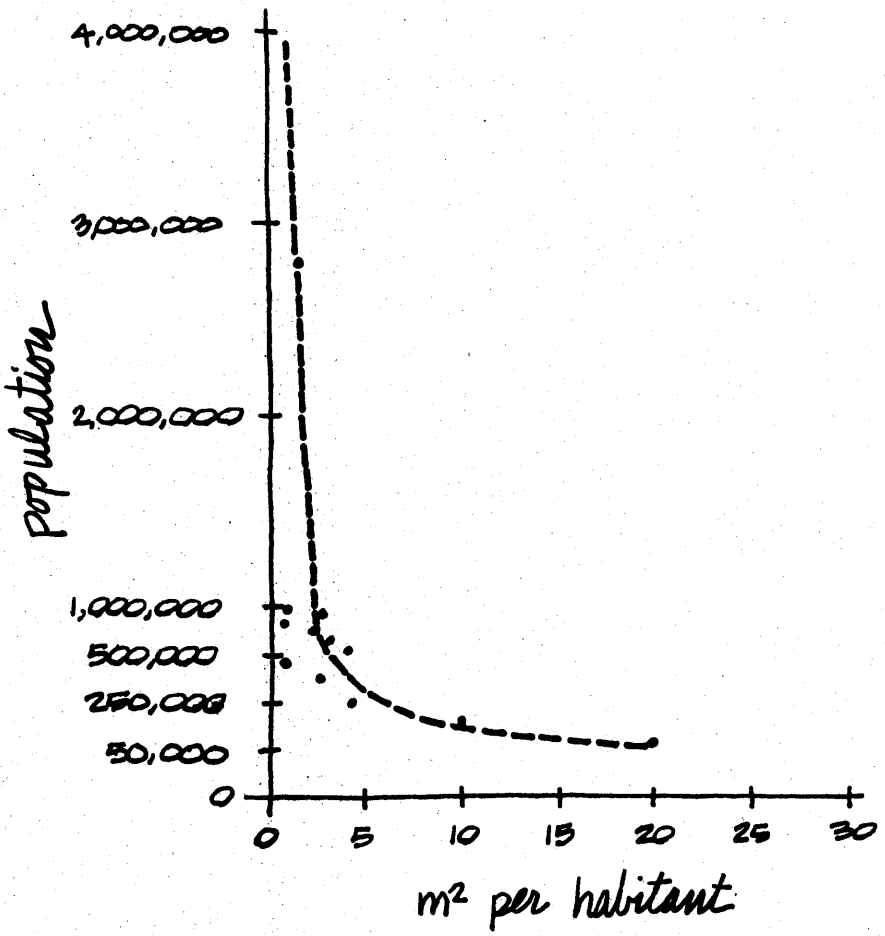
OPEN SPACES FOR RECREATION



		average m²/f
a.	childrens playlots	3.5
b.	neighborhood playgrounds	24.0
c.	neighborhood parks	14.0
d.	community district parks	18.0
		59.5

ill 42

OUTDOOR RECREATION SPACES



density and acquisition of land should be done in the initial development stages.

Location of recreation spaces in relation to adjacent residential properties can be summarized:

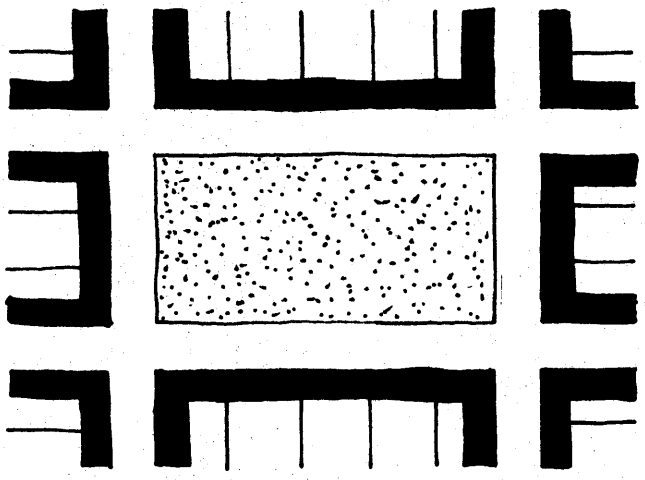
1. Intensively used areas should be buffered from adjacent dwellings to control noise between the common area and abutting properties.
2. Use of facility depends in part on the degree of visability. Small playlots or informal gathering places need not have high visability as their use is restricted to familiarity of adjacent residents. Major facilities should have high visability, some street access at strategic observation points. Parks and playgrounds need some street frontage for
ill 43 access and servicing.
3. Dispersed-spot pattern of facilities integral with pedestrian access network should be planned for rather than isolated or single locations for all facilities. Location of facilities
ill 44 should be central to service population.
4. Design emphasis should be on visual access and approach, the meeting edges, contrast, immediacy of scale, and a variety of visual stimuli, rather than on the stereotype playground plan.

PROTOTYPE RECREATION FRAMEWORK

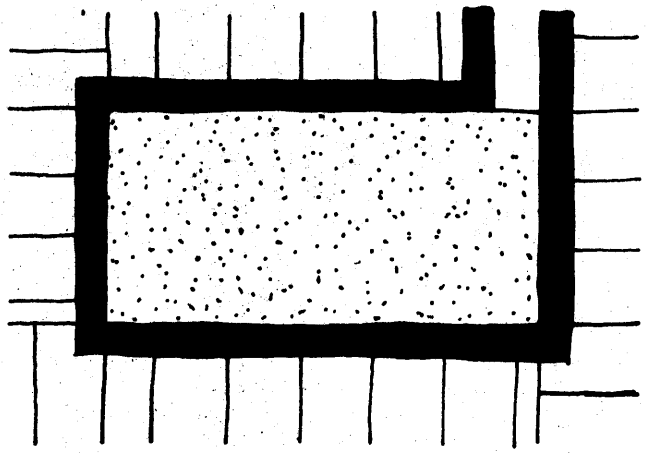
Within the Latin American context, and using the neighborhood as the largest recreation unit the following heirarchy and distribution of open spaces is recommended. It should serve as a guide-
ill 45 line for initial planning and design efforts. The major linkage

ill 43

RECREATION FACILITY ACCESS

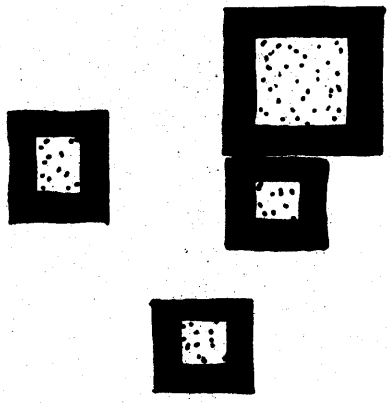


100% street access
park or playground

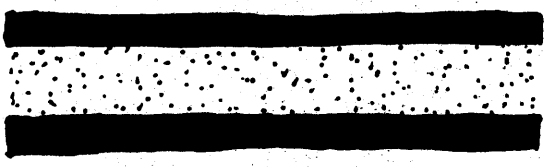


0% street access
pedestrian path
park or playground

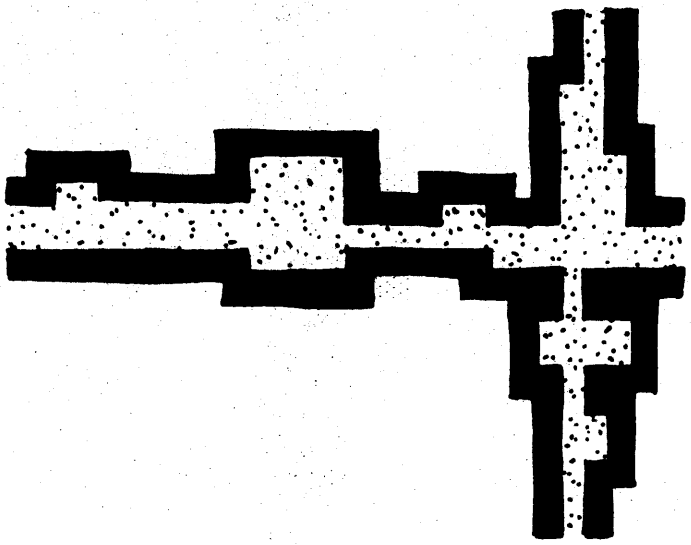
ill 44
PLANNED OPEN SPACE FORM



scattered - unlinked
- isolated use
- non unified



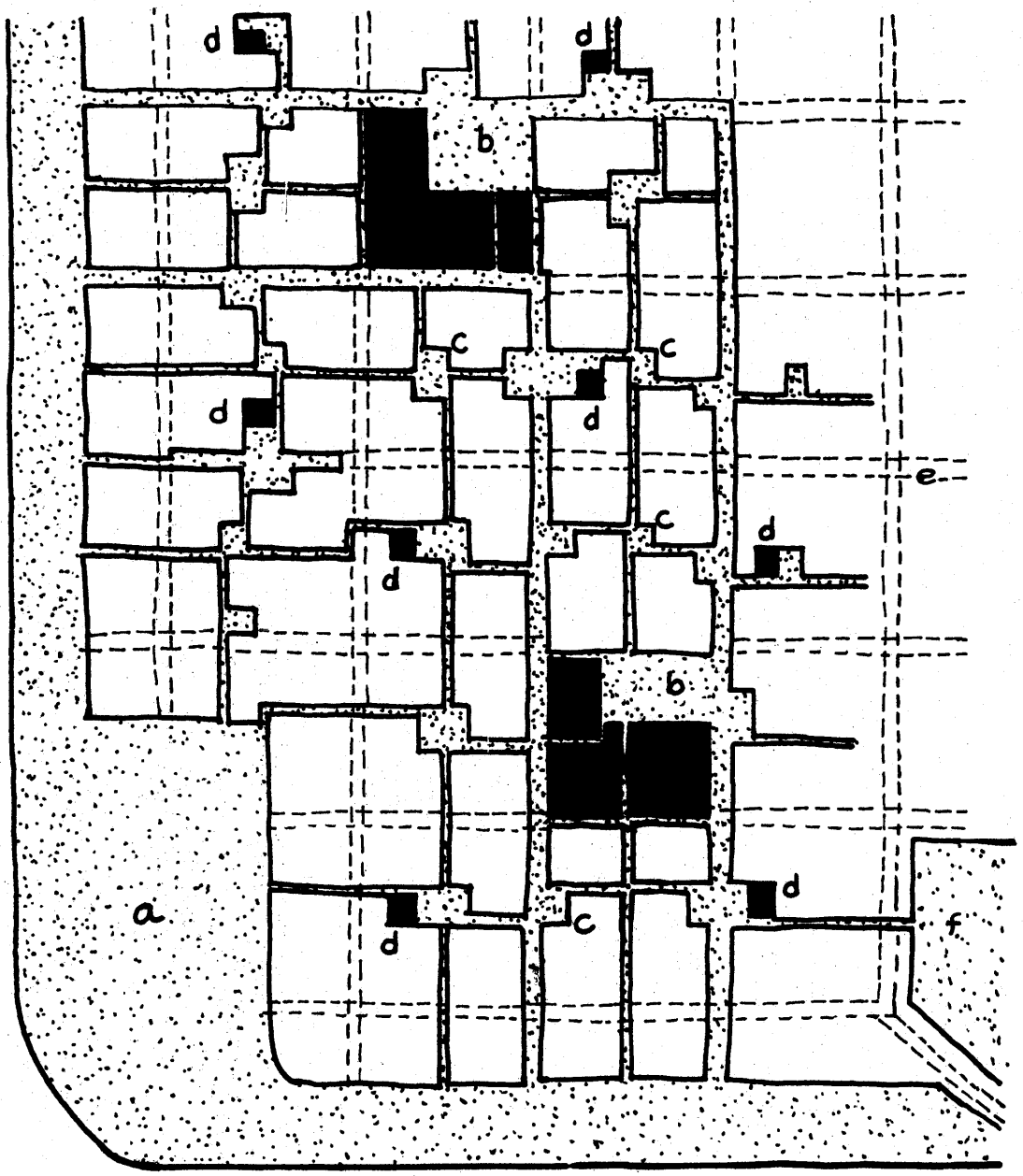
ribbon
- sense of direction
- sense of continuity
- parkways
river valleys
often in conjunction
with circulation



linear network
- sense of direction
- sense of continuity
- sense of visual clarity
- variety

ill 45

PROTOTYPE OPEN SPACE STRUCTURE



a reserved land
b neighborhood playgrounds and elementary schools
c children's playlots and social gathering places
d kindergartens
e block outlines and vehicular circulation
f secondary school site

of the open spaces is the pedestrian path network.

1. Playlots, and Informal Social Gathering Places:

Location of this facility is dependent on the social organization of the community, but it should be designed to serve residents of a one or two block area.

Playlots can be located integral to kindergarten/nursery sites, but locating them at the smaller block increment offers the advantages of better visual control from adjacent dwellings and use by older age-groups in the evenings as a passive social gathering place.

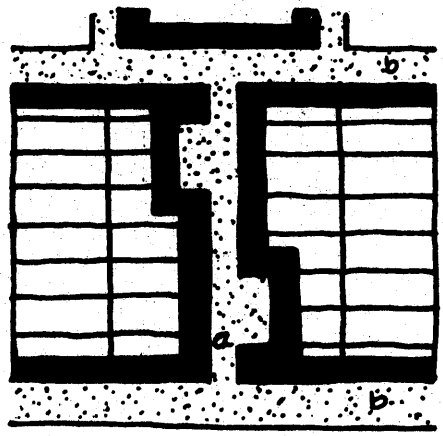
Playlots located at intersections of pedestrian path networks and at the corners of blocks provide for potential use by other than children. Playlots should not be located where conditions necessitate crossing major streets for access. Primary access should be from the pedestrian path wherever possible.

In sparsely populated areas or in single family developments the playlot is the equivalent of the "backyards" of homes or the street when there is no through traffic. In densly populated developments of row housing, court or cluster housing, or multi-family developments, the playlot serves for both active and passive uses, and clusters of small dispersed spaces (i.e. 4x6 meters) may be used more intensively than single large spaces.

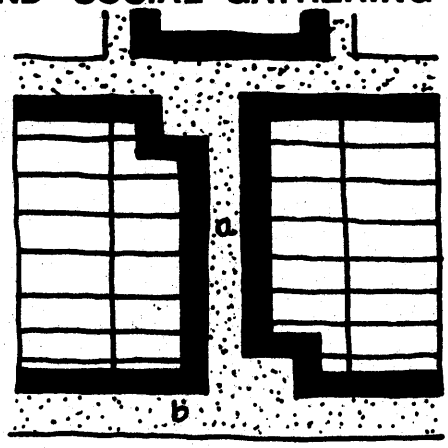
ill 46 Walking distances should be within the range of 250 - 400 meters.

ill 46

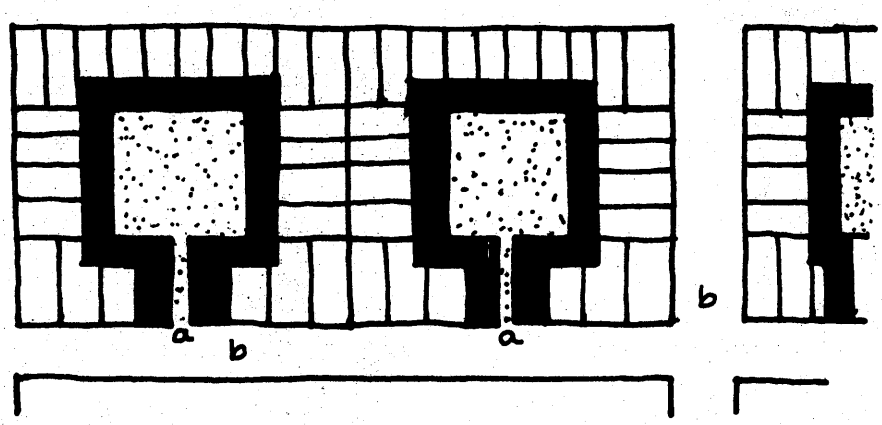
CHILDRENS PLAY AREAS AND SOCIAL GATHERING PLACES



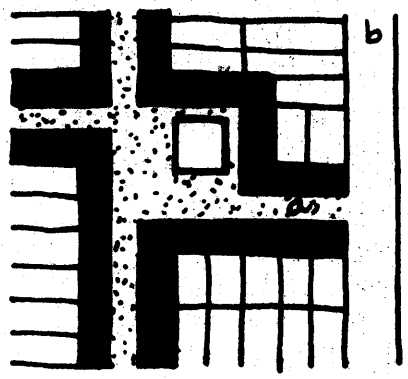
cuadra
a pedestrian path
b street o path



corners
a pedestrian path
b residential street o path



manzana
a pedestrian path
b residential street



kindergartens - walkway junctions
a pedestrian path
b residential street

2. Neighborhood Playground:

This facility may be located in conjunction with elementary school sites and share combined use. If not located as such, then minimal site area should include space for soccer and basketball, swings, climbing apparatus, seating areas, sand areas, and passive gathering spaces.

Access should be from the pedestrian path network with minimal street access for service and emergency vehicles. Maximum
ill 47 walking distances should be within the range of 400 - 800 meters.
48

3. Neighborhood Park or Plaza:

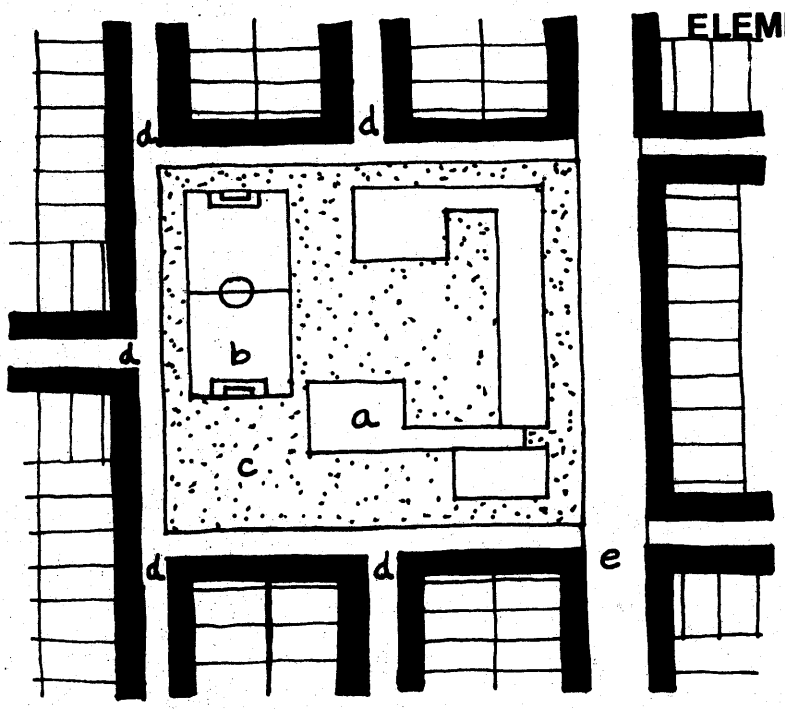
Consistent with traditional spatial patterns and use, the small urban plaza was very often located at the corner and served as entrance area to the church. Examples can be found through out all of Latin America. This focal point today may be much the same or in some cases may be substituted by the school or
ill 49 building sites.

Its use both as a passive gathering place and by small vendors implies that it should be located at points of high pedestrian concentration. In turn it may form the principal social and visual identification of the neighborhood or district.

RESERVED LAND

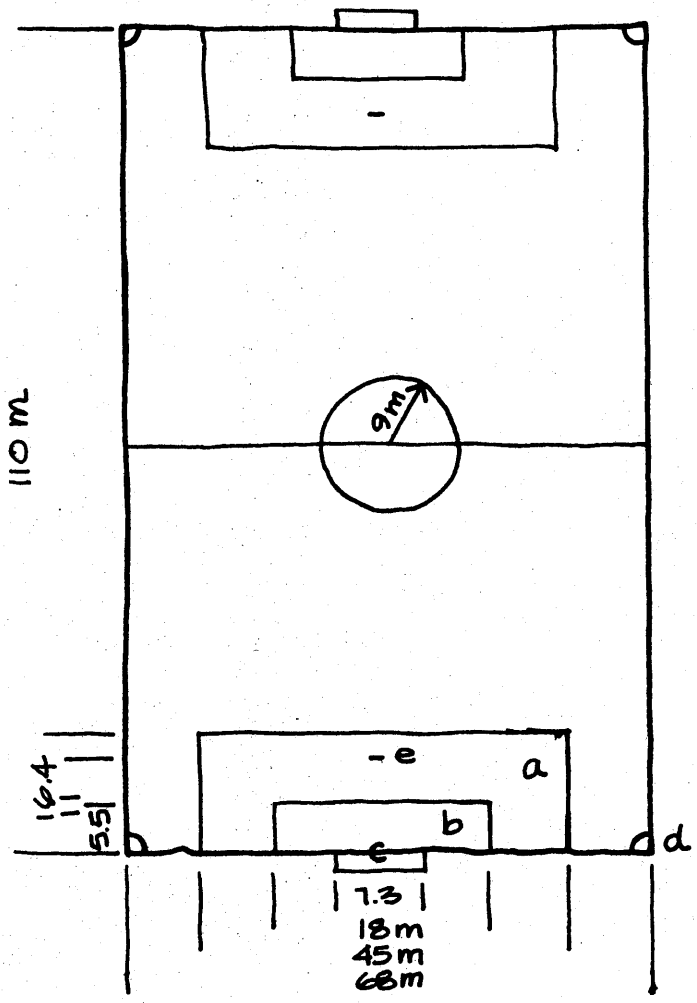
Reserved land is land set aside during initial planning and development stages for either permanent open space functions or anticipated land-uses such as commerce, housing, or industry.

ill 47
PLAYGROUND AND ELEMENTARY SCHOOL



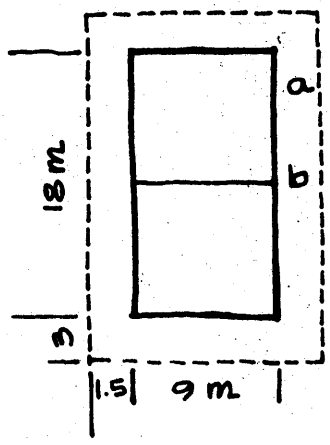
a elementary school
b soccer field
c neighborhood playground
d pedestrian access paths
e residential street

ill 48
GAME COURTS



soccer
min. field 45m x 90m

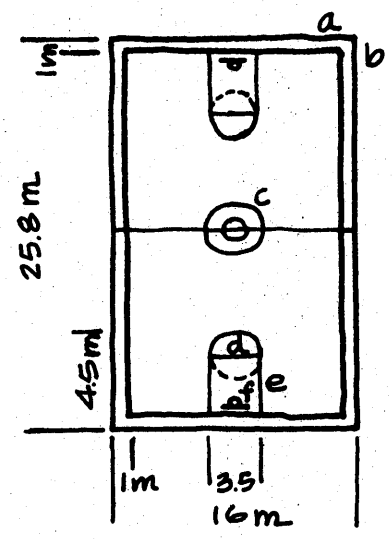
a penalty area
b goal area
c goal - 2.5 m high
d corner flagstaffs
1.5 m high
e penalty kick mark



volley ball

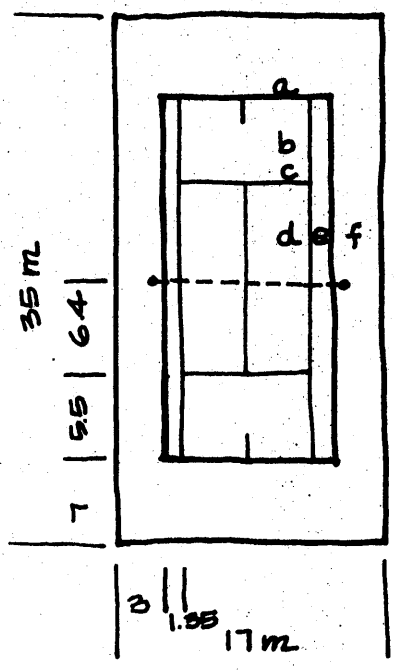
a service area
b net 1 meter deep
2.5 meters from
ground to top

ill 48 cont'd
GAME COURTS



basketball

a end line
b side line
c restraining circle
d free throw line
e free throw lane
f backboard, 1.2m from boundary line on non-regulation courts.

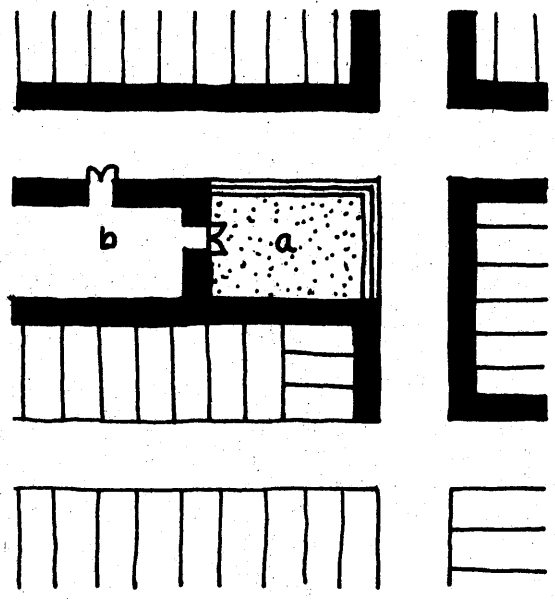


tennis

a base line
b back court
c service line
d service court
e the alley
f reserve space

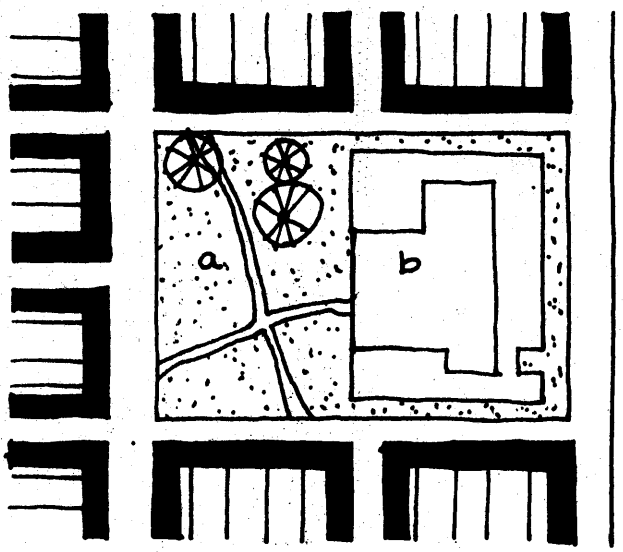
ill 49

NEIGHBORHOOD PARK OR PLAZA



colonial plaza

a entry court
b church



neighborhood park

a park
b elementary school site

This section will discuss reserved land set aside for unstructured open space uses and known by various terms: green spaces, green belts, wedges, corridors, buffer zones, and periferal open spaces. Such open spaces are reserved for the natural propagation of the growth they contain, visual and psychological relief from built upon land, or set aside because they are unbuildable due to ecological factors. Ecological factors include major rock outcroppings, streams and ravines, major areas of dense vegetation, or wet lowlands.

Reserved open space is non-specifiable in amounts per unit of population, and yet as an abstract non-absolute quantity, this entity can help man in his environment to exist in harmony with nature or oppose it. In the final analysis, reserved natural open space will be a dominant factor in man's quest for survival in urban environments. Political or short term economic considerations must not override the decision to include natural open spaces within residential urbanizations, no matter how pressing the demands for land within a larger urban context.

Preceeding the first schematic designs for the residential development, an ecological analysis of the site should be under-taken. This analysis needs to establish two categories:

1. Land not to be built upon with impervious structures or surfaces, and set aside for the conservation of natural features, controlled by the community or city ownership

2. Land which may be subdivided and built upon without complete disruption of the local ecology.

Land-use policy within the proposed development should designate land to be aside permanently as natural open space. It's use beyond the propagation of natural growth and drainage is to provide for passive recreation activities such as walking, hiking, viewing of scenic qualities, and picnicing. It is not the developer's or sponsoring institution's choice to eliminate major open spaces which should remain to maintain the ecological balance of both the immediate and larger regional environment. The developer of a parcel has not only his area to consider but the effects of development on adjacent areas and the larger regional area, whether natural or urbanized. In countries and regions where zoning regulations are not definitive as to natural open space requirements, the developer must take the lead.

The analysis or ecological inventory of the land has to be made around these elements as a minimum effort in establishing open spaces.

Physiography - science of physical geography

1. Typography & Slope Analysis
2. Soil Types & Erosion Patterns
3. Bedrock Geology
4. Vegetation Patterns

Hydraulogy - science of motion of water cycles

1. Rain water Drainage Patterns
2. Ground water resources

Having identified those areas which are hazardous to build upon, it is possible to construct a composite plan identifying land not to be built upon. This plan forms the first and most important step in determining the physical layout of the proposed development.

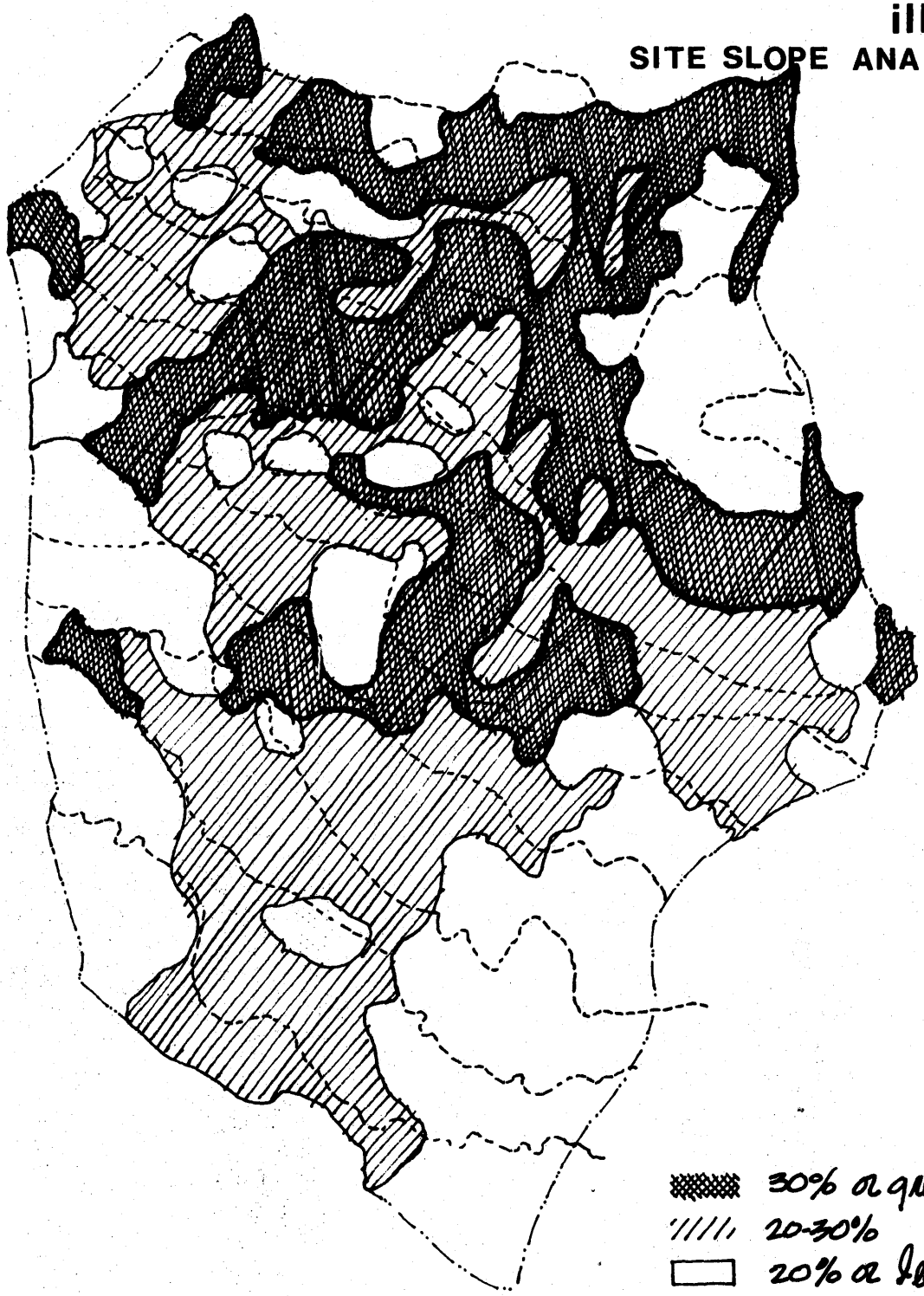
Withstanding the lack of specific detailed information or technical data on the above elements, a plan deduced from careful on-site visual observation is far better than none at all. The option to develop a parcel of land for residential urbanization is not a license to override or destroy the delicate ecological balance of the land. The balance is subtle and the disruption of this natural state is not always immediately discernable. But the indiscriminate flattening of hills, covering or diversion of water ways, removal of major rock outcroppings, removal of topsoil and removal of major growth areas, producing oxygen, means one thing; the short term real estate profits of development economics at the sacrifice of long term livable residential environments. People need to be surrounded by undisturbed natural open spaces for visual diversity, its ability to cleanse the man-made environment, and the passive recreational qualities they provide.

Finally, the preservation of natural open spaces of a city or district begins at the incremental scale of each residential environment and weaves together with other areas to form the unification of an open space structure for the entire region.

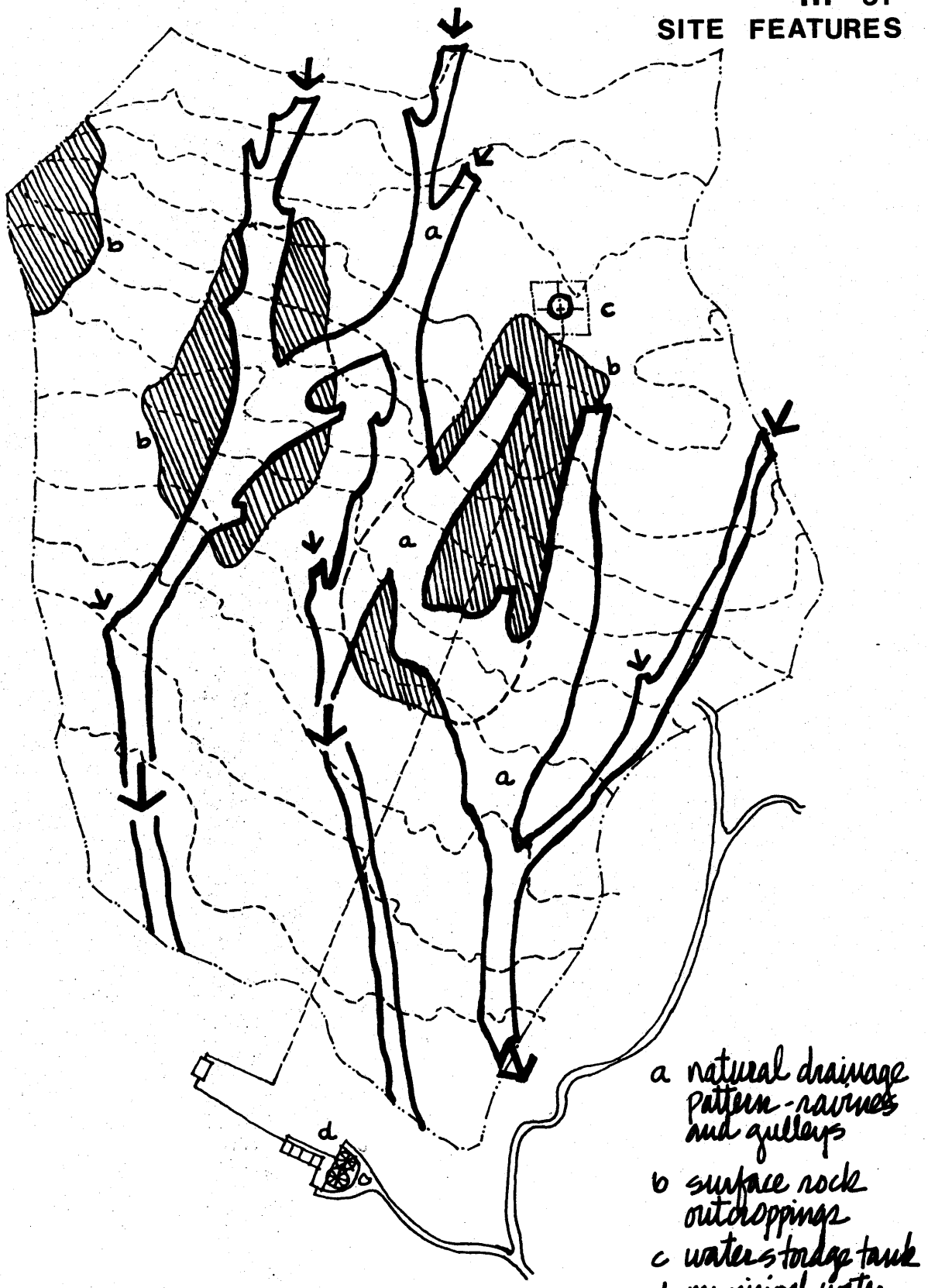
STANDARDS

Standards for reserved open spaces are similar in their deficiencies to standards for recreation open spaces. They do not specify

ill 50
SITE SLOPE ANALYSIS



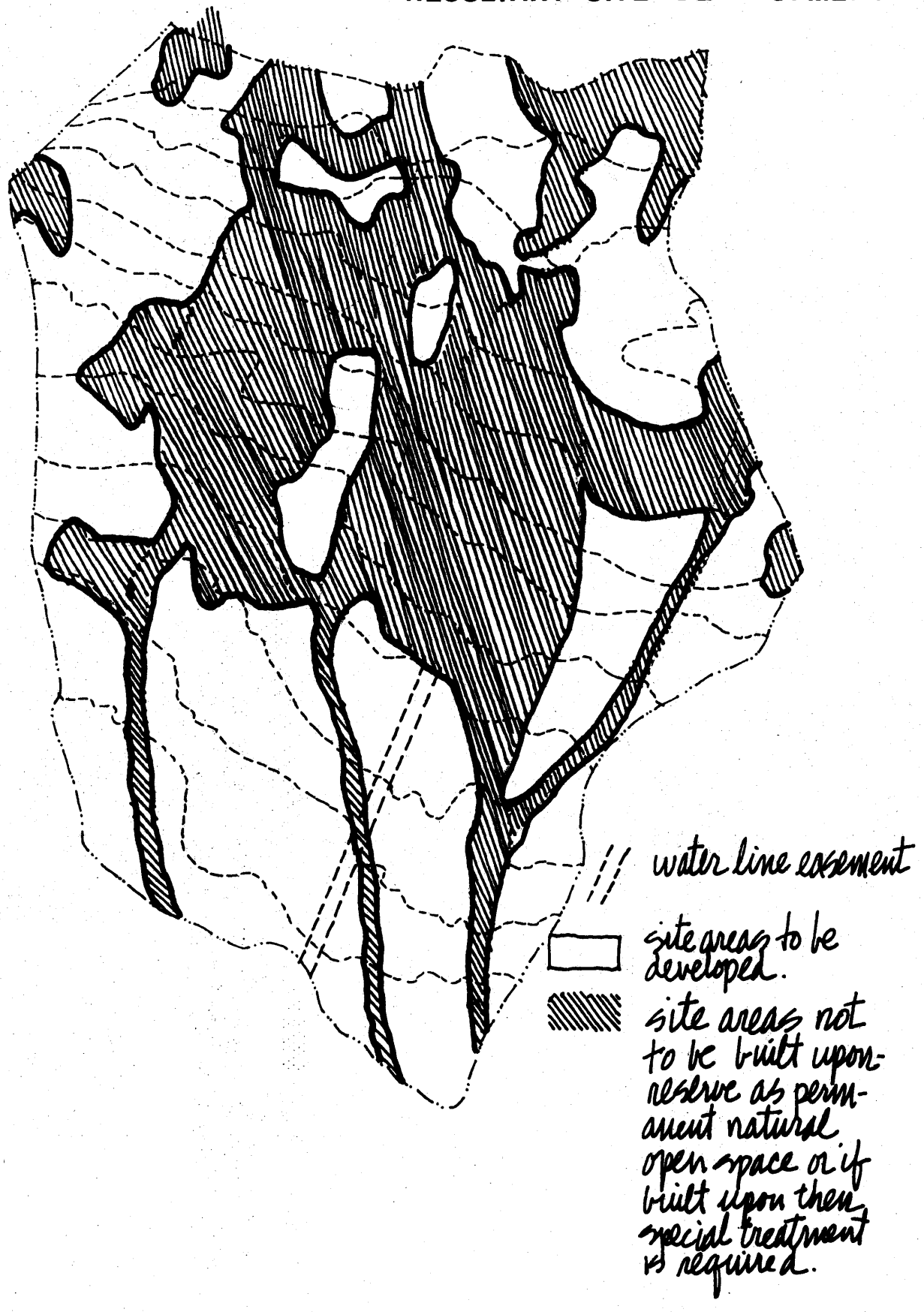
ill 51
SITE FEATURES



a natural drainage pattern - ravines and gullies
b surface rock outcroppings
c water storage tank
d municipal water plant

ill 52

RESULTANT SITE DEVELOPMENT



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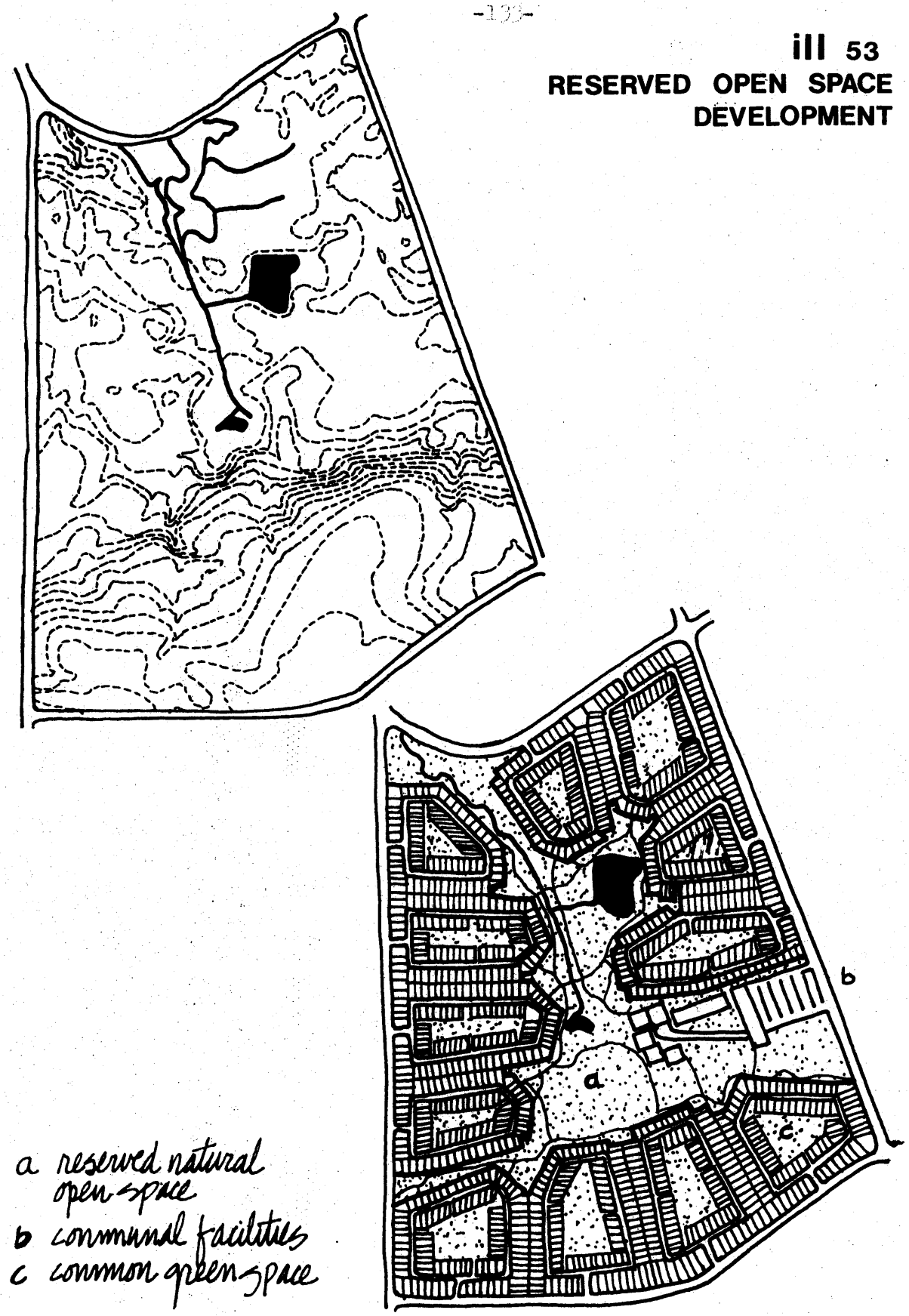
RESERVED OPEN SPACE DEVELOPMENT



a reserved natural open space
b communal facilities
c common green space

MINIMUM STANDARDS FOR PUBLIC RESERVED SPACE

FACILITY	FAMILY	HA.	M^2/F	NOTES	SOURCE
CEMENTARY	12,000	4.0	3.3		GRH
OPEN GREEN	4,000	1.0	2.5		GRH
CEMENTARY	4,000	4.0	10		GRH
CEMENTARY	1,000	1.5	15		GRH
OPEN SPACE	1,000	2.8	28		LCC
GREEN SPACE	250	1.2	48		BRPC
OPEN SPACE	250	2.8	11		GI
AVERAGE			17		

adequately the uses, distribution, or corresponding population densities for reserved land. Not including land reserved from an ecological analysis, the average of the standards compiled indicates that a minimum of 17 M^2/F be reserved for permanent natural

ill 54 open space.

NATURAL OPEN SPACE STRUCTURE

Planned open space networks may be distributed in two alternative forms:

ill 55
56

1. Continuous belts around the periphery of all of the neighborhoods or the entire district.
2. Interspersed green spaces within and between neighborhoods.

The first alternative provides for a tighter and denser aggregate of the physical environment, while the latter alternative has the effect of dispersing density and locating open spaces in closer proximity to all residents. The latter alternative also offers a better chance of combining ecologically determined open space with a more formalized structure of reserved natural open space.

VACANT AND AGRICULTURE LAND

Land within the development so designated as vacant land may exist for various reasons. It may be undesignated for specific use, abandoned or unused. In this state it is highly vulnerable to squatting, or becoming a dumping ground for refuse. Ownership may be either public or private.

Vacant land may also be designated for future use as land for additional housing, commerce or light industry, or temporary uses.

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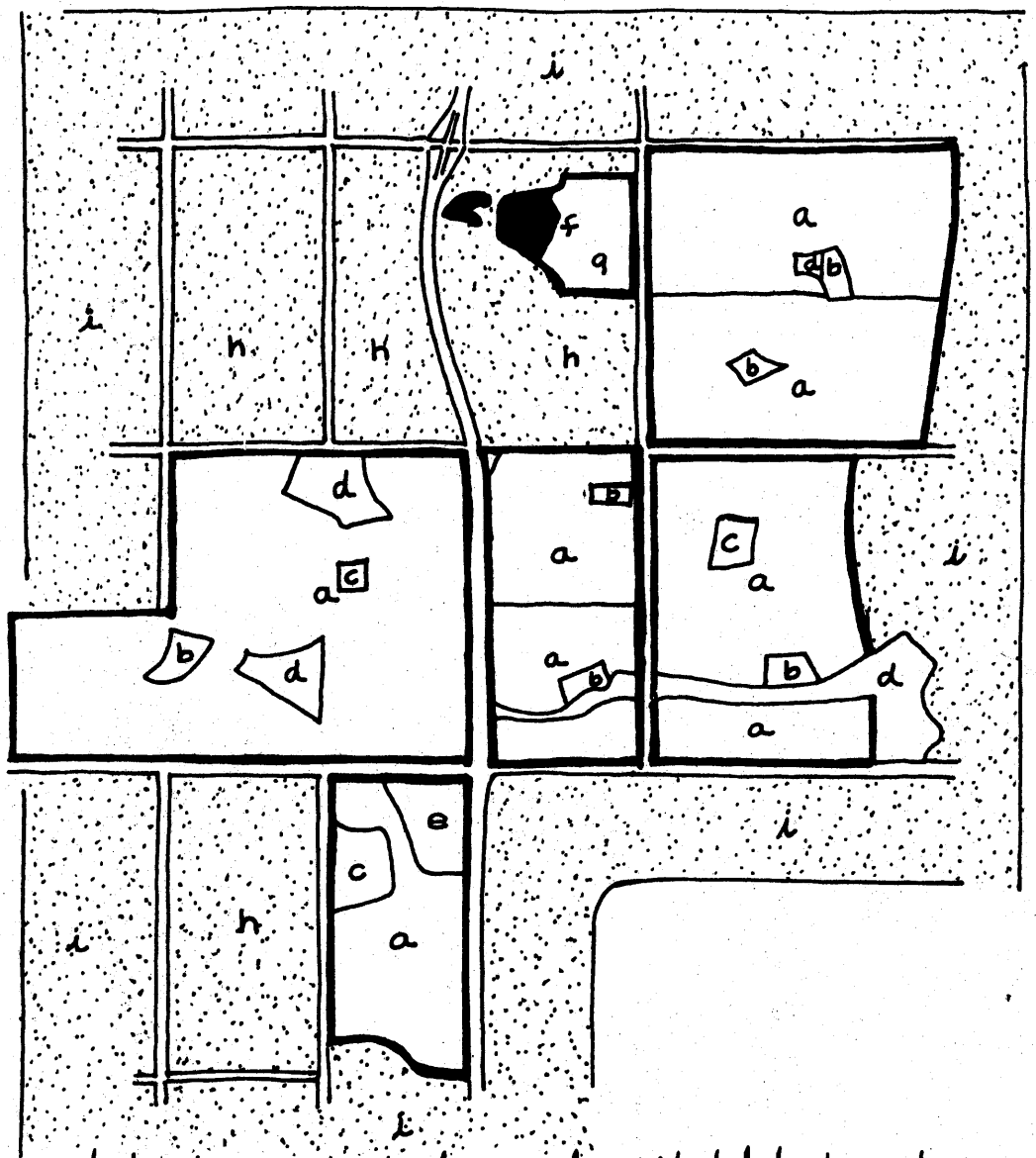
CONTINUOUS BELT OPEN SPACE



northglen, denver, colorado, large scale residential development

a single family residential neighborhood
b elementary schools
c junior and senior high schools
d recreation parks
e golf course
f lake
q garden apartments
h future residential development
i continuous open space development around the periphery - but no assurance that it will remain permanently.

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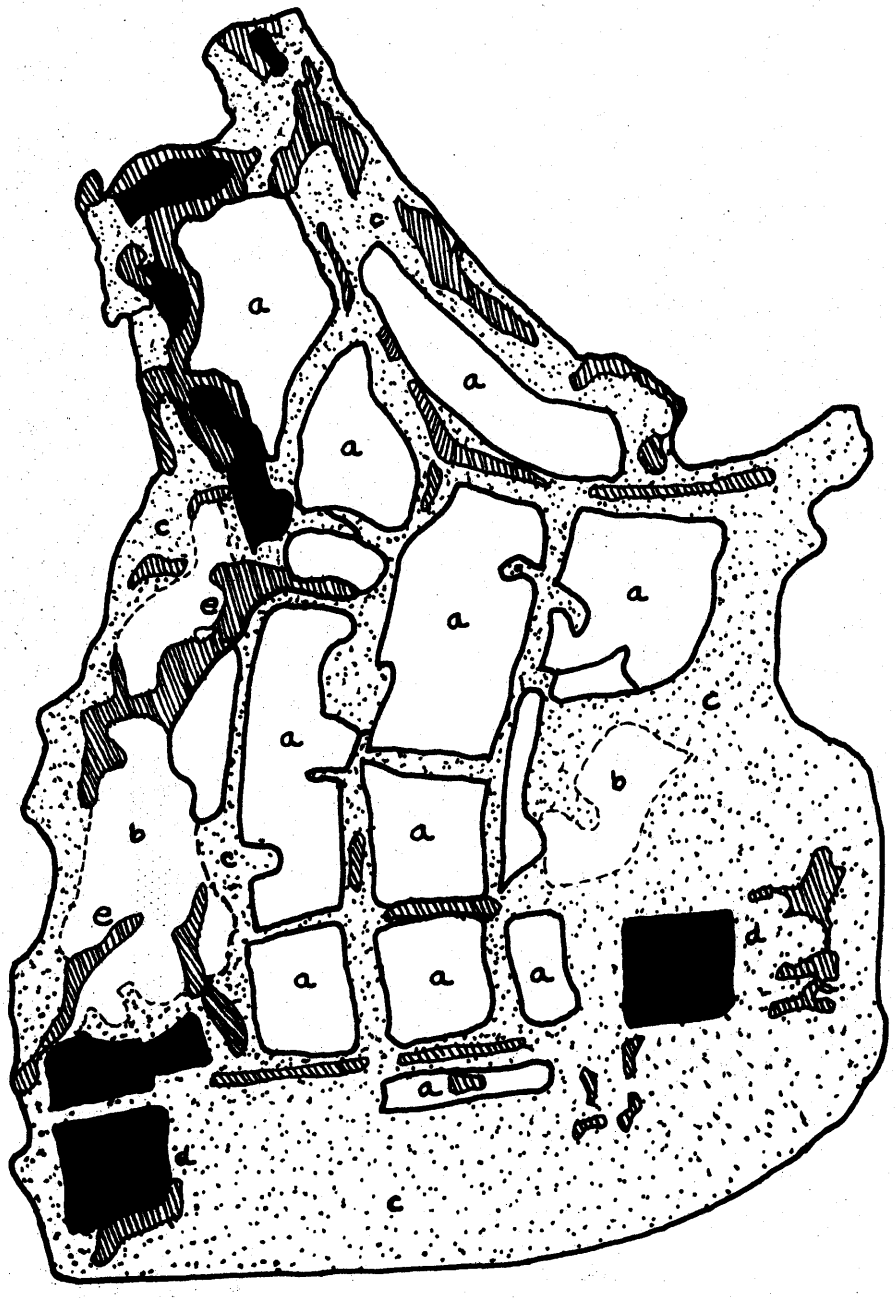
INTERSPERSED OPEN SPACE
HOOK – NEW TOWN



a neighborhoods
b playfields
c open space
d lakes
e wooded areas

These designations really mean that it is reserved land but not occupied or used initially.

In order that vacant land will not be subject to squatting, this land must initially be designated and zoning controls established by the community or municipal authority. If the projected uses of the vacant land are established and known by the residents the combined social & legal pressure of the community can limit squatting or abuse of the vacant land.

FUTURE HOUSING, COMMERCE, OR INDUSTRIAL DEMANDS

Because initial population densities within the development are generally too low to support extensive commercial outlets, or major amounts of light industry, it is necessary to reserve land for the future. Increased and saturated densities will demand the expansion of commerce and industry onto the reserved vacant land.

In a similar way, not all of the proposed housing may be developed initially. The need to test the marketability of the dwellings and lot design, financing, and other physical constraints, may necessitate reserving vacant land for incremental expansion.

Land within the development which is used for agricultural purposes in either small urban farmer parcels or large tracts needs to be subdivided as such and future subdividion of this land controlled by zoning regulations. One of the major problems with existing urban farmer settlements, is the continual uncontrolled subdivision of the initial parcel into smaller and denser parcels. The subdividing by itself is not the problem but rather the burden the

increased densities and irregular method of subdivision places on the community to provide additional services. Unplanned for infrastructure (utilities), streets, educational and communal facilities are costly and difficult to provide once the initial developer has completed his task.

Therefore, either the development is initially planned to absorb and service the probable subdvision of agriculture land, or rigidly enforced zoning controls limit private subdivision.

COMMUNAL FACILITIES

Common use community facilities in low-income residential urbanizations center around three primary needs.

Health and Welfare Programs

Social and Political Organizations

Refuse Removal

This section is concerned with the physical requirements of the organized or formal aspects of the above needs on a semi or permanent basis.

Because nearly always there are very limited funds to invest in communal facilities, whether privately or publically financed, it is recommended that various communal facilities share common space on a community-wide basis with the exception of refuse removal. Under controlled security and scheduling, communal facilities may use portions of the elementary or high school facilities.

Besides the advantage of cost in sharing facilities, another advantage manifests itself in the unpredictability of needs during the planning and initial settlement of the development. For this reason, the site and buildings need to be flexible in use so that they can adapt to expansion and changing use demands over time.

With the concept of providing one or more (only in exceptionally large communities) multi-use buildings these components might be included within the space.

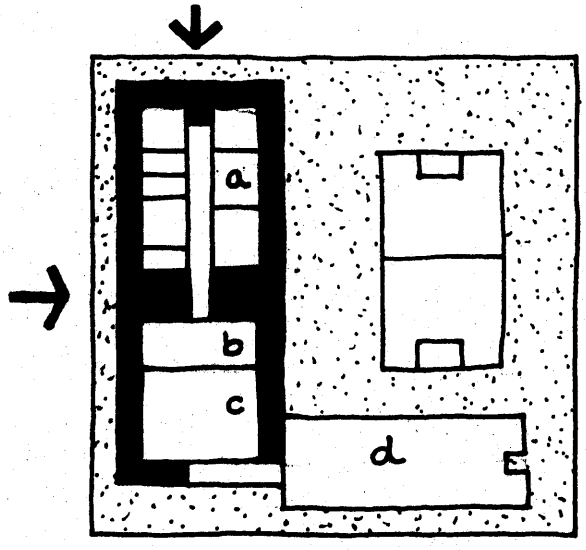
ill 57

1. Health program - general clinic staffed by full-time nurses, visiting doctors and dentists. Beyond the general medical

ill 57
COMMUNAL FACILITIES

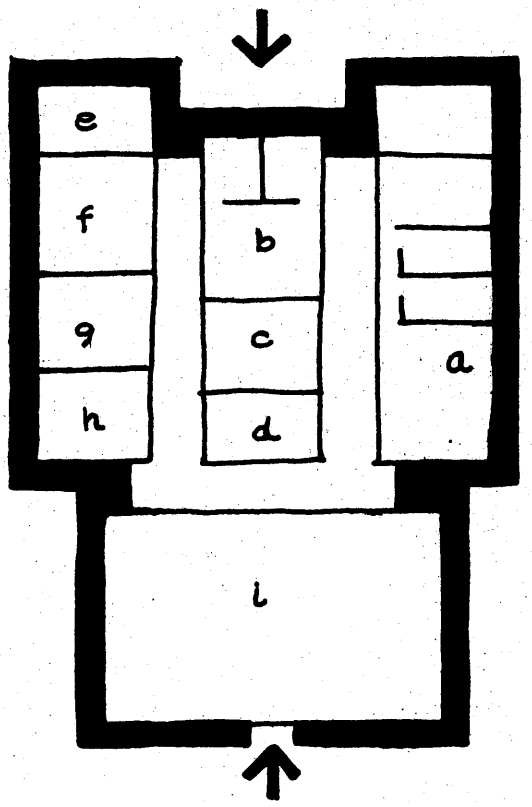
communal facility in conjunction with elementary school

a health clinic and other facilities
b kitchen and storage shared with school
c gymnasium, auditorium, cafeteria, multi-purpose room
d school and classrooms



comprehensive facility on independent site

a health clinic
b security guard quarters
c storage
d kitchen
e junta
f coops (drug, food, savings)
g police / patrol
h public toilets
i multi-purpose room - meetings, workshops



program, the clinic may conduct family planning, birth control, nutrition, home management and maintenance programs.

2. Administrative Services - police, civil patrol guards, junta and political organizations, community action groups, and living quarters for a security guard
3. Community Meeting and Social Activities - pre-kindergarten day care programs, cooperative ventures (savings, food, drugs, clothing), movies, adult education programs, agricultural extension services
4. Religious Program - generally though this component is provided on a separate non-shared basis, but initially services might be held in the facility
5. Resident Reception Center - communal washing and bathing facilities. In planned developments which provide infrastructure to individual lots, this component may not be necessary.

Withstanding the different political and social organization from country to country, the combining of all or part of these components under one roof may not be possible. Certainly, though, these components which are community sponsored and operated (coops, community action programs) can and should share facilities. Depending on the sponsorship and extensiveness of the health program it might not be included in the facility. Its inclusion, however, will help to intensify the use of the facility and extend the potential for non-clinic or social contact among the residents.

LOCATION

The communal facility should be located central to the population distribution. It might be located adjacent to the elementary

school site or one of the major open space facilities such as the neighborhood playground, park, or community plaza. Access should be pedestrian oriented with provision for limited service vehicle access.

STANDARDS - HEALTH, SOCIAL, WELFARE FACILITY

Because much of the uses of community facilities can not be determined or anticipated during the planning stages, absolute quantitative standards are not applicable. However, a few sources suggest the following guidelines.

FACILITY	NEIGHBORHOOD POPULATION IN FAMILIES					
	275	550	825	1,100	1,375	5,000
General[1]	1500M^2	3000M^2	4800M^2	6000M^2	7500M^2	-
Community Hall[2]	-	-	-	1 Fac.	-	-
Health Center[3]	-	-	-	-	-	1 Facility

ill 58

1. Chiari, Joseph D., Koppelman, Lee. PLANNING DESIGN CRITERIA, Reinhold, New York, 1969, p. 189., General includes allowance for indoor social and cultural facilities or separate health center. These apply equally for single and multi-family developments.
2. London County Council, PLANNING OF A NEW TOWN - HOOK, LCC, 1966
3. United Nations, INTERNATIONAL SURVEY OF PROGRAMMES OF SOCIAL DEVELOPMENT, New York, 1959, p. 12., Center to be staffed by auxiliary health workers with supervision of physicians from larger health centers.

HEALTH CENTERS [1]

BARRIO	EXISTING NUMBER	EXISTING AND PROJECTED DWELLING UNITS
Cuidad Kennedy	1 [2]	10,223
La Magdalena	1	1,279
Los Arenales	1	802
La Joya	1	871
Fortaleza	1	1,651
El Guabal	1 [2]	2,278
U. Floresta	1	4,000
Blas de Lezo	1	3,344
Guaimarel	1	1,194
J. Atalaya	2	2,528
Danubio	1	1,070
El Jordan	1	2,375
La Granja	1	5,602
Cuba	1	1,163
Total	15	38,374
Average	1/2500 dwelling units	

Walking distances, because of infrequent or sporatic visits can obviously be much greater than those used for elementary schools (800 meters) or open space facilities (400 to 800 meters).

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1 ICT, Bogota, Colombia, INFORME, 1965, p. 113, 117.

2 ICT considers these health clinic facilities to be acceptable, while all others are providing deficient services.

SURVEY OF COMMUNITY FACILITIES[1]

BARRIO	FAMILIES	HEALTH CENTER	CHURCH	SOCIAL CENTER	POLICE	COOPS	POST OFFICE	LIBRARY	ADMINISTRATION OFFICE
Cuidad Kennedy	10,022	1	6	4	1	2	1	2	1
Fortaleza	1,651	1	1	1	-	1	-	-	-
El Guabal	2,278	1	1	-	-	1	-	-	-
La Floresta	4,000	1	1	-	-	1	-	-	-
El Pedregal	1,348	-	1	1	-	-	-	-	-
Alfonso Lopez	715	-	1	-	-	-	-	-	-
Las Palmas and La Magdalena	2,365	1	-	1	-	-	-	-	-
Los Arenales	802	1	1	1	1	-	1	-	-
Cuba	1,163	1	1	2	1	1	-	1	-

[1] I.C.T., Bogota Colombia, INFORME, 1965

STANDARDS - COMMUNAL BATHING AND WASHING

When utilities (water, sewer, and electricity) are not provided in the development to each individual lot then communal facilities must be provided. These standards may serve as a guideline for minimal facilities.[1]

FACILITY	FAMILIES	MINIMUM AREA	M^2/F	REQUIRED NO.
Site for Communal Sanitary and Washing	100	500 M^2	5	-
Water Closets	100	-	-	12
Pit or Bucket Privy	100	-	-	16
Shower Stalls	100	-	-	8
Laundry Tubs	100	-	-	8

Maximum walking distance to bathing and washing facilities shall not be over 150 meters. In addition when pit or bucket privies are provided they shall meet these specifications.

Pit Privies - minimum 12 meters distance from any well, stream, or drinking water source
- minimum of 4 meters from any dwelling or kitchen
- enclosure shall be a minimum of .90 meters X 1.5 meters with inward opening door
- pit shall be approximately 1 meter wide by 3 meters deep and its sides protected from cave-ins or erosion if soil conditions are unstable.

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1 AID, PROPOSED MINIMUM STANDARDS FOR PERMANENT LOW COST HOUSING, Dept. of H.U.D.A.I.D., Wash., 1966.

STANDARDS - REFUSE REMOVAL

Whenever possible collection of trash and garbage should be made from individual lots by either a municipal community, or private service. When this is not possible then designated trash collection centers must be provided. These areas should be on a block basis or 1 collection point per 25 families and not more than 75 meters from the most remote dwelling.[1] They should be screened from view and designed to insure secure closure to prevent the scattering of trash and entrance by rodents.

[1] Ibid, AID, p. 20.

COMMERCE, BUSINESS AND INDUSTRY

Commercial activity within planned residential urbanizations in Latin America is of three discernable types:

1. Scattered stores and artisan shops throughout the neighborhood.
2. Ribbon or strip commercial, business, and light industry development along major circulation routes.
3. Shopping Centers at a regional scale or downtown commercial areas which may serve the residential development.

All are generated by private capital and are generally under private ownership. The scattered and ribbon developments are the ones of primary concern to the planning of the residential community.

SCATTERED COMMERCE

This very small scale scattered commercial activity is usually the first form of commerce to spontaneously develop within the community. It is generally located within the dwelling, on the street level, owned and operated by the dwelling occupant, and non-predictable in the site planning process. Because it is often an essential source of primary or supplemental income for the family, its existence should not be threatened by zoning restrictions which will not allow this activity to occur throughout the neighborhood.

The trade areas for these small stores and artisan shops are usually on a block basis, and rely on pedestrian traffic. Servicing

is not a problem due to the small volume of goods handles by an individual outlet.

The kinds of activities which can be classified in these categories are:

small cafes and coffee houses

pastry and bakery shops

small grocery shops

barber and beauty shops

craft shops, wood, metal, masonry

flower shops

small clothing, shoe shops

Predominant locations where these shops will develop are on the corners of blocks, and in mid-block locations along heavily frequented pedestrian routes. They will also occur at nodes of transportation stops, social and educational activity.

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Surveys of some existing planned and un-planned residential urbanizations in Latin America provide an indication of the degree of scattered commercial activity which takes place.

	Percent Dwellings Having Commercial or Artisan Shops
1. Cueves, Lima, Peru	
1962 Survey[1]	8%
1969 Survey[2*]	7%

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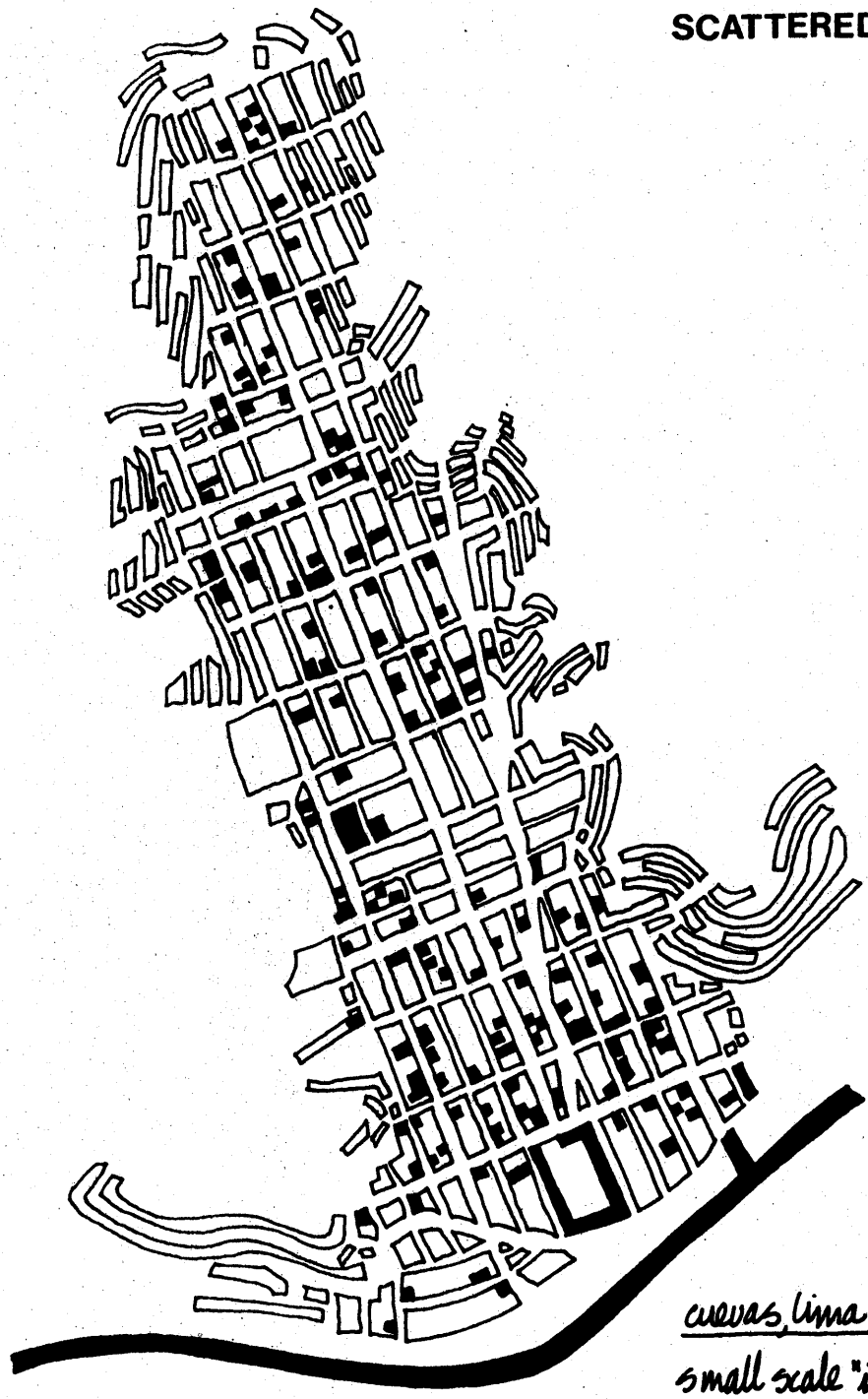
[1] Caminos, Steffian, Turner, URBAN DWELLING ENVIRONMENTS, M.I.T. Press, Cambridge, 1969, p. 134.

* On next page

ill 59
SCATTERED COMMERCE



cuevas, lima, peru

small scale "in dwelling" commerce.
developes in random pattern but tends to consolidate along major circulation routes

	Percent Dwellings Having Commercial or Artesan Shops
2. Cuidad Kennedy[3]	
1965 Survey	20%
3. Average of 22 ICT Barrios in Colombia[3]	9%

RIBBON COMMERCE

This form of commercial activity is of a more permanent nature. It is usually developed later than scattered commercial activity but consolidates as a strip along major through circulation routes. Requisite to location is the need to plan for easy vehicular and pedestrian access, servicing, and parking.

As in the European tradition, the street level store with the owners living behind or above, may start with little investment. But because of location and a trade area which is generally community wide or regional, the store or shop may expand into a long term viable entity.

Since the growth and success of these ventures relies on a larger than neighborhood trade area, location and lot size is of primary importance. Lots fronting on the major collector, and community access roads should be substantially larger than most of the residential lots to allow for growth and expansion. One alternative

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2. Parker, G.R., OBSERVATIONS ON THE LOW INCOME HOUSING SITUATION, PUBLIC AND PRIVATE, IN PERU, M.I.T.,CINVA, 1969, p. 11.

3 Instituto De Credito Territorial, INFORME, 1965, Bogota, Colombia, 1965, p. 113.

in planning the initial subdivision layout would be to reserve strips along these major circulation paths. Then as the community grows, sub-divide and sell commercial parcels as demand dictates. This also has the advantage of using this land for other uses if the demand for commerce does not exist. Multi-family housing, light industry, or open space might be alternative land uses.

ill 60

It should be recognized in locating the ribbon commerce along major circulation, that these areas will potentially have high land values relative to the main residential areas. If the commercial and light industry areas can be owned cooperatively by the community, and leased to the occupant, it may offer substantial long term income which can be used for the benefit of the community.

Some of the forms of commerce, business, and light industry which may develop along the ribbons are:[1]

1. Food and Food Service
   - Supermarkets
   - Groceries
   - Restaurants
   - Open Markets
2. General Merchandise
   - Variety Store
   - Dry Goods
3. Clothing and Shoe
4. Other Retail

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[1] Urban Land Institute, COMMUNITY BUILDERS HANDBOOK, Urban Land Institute, Wash, D.C., p. 325

Hardware

Drugstore

Florist

Radio. TV, Records

Beverages

5. Services

Beauty, Barber Shops

Laundries, Cleaners

Banks, Savings Associations

Automobile Repair

6. Entertainment

Night Clubs

Cinemas

7. Offices

Medical, Dental

General Business

Since it is not possible to foresee the amount of ribbon commercial space which a community will ultimately support, few standards have been developed which can be used as a planning guideline with any reliability.

Cuidad Kennedy in Bogota, Colombia, utilized the following standards,[1] for a support population of 10,000 dwellings (approx. 80,000 persons).

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[1] Instituto de Credito Territorial, INFORME, 1965, I.C.T., Bogota, Colombia, 1965, p. 68.

1. local shop per 115 dwellings (located in "centro-civico" of each supermanzana)
2. 1 supermarket per 5,000 dwellings
3. 1 cinema per 2,5000 dwellings (800 seat capacity)
4. 1 bank, savings institution per 5,000 dwellings
5. 1 food, drug coop per 5,000 dwellings
6. 1 covered market per 10,000 dwellings

A minimal survey of five standards indicates the following space requirements, but does not specify the nature of commercial outlets or location.

SUPPORT POPULATION	COMMERCIAL STANDARDS HA/1000 PEOPLE				
	1 USA	2 CINVA	3 APHA	4 GERMAN	5 SAN JUAN
1000		0.017	0.320		
2000	0.22	0.017	0.240		
3000			0.292		0.227
4000			0.260	0.438	
5000	0.32	0.017	0.240		
6000					
7000					0.210
8000					0.790
16000				0.332	
25000					0.255 0.700
30000		0.017			
50000				0.332	0.500 0.595

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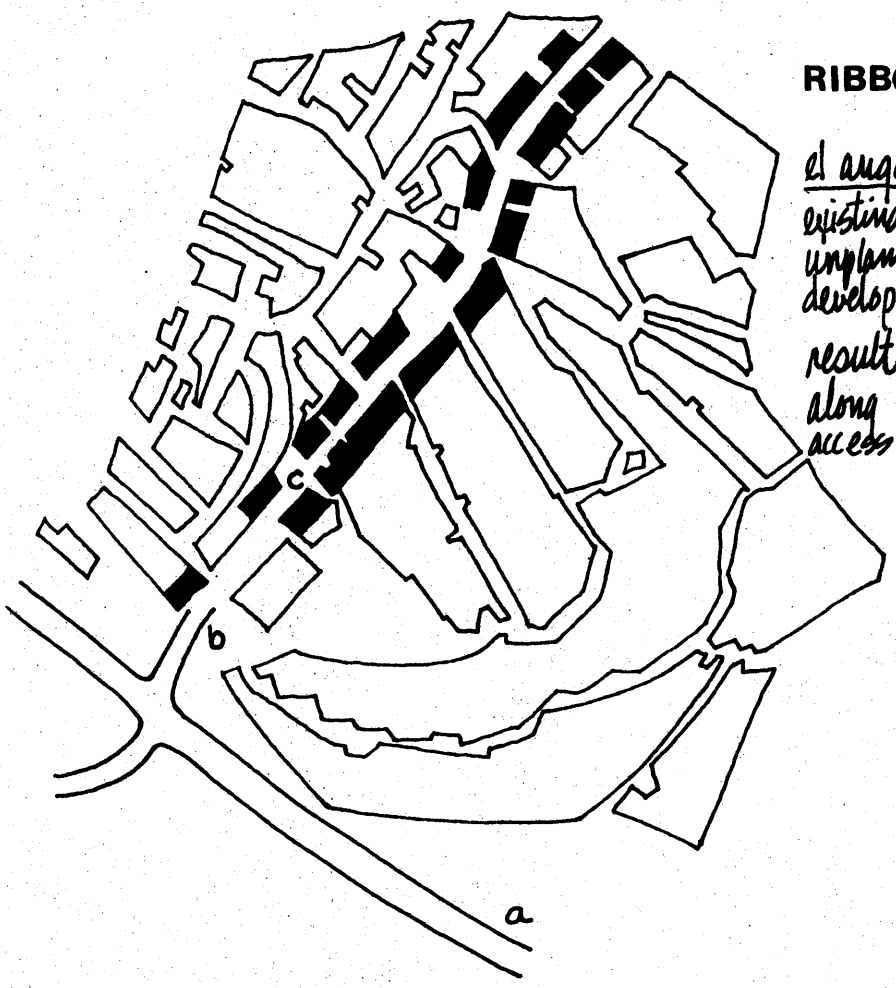
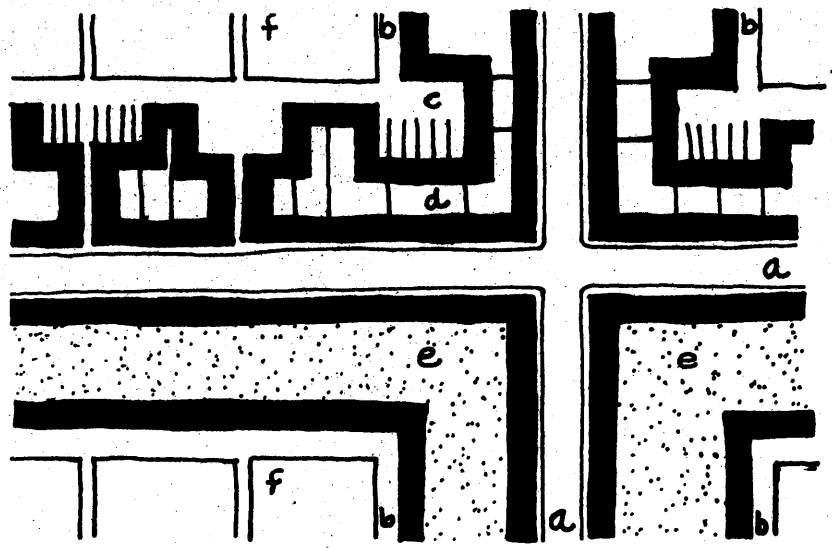
RIBBON COMMERCE



el augostino flat, lima, peru
existing ribbon commerce
unplanned spontaneous development.
results from consolidation along major inter-community access route.



example of ribbon commerce alternative

a inter-community access or collector street
b service street
c parking for commerce and business outlets
d. commercial lots subdivided as multiples of residential lots
e. reserved land initially for future commerce & residential lots

SHOPPING CENTERS

Shopping centers are a relatively recent form of commercial activity in Latin America. As with the United States shopping center, they are usually located on large tracts of urban peripheral land, and serve a regional trade area. They depend on vehicular access with large areas set aside for parking. Shopping centers as classified by the Urban Land Institute, relate to different scales, and types of tenant classifications:

Neighborhood Center (supermarket-major tenant- 5,000 to 40,000 population) 2.5 KM service radius

Community Center (junior department store - major tenant - 40,000 to 150,000 support population)

Regional Center (large department store - major tenant - 150,000 + support population)

Unless, such a shopping center is adjacent to the urbanization site or unless the development is extremely large (i.e. Cuidad Kennedy - 250,000 people) there is little relationship of the shopping center concept to the planning of the urbanization.

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1 Chiari, Joseph De, Hoppleman, Lee, PLANNING DESIGN CRITERIA, Reinhold, New York, 1969, p. 231, 232. (neighborhood shopping centers)

2 O.A.S., Centro Interamericano de Vivienda y Planeamiento, NORMAS MINIMAS DE URBANIZACION, Bogota, 1968.

3 Ibid, Chiari, p. 191, AMERICAN PUBLIC HEALTH ASSOCIATION REPRODUCTION

4 Goderitz, Rainer and Hoffman, DIE GEGLIEDERTE UND AUF GELOCKERTE STADT, 1957.

5 Puerto Rico Planning Board, REGIONAL PLAN SAN JUAN METROPOLITAN AREA, San Juan, 1956.

CONVERSION TABLES

COMMON CONVERSIONS

1 Hectare = 2.5 Acres

1.6 Kilometers = 1 Mile

1 Square Meter = 10.9 Square Feet

1 Meter = 3.3 Feet

30 Centimeters = 1 Foot

ACRES	HECTARES
25	10
50	20
75	30
100	40
150	60
200	80

ACRES	HECTARES
10	4
20	8
30	12
40	16
60	24
80	32

FEET	METERS
33	10
66	20
98	30
131	40
164	50
197	60
230	70
263	80
295	90

FEET	METERS
10	3
20	6
30	9
40	12
50	15
60	18
70	21
80	24
90	27

MILES	KILOMETERS
6	10
12	20
19	30
25	40
31	50
37	60
44	70
50	80
56	90
60	100

MILES	KILOMETERS
10	16
20	32
30	48
40	64
50	80
60	97
70	113
80	129
90	145
100	160

SQ. FEET	SQ. METERS
1076	100
2153	200
3229	300
4306	400
5381	500
6458	600
7534	700
8611	800
9687	900

SQ. FEET	SQ. METERS
100	9
200	19
300	28
400	37
500	46
600	56
700	65
800	74
900	84

PERSONS/ACRE	PERSONS/HECTARE
4	10
8	20
12	30
16	40

PERSONS/ACRE	PERSONS/HECTARE
40	100
80	200
120	300
160	400

PERSONS/ACRE	PERSONS/HECTARE	PERSONS/ACRE	PERSONS/HECTARE
20	50	200	500
24	60	240	600
28	70	280	700
32	80	360	900
36	90	400	1000

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