PLANNING CONSIDERATIONS FOR SITE SELECTION OF LOW INCOME SETTLEMENT PROJECTS

by

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ABSTRACT

Of the issues involved in the development of low income settlement projects, important consideration must be given to the selection of the site. This is because it affects the affordability of the development for the targeted income group along with the ability to satisfy their needs. This work aims to address the criteria that planners should use and the current "state of the art" for site selection, by investigating its key elements of concern, existing methods and tools for evaluation; and the current involvement within institutions. These aspects are then brought together in a case study illustrating the points indicated above, and that 1) it is necessary to determine priorities of importance that many times involve trade-offs of criteria; 2) there is a process involved in selection of sites; and 3) other political concerns are just as, or more, influencial in site selection than existing technical criteria.

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PREFACE

This study intends to describe and explain planning criteria, methodologies and process of site selection for low income settlement projects. It is applicable to people, professionals or otherwise, concerned with development of housing for the poor particularly in developing countries but it is appropriate to other localities as well.

The specific elements, methodologies, discussions, and data for the study are derived principally from individual research of information documented in relevant literature, and conversations with persons knowledgeable on the subject. The case study of Cairo, Egypt, was chosen because of the availability of studies on 1) the existing urban features; 2) proposed growth patterns and policies; and 3) site selection for this urban area; and persons knowledgeable about the dynamics of its land market, and capabilities of its political and institutional frameworks.

The attitudes and points of reference for this study are reflected in the background and experience of the author. This includes four years, from 1974 to 1978, connected with the Vice Ministry of Urban Planning in Managua, Nicaragua, (Central America), where I was employed as an Architect/Planner during the era of General A. Somoza. Also influencial was the author's participation in the Urban Settlement Design Program (U.S.D.P.) at M.I.T., from

1978 to 1980. This program emphasized the evaluation of existing urban dwelling environments, i.e., traditional, public and private, and the design and evaluation of alternative solutions, particularly site and sevice projects.

The author gratefully acknowledges the support, guidance, and advice of Professor Lisa Peattie, whose direction has been invaluable in the preparation of this work. I am also indebted to Reinhard Goethert and Tunney Lee for their assistance, constructive criticism and suggestions; and to Mauricio Silva for sharing his insite of institutional involvement and concerns in site selection with the author.

Finally, I would like to thank my wife, Maria, --who with her constant interest and support, was instrumental in my finishing this work-- and my children, Carlos, Alan and Brian, for their patience and their love.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

In developing countries, the continued migration of poor rural families to the urban centers in search of employment creates problems in the availability of low income housing. A particularly acute problem is that of affordability. In part, this is a question of housing standards, in part a result of high land and development costs. As a result, low income squatters or illegal developments are becoming permanent features of the urban centers in order to be close to employment sources and benefit from central city infrastructure and services. To deal with this problem governments are now developing alternative low income settlement projects. For these projects to be acceptable and affordable to the low income, however, the government must consider numerous development issues in project formulation and implementation including acceptable financial terms per household, project funding, project design; cost recovery, site selection, etc.

Of the issues involved in the development of low income settlement projects, important consideration must be given to the selection of the site. This is because it affects the affordability of the development for the targeted income group along with the ability to satisfy their needs. Presently, the tendency has been to utilize the cheapest possible land which is often of poor quality and located well out of town due to the fact that there is little

easily developable land available for low cost settlement projects in the urban center. That which is, is generally economically and/or politically suited for other land uses which although cheaper to develop is too costly to purchase and be affordable to the urban poor. However, the peripheral locations with poor physical standards (soil, topography, etc.) can increase development costs of land preparation and infrastructure installation (depending on costs of off-site infrastructure) which when combined with raw land cost may still jeopardize the affordability for the desired urban poor population. Apart from affordability, another concern is that these sites may not provide for the needs of the people involved. For instance, it is necessary that the site be accessible to transportation, major employment and economic sources, community services and infrastructure, and be capable of long term development and expansion opportunity. Experience has shown that families will not stay if the site is not acceptable to the people served.

These concerns and others influence the selection of the site for low income housing projects and have an effect on its success. This thesis aims to address the criteria that planners should use for the selection of sites that will allow the project to be affordable while also providing for the needs of the targeted low income group. It will investigate the key elements of concern in site selection, i.e., physical, social, economical, and political, and will

also look at the current "state of the art" of site selection for low income settlement projects. It will particularly review existing methods of evaluation; a current tool being utilized, the Bertaud Model, relating its advantages and disadvantages; and lastly, the existing involvement in site selection of appropriate institutions. To support this, it will also utilize case studies from Cairo, Egypt, in which alternative sites will be compared. In this way, the site selection process and a real evaluation of locational criteria will be illustrated. Based on this discussion and case studies, observations and conclusions will be made in relation to the key element of concern in site selection.

In closing, this work focuses on the physical and technical aspects of site selection as opposed to the political. Though potentially more influencial (to the extent that unreasonable sites do get developed) political aspects are difficult to generalize, changing from locality to locality, and from government to government. Therefore, they would be better discussed only within a particular context.

CHAPTER I.

PLANNING CRITERIA FOR SITE SELECTION

Site selection is a complex process and underestimating its importance risks the success of a project. To assure that the sites for urban settlement projects will be adequate for the targeted low income groups, basic considerations for selection must be analyzed in regard to the site itself and the area where the settlement is to be located. These key elements can be classified under headings of pertinent physical characteristics of the site; necessary socio-economic criteria relating to the needs of the residents which may be enhanced by the site location area; economic realities of the site location and the planning policies which govern the project. These factors must be evaluated in order to produce a livable environment that satisfies the needs of the residents, is affordable to them, while still respecting the character of the land. Common cases of site selection include a) given an intended use, find suitable sites, or b) given a site, determine options for its use/development.

A. PHYSICAL CHARACTERISTICS

The physical characteristics which influence its selection for urban settlements are its size, shape, soil conditions, and topography of a given site. They reflect the acceptability/suitability of the site for development by determining the constraints of physical planning, and the economic and practical feasilibity of development.

1. Size

The size of the site is its physical magnitude defined by the total area in hectares or square meters within its boundaries and the unusable areas. Its influence to site location pertains to its impact on the suitability for development. Given a site with a known size , for instance, it is possible to determine options for populations, areas for land utilization and number of units to see if the site can support established project criteria, i.e., population, densities, number of dwelling units, etc. and be a settlement of sufficient scale that is worthwhile to justify administration and start up costs and cost recovery. It should be large enough to lessen illegal invasion of land (squatter, slums) and reduce pressure for increasing land values from scarcity and speculation. On the other hand, if given a proposed population, acceptable sizes of sites can be determined by finding options of densities, number of units, and areas for land utilization.

These size requirements can then be compared to alternative site locations.

In addition, the size of a site influences the type of community or urbanization which will develop along with the future expansion potential of the initial site. For instance, generally, projects with sizes of 12 hectares or less can be considered small and are not able to or need to include all community elements. Those with greater sizes can and must. Those with sizes greater than 30 hectares are large projects and begin to include other elements not related to basic community life and activities; secondary schools, large playgrounds, parks, etc. (1) Because of this, for a small site, a community is more likely to develop as a part of an adjacent urbanization. They are generally infill sites not capable of expansion. Larger sites, however, can produce a single self-contained large community or numerous subcommunities or neighborhoods since, in general, they have a larger variety of services and population in terms of income, ages, household compositions, education, skills, cultures, aspirations, ambitions, etc. These large urban sites are generally those located in the periphery and maybe capable of expansion as demand increases. Another important determinant of project size is that is should be within a range conditioned by the local characteristics of culture, income, topography, climate, etc.

In addition, a multitude of small sites will be more costly to develop and administer than a few larger sites.

2. Shape

The shape of the site is its surface form or configuration defined by its boundaries. Its impact is reflected in the suitability or usability for development of a site in terms of land utilization, lot and street layout. Generally, compact shapes allow more efficient development, because they provide more uniform symetric conditions for land utilization, subdivision and circulation; irregular, dispersed shapes, however, result in unusable areas and/or inefficient layouts.(2)

3. Soil Conditions

An analysis of soil conditions assists in making decisions about alternatives for settlement locations as well as land utilization within a project. This is through its data which identifies: 1) the location of streams and valleys for drainage purposes; 2) excessive slopes where soils are susceptible to erosion; 3) impervious areas; 4) flood plains; (3) and 5) the nature and type of vegetation, infrastructure and building types, i.e., roadways, foundations, sewage systems, that can be sustained, (4) while also assisting in guiding sound subdivision layouts and designs.

The soil conditions are analyzed through survey ranging from simple examinations of surface soils to elaborate

subsurface boring. The data is recorded on soil maps and reports which show the location of the different soil types and capabilities of the soils for various purposes.

Soil survey data is particularly influencial in predicting potential problems that maybe encountered at a site. Unfavorable soils, for instance, may cause difficulties resulting in, 1) the structural instability of buildings from soils with shallow depth of bedrocks, poor bearing capacity, or high shrink-swell potential; 2) the failure of roads and highways in terms of cracking, potholing, settling or heaving from poor bearing capacity soils; 3) the corrosion of pipes; 4) the failure of septic systems (because of soils with poor effluent absorption); 5) pollution from rubbish being buried in unstable soils; and 6) flooding because of soils that have high water tables or allow excessive surface runoff, etc. (5) Oversite of poor soil conditions will cause extra development and maintenance costs.

Structurally, soils consist of particles of various types differing in size, shape, stability, and degree of adhesiveness to one another. This gives soils properties that distinguish one from another and makes differences in the soils potentials and limitations. Generally, gravel soils with particles ranging from 2mm and greater in diameter are the most desirable for development. This is followed by sand soils with particles ranging from 2mm to

0.06mm in diameter, silt soils with particles ranging from 0.06mm to 0.002mm in diameter.(6) A last type is organic soils, composed mostly of plant materials, which is very poor to unsuitable for development.

Because of these characteristics, the kinds of soils and their locations do make a difference for development potential and costs incurred. An awareness of soil conditions and the development problem they create can prevent these extra development and maintenance costs from arising by either assisting in identifying special design precautions necessary to deal with the specific soil problems of the site or indicating the necessity for an alternative site if soil conditions cannot be improved or improvements are not economically feasible. Generally, the soils must have acceptable characteristics for the sub-base of streets, foundations of buildings, sewage disposal as well as drainage.

4. Topography

Topography is the configuration of the land surface including the relief and position of its natural and man-made features. Its primary importance to site selection is judging the economic feasibility and development potentials and limitations of the site.

The most important elements of reference to judge the economic feasibility of a site are the aspects of terracing, especially the amounts of cut and fill of land

and retaining walls necessary to develop lots, streets, public and semipublic areas, and to provide the basic services of infrastructure. This is significant since the greater the amounts of cut and fill (earthmovement) and retaining walls, the greater the development costs. This earthmovement is reflected in the topography (slope) of the site since the smaller the percentage of slope, the less the cut and fill and necessary retaining walls. This is verified also in the design layouts of the sites. In general, lots whose long sides are parallel to the contours, minimize earthmovement and are utilized for more gentile slopes of less than 3%. However, because this configuration restricts utilization of patios for playgrounds and other social activities, lots perpendicular to the slope are utilized for steeper slopes greater than 3%.

Because of the small amounts the urban poor can pay for housing, low income settlements are particularly concerned with minimizing costs, therefore, earthmovement must be minimized. For this target group topography is a primary planning and design consideration. Topographies differ from site to site and selection of locations for low income settlements must reflect this difference that identifies sites that minimize earthmovement to a point that costs are economically feasible for the low income residents.

Site selection must also consider physical development potential of the site. Topography, for instance, identifies the potential and limitations of the site in regard to the physical aspects of the project layout, ie., sewage and storm drainage, landuse, land subdivision, vehicular circulation, land development and maintenance, buildings, and surface projection. The main indicator of topography is the slope or angle of inclination of the ground in relation to a horizontal plane which is measured in terms of degrees. Generally, those sites whose slopes are between 5% and 10% are the most suitable and feasible for the development of these physical aspects. Less than 5% can create problems requiring special attention for drainage and also monotony from a lack of visual relief. Slopes over 10% have problems in sewage and storm drainage, and in developing small lot subdivisions. Since general land development and maintenance costs for streets, infrastructure, and lot terracing are high to prohibitive in this case, special treatment is needed to preserve the natural terrain, vegetation and other features.

The topography also influences the decision of development types, whether it is small lot subdivision or large lot subdivision of walk-ups and high rises for low income settlements. Although low income groups are more suited to small lot subdivision, the decision of small versus large lot subdivision for a site must be made in conjunction with that which minimizes the costs per family of land,

development and maintenance for low income groups.

While the location aids in determining land costs, the topography is important in determining development and maintenance costs. Generally, sites of predominantly less than 20% slopes are feasible for small lot development since adequate placement of the physical aspects of the project layout and other site improvements can be made. However, sites with slopes ranging between 5% to 10% are the most economical to develop for small lot subdivisions as opposed to flat or steeper slopes since they further minimize costs by more easily facilitating storm and sewage drainage.

If slopes are predominantly greater than 20%, the site is not adequate for small lots since development and maintenance costs will increase sharply. For instance, there will be retaining wall and foundation complications, drainage and erosion concerns, plus street layout restrictions which require roads parallel or diagonal to the contours to reduce its slope. The cost of utilities will also increase. Therefore, to reduce the cost per family requires greater population densities which are achievable only through walk-ups and/or high rise development.

Because of topography of a site, small or large lot subdivision is determined by tradeoffs between preferences and acceptable development costs. If the preference is not

flexible it may be necessary to locate an alternative site with a more suitable location and topography if development costs are too great. In regard to site selection, this implies two alternatives for low income settlement project locations: a) given a desired subdivision preference, locate a suitable site, and; 2) given a site determine the suitable subdivision alternative.

B. SOCIAL CRITERIA

1. Accessibility -

The location of low income settlement projects have social influences since location determines access to employment opportunities (jobs), community facilities (health, educational facilities), and infrastructure (water, drainage, etc.). Since these are critical needs of the low income residents the provision of access is vital to the success of the projects.

To understand this fact it is necessary to look at the characteristics of the urban poor and their needs. For instance, the poverty of the low income residents results from a lack of education, skills, political power. This results in limited access and mobility to satisfy needs because of a lack of money and adequate transportation service. The low income sector predominantly uses public transport, with owners shifting the worst conditioned units to the poorer localities. In addition, poorly paved streets can cause transport vehicles to reduce or deny service altogether. Because of this, time, distance, and monetary costs are important to poor persons and affect housing location. Their primary need, however, is for work. They desire housing at locations where they can find employment opportunites at reduced transportation cost; along with the provision of minimal utilities and community services, rather than the provision of dwellings. This is

because, to low income people, housing, in addition to providing shelter for families, serves as the center of their total environment that maintains access to social-economic resources, and is a symbol of their achievements.

Locating housing for the poor depends on trade-offs between project costs of land and development and transportation costs to satisfy their needs that together must fit within their family income. Activities centers, however, have fixed locations, and the movement of persons and goods to and from their locations involves costs. Therefore, for the urban poor, where they live is of greater importance than the conditions under which they live. For the poor, cheaper projects located for instance, in the periphery, far from employment opportunities and social services are in the long run more expensive than identically prices units with better access because travel or transport costs are a part of the cost of living at a given location. This is particularly important to multi-earner families. Long costly travel to work utilizes a high percentage of their income which is especially damaging to the family economy. This poor access may mean exclusion for the urban poor from economic opportunities in the city center or other periphery areas where the large percentage of low skill employment and cheap shopping opportunities are located. Poor families are aware of the value of locations that have convenient access to jobs and social services and try to

obtain it in the best possible way.

Consequently, accessibility is a vital criteria for the location of housing for low income families that involves searching and finding employment and other incomes earning opportunities, community facilities, and infrastructure. However, access to the urban centers, other centers of urban activities, friends and relatives are also influencial.

A benefit of taking into account the spatial location for sites, that promotes accessibility for residents, and provides for their needs, is that it leads to cheaper housing for the urban poor, by indirectly adding to their income by reducing commuting costs.

Improved access to the needs of the urban poor can best be achieved by emphasizing either the proximity of the project location and social economic sources to each other or by linking the locations and sources by improved transportation facilities including both modes of transport and roads. In the first instance, proximity can be achieved by locating the site, 1) close to existing urban utilities, 2) near employment concentrations and community services (within walking or bicycling distance) by locating activities near or within low income housing projects, 3) to have direct access to some form of public transportation. This will effectively reduce travel time and costs for the residents and also may eliminate the need

for a number of trips. This is crucial for those who cannot afford public transport or even a bicycle but must walk.

The second alternative to improved access can expand location opportunities through emphasizing the mobility of the poor by improving existing mass transportation services. Transportation is a particularly important consideration in the location of low income settlement projects in developing countries, since it is a means to facilitate satisfying the needs of the low income residents. By providing access and communication, links are created among people, places and things such that people and goods can travel from one place to another. These links are facilitated by a circulation system (i.e. streets, paths, waterways, railways) and different modes of transport whether public (i.e. bus, subway, taxi, etc.), private (i.e. auto, jitney, etc.), or walking, or bicycling, and are measured in terms of distance, time and monetary costs. However, because of the level of bus service, etc., that the poor can afford and the inability to obtain private autos, intermediate, less centralized systems of personal transport should be stimulated. Collective taxis, minibuses (by individuals or cooperatives), jitneys, etc., that can maintain lower costs than buses are well suited to meet the needs of the low income sector. Licensing procedures should also be liberalized and taxation should be reduced to make them

more attractive as ways of earning income and making them cheaper for use.(7)

To complement this action, street paving programs between residential locations, and sources of social services and economic opportunities outside and within the neighborhoods themselves, could increase penetration for buses and allow access for fire engines, public utility maintenance, garbage collection, etc. Bicycle and pedestrian traffic could be enhanced as well by the installation of bicycle paths, sidewalks, footpaths, pedestrian overpasses, etc. (8).

The impact of access to the location of settlement projects is further exemplified in "Figure 1 and 2" illustrating ranges of modes of travel in terms of speed, time, and distance, along with preferred distances of activities/facilities in terms of travel and distance.

An additional aspect for consideration is how the transportation of materials can influence housing location of the low income sector. A main reason for this is that transport costs account for a large difference between factory and retail prices of materials, i.e.., costs of sand, gravel, stone brick, etc. Affecting this cost is the size of the order and the distance from the source. For instance, the transportation of small quantities of building materials is one of the difficult problems of the low income sector housing. Single small deliveries are

FIGURE 1

RANGES OF MODES OF TRAVEL

Modes	Speed (km/hr)	Time (Min.)	Distance (M)
Walking	4	6	400
		14	1,000
		28	2,000
Bicycling	16	15	4,000
		30	8,000
Motorized	30	30	15,000
		60	30,000
Water	20	30	10,000
		60	20,000

Maximum Walking Distance: 2,000 m.

Maximum Bicycling Distance: 8,000 m.

SOURCE: Caminos, H., URBANIZATION PRIMER, MIT Press, Cambridge, MA 1978, Figure 1, p. 61.

FIGURE 2

PREFERRED DISTANCES OF ACTIVITIES/FACILITIES

Activities/Facilities	Frequency of Travel	Distance (m)
Education		
.Kindergarten;playground	Daily	400
.Primary; playground	Daily	1,000
.Secondary; playground	Daily	8,000
.Community	Daily, Weekly	1,000
Recreation (Social)		
.Local: Children	Daily, Weekly	400
Adolescent	Daily, Weekly	1,000
Adults	Daily, Weekly	400
.Regional	Occasionally	(over)30,000
Shopping		
.Local	Daily, Weekly	400
.Regional	Daily, Weekly	15,000
Employment		
.Low Income Groups	Daily(Walking)	2,000
	(Bicycling)	8,000
	(Motorized)	15,000
.Other Income Groups	Daily	30,000

SOURCE: Caminos, H., URBANIZATION PRIMER, MIT PRESS, Cambridge, MA., 1978, Figure 1, p. 61.

difficult to arrange, very expensive, and time consuming, since customers must wait until a truck lines up a series of deliveries in the same direction.

Another problem of transportation of materials is that even though the demand for materials grows steadily, predictably because of the continuous stages of housing consolidation, the supply can fluctuate, not according to the popular sector but to the public sector. Intensive public construction creates shortages for the low income sector and causes inflated prices.(9)

Remedies for this transport problem of materials pertain to housing locations in close proximity to material distributors and the utilization of transport modes for small conveyance that are economical on fuel and maintenance costs, and do not require high quality road surfaces.

2. Proximity to Off-site - Nuisances/Hazards

Additional social criteria that influences site potential, are the offsite visual, auditory (sound), olfactory (smell) nuisances, and safety hazards that may affect the site when in proximity to it. For instance, disruptive visual elements can consist of power lines, water towers, billboards, industrial complexes, highways, garbage dumps, while possible auditory elements can include heavy auto, rail, air and pedestrian traffic. Olfactory elements may

originate from odors from dumps and other chemical wastes. Safety hazards that may impact the site result from a lack of joining roads in areas of heavy traffic; sewer and sudden changes in land, i.e. cliffs, vibrations, floods, dust/dirt, fumes, fire/explosion hazards, air pollution. If one or more of these problems is uncontrollable, an alternative site may have to be chosen.(10)

C. ECONOMIC CRITERIA

Acceptability of locations for low income settlements projects are influenced by the economic costs that will be incurred in providing for the needs of the settlers. The advantages and disadvantages of site locations influence the economic costs of acquiring housing at that particular location. Since these costs must be compatible with income, location and/or availability impacts on the affordability of housing.

Though economic costs may not present a problem for middle to high income groups, they have a tremendous impact on acceptable and affordable locations for housing of the low income groups. Generally, housing locations, which provide the best access to employment needs will have the highest direct front-end economic costs because of high land price. However, since distance has costs over time to the people who are commuting, their economic costs are minimized thereafter because of improved access. As access deteriorates, front-end costs decrease with an increase in commuting costs. In other words, you generally pay at the beginning at better locations and pay later in poorer locations. Since the poor, who pay 15-20 percent of their income on housing, have minimal economic resources, it places a burden on them by reducing or prohibiting their ability to afford housing at the better locations. This can have an effect on their upward mobility since they can

only afford locations with reduced accessibility which require increased transportation and travel costs. To provide housing locations which satisfies their needs requires methods to reduce the economic costs of housing for the low income to the point where housing is truly affordable.

The major cost components of low income settlement projects are land, site preparation, on-site infrastructure and plot development. Based on site and service projects sponsored by the World Bank, the mean percent distribution of costs of these components are shown in Figure 3. Any reduction in economic costs, therefore, will have to be made in one or more of these cost components.

Site selection is influenced by the first three cost components of land, site preparation, and on site infrastructure. These are also known as the Real Land Costs" that the poor must pay to acquire land for shelter. The importance of site location on housing costs, therefore, becomes apparent when it is realized that these components account for 67% of the total costs.

1. Land Costs

Raw land cost is one major component in determining the real land cost at a given location. Principally, its market value differs as a result of varying demand. The most valuable or high priced land is primarily that which is near to the city centers (the central business district)

FIGURE 3

MAJOR COST COMPONENTS IN SITES & SERVICE PROJECTS

Cost Item	Unweighted Mean (%)
.Land Acquisition	21
.Site Preparation Earthmovement/Survey Work	13
.On-site Infrastructure Water/Sewage/Drainage Roads/Lighting/Electricity	33
.Plot Development Core Housing/Material loans for Construction	33
TOTAL	100%

SOURCE: Popko, E., Ph.D. Thesis, p. 56 from World Bank, "Housing Sector Policy Paper", (Washington, D.C., World Bank, May 1975), pp. 40, 72.

along with economic activities in other locations. This is because these areas maintain a high proportion of the total employment, commercial and social services, and other urban facilities of the city. Since these activities and facilities attract people and the low income groups desire to live within easy access to these areas, the demand for land in or in close proximity increases. This demand is reflected in higher land prices.

In addition, land in or near the city centers is demanded by not only residential uses, but also commercial, industrial, institutional, governmental, financial, recreational uses, etc., as well as infrastructure and transport systems. These alternative uses, on one hand, affect availability of land and make it difficult to locate any land for residential use at all, particularly in the most desirable areas of the city centers which are usually allocated to the most profitable uses, generally commercial. This competition and demand for scarce resources leads to even higher land prices.

For this reason, maximum land values occur in the city centers with the price declining as the distance from the city centers increase. Land is generally cheapest in the periphery also because the provision of infrastructure is often poor, and inadequate urban transport make access to employment and urban facilities costly and time consuming. As a result, land available for housing in the centers is

generally too costly and rents are too high to permit residential locations, particularly for the urban poor. However, in the periphery, locational demands are less such that land costs may be low enough to permit affordability of a small parcel of land in a low density settlement project. In intermediate zones, with improved access and higher land prices, it may also be possible to develop land by utilizing high density units to reduce the cost per capita. This would dictate row housing or multi story buildings characteristic of large lot subdivisions of walkup and high rise construction.

Variation to this pattern of land prices will result from the demands for areas that provide the best access to secondary employment centers within the metropolitan area and other amenities such as schools, parks, markets, health facilities, and transport facilities which raise the price of land in proximity to them. Because of this pattern of demand, which affects land prices, slums develop in many cases in or near the city center as the only alternative for access to employment opportunities and services for the lowest income groups. Though they cannot compete for long-term tenure in such locations, they can occupy, on a short-term rental basis, at relatively high levels of density, land which is "not yet" redeveloped for its most profitable use.

Additional factors that affect land costs for settlement sites are the land tenure or ownership patterns and land speculation. For instance, publicly owned land does not require the same land acquisition costs as privately owned land would. In this case, the values or costs of land are absorbed entirely or partially by the government by either donating public land for projects or purchasing private land and then donating or selling it to the beneficiaries on a subsidy basis. This can reduce the real land costs of settlement projects to low income groups. Such land also minimizes costs to government since land is acquired and transferred to projects at prices that reasonably reflect market conditions at the particular locality. Privately owned land, however, is susceptible to the phenomena of land speculation. The holding of land and imposing high selling prices jeopardizes the prospects for a project at a specific locality by increasing real land costs to a point that it may not be affordable for low income groups. This is possible when there is a fixed quantity of land in a given location; when demand is greater than supply; when there is uncertainty as to where and when land development will take place.(11) Means to control this phenomena and consequent increases in land values for public use are through direct interventions of land banking to acquire needed land for development ahead of time and the indirect methods of zoning and planning restrictions; rent controls; and taxation such as site value tax and capital gains tax.

2. Development Costs

The site preparation and on site infrastructure costs, also known as the "development costs" make up the other components in determining the real land costs that the residents would pay for housing in a settlement project. Site preparation costs pertain to land leveling, earthmovement, surveying, etc., while infrastructure costs reflect the installation of services in terms of roads, water, sewage, drainage, and other utilities. Together, they turn raw land into land suitable for housing. Principally, development costs vary as a result of topography and other natural features. The worse the conditions, the more expensive the development costs. For instance, steep slopes, unfavorable soil conditions (See Section on Physical Characteristics) or sites susceptible to seismic risk are relatively difficult and costly to develop. Lowest development costs will occur on nearly flat land.

Along with this, development costs can also be high if services must be carried long distances to less accessible land. By locating low income settlement projects close or adjacent to existing facilities, or more appropriately, to higher income development projects with existing facilities, these costs can be reduced. Services can be provided at relatively low costs by paying only the additional costs of supplying both projects together. This arrangement also provides the additional benefits of

facilitating urban expansion and desired heterogenity among income groups.

To reduce the economic costs that low income groups will pay for housing, the site must minimize the real land costs. This means that after determining the amount the prospective residents can pay for housing, a site must be chosen that minimizes either the raw land costs or the development costs, or both enough to be affordable to them. Generally, governments pick locations a great distance from the city center in the periphery on public land. Their criteria is to use the cheapest land possible even if it is unsuitable in terms of location (transport and economic opportunities), topography and soil conditions. This, over time, can be more expensive to the low income groups, since transport costs are a cost of living at a given location as opposed to higher priced land with better access (location). More times than not this criteria leads to continued development and expansion of squatter and illegal settlements in and near the city centers.

A better strategy for the government to influence affordability of housing for low income, would be to work within a system of tradeoffs or substitutions that reflect the general trend in decreasing land prices as the distance from the city center increases. For instance, given an income level with the particular ability to pay for housing, a site location could be based on trade offs

between socially accessible land with higher land costs (Refer to Section on Social Criteria) and the costs of development of services. If periphery locations lack adequate access it may be better to reduce standards of development to maintain access at the more expensive site. Reduced standards could be achieved through 1) changing high cost materials for indigenous materials and traditional building methods, and 2) reducing services to minimal levels through communal facilities.(12) Cheaper land is capable of more services.

Another substitutional prospect pertains to considering dwelling type options and variations in densities. Generally, the higher densities reduce real land costs per dwelling unit provided, of course, that high density does not require more expensive construction systems. In this case, costs may actually go way up with increasing density. For example, where raw land costs are low as in the periphery low density small lot subdivisions are possible. As land prices increase, however, large lot subdivisions of walkups and high rise construction with higher densities may become economic to reduce settlement costs per dwelling unit. This allows the poor some options of improved access without compromizing construction and service standards.

D. PLANNING POLICIES

The previous physical, social, and economic factors that influence site selection for low income settlement projects are given external constraints that a government must consider and has little control over. As such, they must be viewed as they presently exist and evaluated in terms of additional costs and necessary trade offs. If they are unacceptable, a different site location might be necessary. However, there are additional aspects to consider called "Planning Policies" which the government does have control over that influence the feasibility, acceptance, and affordability of a project location to the low income and promotes desired urban growth patterns. These policies can be classified according to project criteria, urban land development policies, and institutional structures.

1. Project Criteria

For the development of a settlement project, the government must make initial policy decisions that have implications on the selection of sites. These policies are primarily concerned with, 1) the limits of population, density, and number of dwelling units of the projects; and 2) determining who is the target income group of the project. These factors influence the site selection through requirements of size, location, and dwelling types preferences.

For the government, adequate population ranges are important to provide for the continuing growth of the population, particularly the low income groups, into the urban areas from natural growth and in migration. This means the project site should be large enough to relieve overcrowded slums and lessen the prospect for additional illegal invasions. This reflects the criteria of size, and location requirements of the site. For instance, if policy dictates a project population, alternative sites of sufficient sizes can be determined by finding acceptable options of population densities, number of dwelling units, and areas of land utilization. Also, population standards reflect size and location of site through the levels of required community facilities, i.e., clinics, markets, schools, police and fire protection, etc. Projects with smaller populations require less facilities which allow smaller site sizes. Furthermore, they are more likely to develop as part of an adjacent urbanization in infill areas to make use of adjacent facilities. Because of this, they are not generally capable of urban expansion. Those projects with larger projected populations, however, can support, need more facilities, and are more self sufficient. Thus, they require larger size sites which are generally located in the periphery and may be capable of expansion as demand increases.

Additional policies on population densities are also relevant to site selection. For a given population, a

lower density project requires a larger site than if it had a higher density. Lower densities also result in higher costs per capita in land and infrastructure, while too high densities show negative impacts of excessive service loads and social conditions. Based on existing projects evaluated by Horacio Caminos and Reinhard Goethert and documented in their UBANIZATION PRIMER the most reasonable net density ranges from 200 persons/hectare in initial phases to 600 persons/hectare in the saturated phase.

Limits in the number of dwelling units, or lots, are also important policy considerations for site selection of a project. Generally, there is a minimal number of units needed to justify administration, start-up costs and make it worthwhile to implement cost recovery mechanisms. For this reason sites are becoming larger and larger, particularly in site and service projects, and are being located in the periphery. This, however, raises problems for employment accessibility.

Though these policy limits of population, density, and number of dwelling units are significant because of their own individual impacts on site selection it is important to be aware of their interrelationships. Based on the costs of affordability and services required for a population, each policy element influences or is influenced by the others. For instance, for a given site, population can be estimated by options of density and/or numbers of dwelling

units (with knowledge of number of persons/family). The same is true for densities and number of dwelling units. Density can be reflected by population estimates and number of dwelling units; while the number of dwelling units can be reflected by population estimates and densities.

An apparent conclusion from this interrelationship is that it may be possible for a government to make decisions on only one of the limiting factors, the one with the highest priority, and calculate the other two limits for a given site. However, the impacts of all three factors must be considered within their optimal ranges and reflected in site selection.

A second project criteria that impacts on site selection concerns the analysis of those for whom the project is intended. Making decisions on the targeted income group initially is a most important criteria because of its impact and implication on the total development of the project. It particularly indicates the social economic needs and the level of cost affordable to the group that the project must resolve to be successful. Location of the site impacts on these constraints by providing desired levels of accessibility to these needs at affordable prices.

Though it is understandable that the needs and levels of affordability of different income groups will vary, i.e., high to middle to low incomes, for the success of a low

income settlement project target income groups means more than just general low income groups standards. It is imperative to understand that there are different levels and type of needs and interest priorities even within the same low income group. The settlement location must be responsive to each of the specific needs of each case.

Settlement projects, therefore, must be responsive to the variations in the low income group. This means identifying relevant and necessary characteristics about the beneficiary group and how they interact to realize optimal project location and design. For instance, what are their present conditions and future expectations and aspirations concerning economic, social and geographic mobility. This can be realized through an understanding of the income group patterns of, 1) "consumption" of food, water, sanitation, power, fuel, etc., 2) capital assets of health, education, skills, rights, and access to urban land and credit, etc., 3) employment/ occupation characteristics, 4) income, and 5) territorial orientation whether it be "externally oriented", "in transit" or "consolidation". These variables are indicators of present and potential well being as well as a committment to particular localities in which projects might be undertaken. (13)

Different low income groups are best exemplified through the territorial orientation that is particularly important in determining site location which reflect income and time

within an urban area. These can be considered as stages to consolidate as conditions improve. The initial stages are the "externally oriented types" who are interested in locating in areas only for the purpose of sending income back to family and relatives who live elsewhere. In transit groups are a second stage and are interested in locating temporarily to gain a "foot hold" in an urban area to move later to more permanent locations when they are capable. These first two stages are typically characterized by types of people who are the poorest income groups and who 1) have no interest in investing permanently in the particular area, 2)are more concerned with location than dwellings. For these reasons, these people probably desire rental units in the central or intermediate zones achieved through high density development.

The third "consolidating" type, however, desires to establish permanent residence in their present locality and intend to invest and improve their conditions there. These types are characterized as people in the middle to high stratum of the low income group, and are interested in more amenities and capable of living further from work places, in intermediate and periphery zones. This last type, because of its ability for cost recovery potential, is the primary focus of most low income settlement projects, particularly site and service projects.(14)

In addition to territorial orientation and characteristic, the low income groups have similar preferences that differ from higher income group that impact on dwelling types and project locations. Consideration must be given to this for site selection as it affects access at affordable costs. These preferences are apparent through the social economic and cultural tendencies of the group. The predominant economic characteristic of low income, for instance, can impact on the family structure that may lead to a tendency of larger families, i.e., children, extended families, for their survival. This influences their social characteristics of: a) little mobility, b) need for community facilities, i.e., schools, parks, clinics, c)need for larger family dwelling areas, d) the desire to be close to sources of employment because of a lack of transport possibilities. This is in contrast to the higher income groups who generally maintain smaller families with social characteristics of, a) higher mobility, b) smaller dwelling requirements (though preference is for large plots, in many cases) and c) less need to be in close proximity to employment sources.

Based on these characteristics, low income groups are more suited to small lot subdivision rather than large lot subdivision of walk ups and high rise developments. With small lots each family can at least maintain ownership of a piece of land and with the use of lot clusters greater community involvement can be promoted. In addition, this

allows for animal breeding, home industry and incremental construction of housing. These are important elements to low income families for the development of a viable neighborhood. This type of subdivision influences locational criteria because it results in a lower density which requires large sites with less expensive land costs. For this reason these type of settlement projects are generally in the periphery.

For higher income, large lot subdivisions may be more acceptable including not only walk ups and high rises but in many cases, large individual plots. Because of economic advantages, the location of these sites are less restricted. For instance, required land sizes and preferences for large plots may result in periphery locations but central and intermediate zones are also possible.

For the low income, however, their preferences may not indicate a final subdivision type. The decision of small lot subdivision versus large lot subdivision for sites must also be made in conjunction with affordability of costs per unit family of land, development and maintenance. For low income groups these costs must be at a minimum. As costs increase, densities must rise to reduce costs per capita such that walk ups and high rise developments become more appealing. To arrive at a solution, trade offs of preferences versus costs may be required. If they cannot

be made, it may be necessary to evaluate other alternative site location. In general, walk ups and high rises for low income groups are solutions dictated by costs and do not provide desired social benefits.

An alternative policy concerning project criteria of the target income group is to utilize a mixed income approach which mixes higher and lower income groups into small but still homogeneous groups not individual plots. This alternative can, 1) allow greater ranges in site location to more accessible and costly land and 2) allow affordability to a greater percentage of the poorest of the low income groups. This would be by improving affordability while maintaining cost recovery by having higher income groups pay higher prices for their plots which could cross subsidize the lowest income groups. Optimistically, this alternative allows for more heterogenity that avoids class segretation and can promote local employment opportunities for the poorest income groups by acquiring services and jobs from the higher income group. It also promotes improved qualities of utilities, services, transportation and the avoidance of ghetto slums. However, in practice this mixed income approach turns out to be somewhat limited because of the difficulty of having a sufficient variation in incomes to allow cross subsidization to work.

2. Urban Land Development Controls

Site selection for low income housing is particularly impacted by the availabity of land. For governments to insure an adequate supply of land for housing, requires not only anticipating housing needs and economic situations but maintaining appropriate legal policies or mechanisms to acquire sufficient land and influence development at acceptable locations and at reasonable costs, in view of scarce resource limitations on the part of both the governments and low income groups. These mechanisms are known as urban land development controls. Governments can use these controls in influencing location of settlement projects that influence positive urban growth pattern by: directing urban expansions; stabilizing or reducing land costs on government by controlling speculation in ideal areas; and raising revenue for public use by acquiring a portion of betterment values in private land associated with the provision of urban infrastructure and services.

Policies to achieve these objectives can be distinguished by direct and indirect controls. While both are designed to influence private development and raise revenue for public development, direct controls are also designed to substitute public for private sector development. These direct controls which require adequate legislation, appropriate political support, and administrative capacity, allow for public acquisition of land and public land

development schemes; while indirect controls use legal measures such as land use controls and fiscal incentives to influence behavior. These governmental actions guide, limit and regulate the use of land. It is important to consider that both direct and indirect measure are highly interdependent, and for the greatest probability of success in providing adequate land at acceptable and affordable locations, they should be utilized simultaneously. Appart from the benefits from these development controls, they are still only legal policies or mechanisms. As such, they are confronted with issues of political feasibility. Those that stand to lose the most from these controls are the small minority with the most land, wealth, and political power. Therefore, implementation of these policies can become very difficult.

Direct Controls:

- Public Land Acquisition

The most direct and effective means of supplying land for specific purposes, i.e. housing, is for governments to directly participate in the land market. This means becoming involved in public acquisition of land through direct purchases of land. This purchase of raw land can be either for immediate development or to form publicly owned land reserves through advance acquisition.

For advance acquisition, land values are generally cheaper since costs are at current use values as opposed to future

use or speculated values if land is for immediate development. Land reserves are used as land banks and are particularly advantageous to governments in ensuring an adequate supply of land for the future (10-30 yrs.) to meet the needs of development projects or also withholding land from development for environmental reasons. In addition, advance acquisition of land provides a control over land resources that has benefits or reducing land speculation by keeping prices down through increasing supply; allowing increases in land values to go to the governments,i.e.., public sector; and providing greater governmental control over land development to provide orderly, timely and rational urban expansion that include efficient extensions of public services, housing, and maintenance of natural resources for the realization of the socio-economic potential of the land. This approach particularly can impact government selections of sites for settlement projects at acceptable and affordable locations.

Apart from these benefits, however, there can be concern with large scale advanced land acquisition. For instance, governments may not be able to acquire very much land because there can be considerable costs, administratively, financially, and politically, on land holdings until project implementation. It can tie up large sums of money, which strains budgets, and can increase demand to a point that land prices still increase. It can also create dissatisfaction and alienate all the classes of people

through unfulfilled expectations, negative impacts, etc., raising pressure against large advance land acquisition. Finally, governments may be unable to hold large land reserves because of the wide spread squatting that may follow on the most prime land with the most accessible locations.

Apart from purchasing land on the free market, other techniques are available to the government to facilitate public acquisition and control of land. These include mechanisms of eminent domain and expropriation; pre emption, and purchase of development rights. The degree of success of these mechanisms depends on the appropriate legislation giving the government power to use and enforce them.

Eminent Domain and Expropriation allow governmental take over of private land and are the least costly of the available techniques. However, the government must prove that acquisition is in the public interest and allow the owner to defend his right to the land and demand compensation. Powers of eminent domain allow acquisition of only land scheduled for a specific development, not nearby land. It also does not allow for acquisition of land reserves for future unspecified uses. Expropriation is an alternative technique which has the same use but also allows for excess acquisition of surrounding areas or other areas for land banking purposes. These techniques do have

difficulties since neighbors are free to keep or sell adjacent land at speculated values on the free market. Because of this it may be necessary to freeze land prices in an area to reduce speculation selling.

Pre-emption is a means of transferring ownership from private to public by giving the government the right of first priority to acquire land in instances where the land owner is interested in selling. If they are interested in buying the land, a price is negotiated such that both sides are able to reject each others offer. For this reason, this mechanism must also be supported by the power of expropriation. If the government is not interested, the owner can then sell the land on the free market.

This mechanism allows the government to 1) control land changes and land market prices, etc., to some degree, 2) create land reserves without being forced to purchase large areas in a short period of time and 3) influence development, simultaneously in more than one geographical location.

The Purchase of Development Rights allows the government to acquire the development rights to property without transferring land titles. For this reason it is more regulatory and less restrictive than the other acquisition techniques. The owner still maintains land titles but can be restricted in how he uses it, i.e., right of ways,

scenic or environmental purposes, etc. This technique is particularly advantageous in providing the government with control over the rate and type of development planned while reducing the cost of full land purchase.

- Land Development Schemes

An alternative to direct acquisition is public land development. this strategy is concerned with the provision of infrastructure, i.e.., roads, sewage systems, water facilities, public utilities, etc., for efficient urban expansion along with the construction of housing, secondary centers and even new towns. It is the single most effective method, short of actual land acquisition, for governments to supply land for low income housing and guiding growth with respect to desired urban patterns. New development, i.e.., housing, generally depends on the availability of public services. Without it, development will not occur. For that reason infrastructure should be prohibited from being extended to questionable areas which will curtail development of new settlement projects while locating services in favorable areas, promoting development.

One method the government has to direct infrastructure and housing is through the land development scheme of "land readjustment". This is a mixed public and private scheme with temporary public ownership. It involves the "pooling" together by public authorities of numerous small land

parcels, without paying monetary compensation, creating a large site in which all parties, public and private, have an interest. The land is then subdivided according to a master plan with the government retaining land for public services. Most of the building plots are returned to the owners in respect to the value of land contributed. The remainder is sold by the public authority to recover costs.

Though similar to public acquisition, this scheme is advantageous since no governmental purchase of land is necessary which minimizes governmental financing of services and development costs.

Indirect Controls:

- Land Use Controls

Land use controls are legal regulations that governments can use to influence settlement locations by guiding physical growth according to desired patterns of development. This is done by placing locational restrictions and minimum standards on the specific types of land uses and activities. The most influencial of these controls are, master planning, zoning, subdivision regulations, and building regulations.

Master Planning is a planning process that sets the direction, location, and limits for desired long term land use development. One of these land uses is housing for low income. This can be done on national, regional and urban

scales. However, this type of planning has many problems. These plans are characterized as being too elaborate, sophisticated, and costly; time consuming and static. Because of the continual changes that must be made in the future, these plans cannot reflect future reality of needs and become obsolete very fast and too inflexible to legally enforce.

Because of this, "strategic planning" is gaining favor as an alternative planning process for making decisions about the physical environment that can respond to changes. This alternative focuses on critical issues and areas of development, i.e.., housing; and establishes priorities for investment, i.e.., infrastructure. It proves to be a more flexible and dynamic approach to influence urban growth patterns, and encourage efficiencies in resources, time and space.

Zoning is another valuable technique of urban land policy that governments can use to indirectly control the growth of urban areas. This is by placing locational restrictions and regulations on specific land use types. For instance, the urban areas are divided into an array of districts or "zones" by prominent land uses including residential, industrial, commercial, institutional (i.e.., governmental, educational, religious, etc.) recreational, undeveloped, etc. Regulations are then established within each zone which affect heights, shapes and bulk of buildings, floor

area ratios, set backs, population densities, etc. This technique is particularly useful for insuing proper amounts of land for all activities in the most efficient manner at optimal locations.

A particular zoning regulation that affects low income housing settlements is population density. It influences the number of developed families and dwelling units that can be developed per hectare. For instance, permitted densities that are too low may effectively prevent the use of site and service projects at a particular location. The real land costs per capita will be unaffordable to the low income. Zoning can also influence site location by excluding project areas that are near industrial,, commercial, or high income zones which provide income earning opportunities. The opposite should be true. Zoning should allow industrial and commercial activities adjacent to chosen project areas.

This phenomena has led to an alternative zoning concept of planned unit development in which a large parcel of land can be developed in a number of ways. Within one area, various forms of housing, social services, and economic activities may be introduced without regard to lot configuration. the emphasis is on total physical, socio-economical development.

Subdivision Regulations provide governments with another land use control over the proper development of raw land for designated purposes. This is through establishing restrictions on the exact way land is to be subdivided, the provision of public facilities and the infrastructure. For low income settlement projects it is particularly useful for its influence over location and timing of development to ensure proper growth patterns. For instance, it can preserve land from being developed, or prevent low income housing by requiring high standards that make cost unaffordable. On the other hand, it can promote, for example, numerous subdivisions located in one area eliminating piece-meal and spot development which contributes greatly to high costs of human settlements.

The regulatory instrument of Building Codes is a final land use control concerned with how a development is to be built. It establishes minimum controls over building design, construction techniques, materials, maintenance, etc., to protect life and health of residents. For low income people, however, if these controls are too stringent and uniform over the entire urban area, low income settlement projects will be unaffordable because of high costs of materials and labor. It will allow only alternatives of squatting, and illegal settlements that do not have enforced standards.

An alternative for governments is to maintain variation of standards that relate to probabilities of vulnerability. The highest standard would be in the most hazardous areas while minimum controls would be in the less hazardous areas. The concept of performance standards could be utilized to reduce costs further. In this way, building codes would influence the affordability of low income settlement projects to the poor at locations of least hazardous risks.

- Fiscal Incentives

Fiscal incentives are another indirect control which influences urban settlement locations. This is by affecting the behavior of land owners through incentives that can stabilize land prices, raise revenue, and promote development that corresponds to desired urban growth patterns. Two principal approaches to fiscal incentives are through subsidies and land taxation. Subsidies encourage development with financial assistance in the form of capital grants and low interest loans for the purchase of materials and building at appropriate locations. For settlement projects the recipients would be the low income land owners who comply with urban and land use regulations.

Land taxation measures, on the other hand, penalize land owners in a monetary sense for uses that are inconsistent with desired urban land patterns. This can influence desired locations for projects while importantly allowing

the benefit of raising revenues for the city. For instance, desired settlement locations have problems with high land prices resulting from speculation. These problems could be addressed by (1) a tax on vacant land which is designed to encourage land being put into productive use, and discouraging withholding for speculation purposes; (2) a capital gains tax which discourages excess profits from land sales which reduces speculation; and (3) a betterment tax which discourages undesirable land improvements from being made on a site which increases land values as well. In addition, favorable development at a particular location could be encourage through a property tax. This measure has great potential for low income settlement locations. With the use of a differential tax rate, land can be taxed more favorably if developed for low income housing than for other uses. This would discourage land owners from developing alternative uses for the same land.

Together, these subsidies and land taxation measures that reduce speculation, raise revenues by benefiting from rises in land prices, and influence the type and location of development, contributing to the land supply for low income settlement sites at desired locations, and payments of expenditures for urban growth.

3. Institutional Structure

Site selection for low income settlement projects is affected by the governments ability and capacity for acquiring and developing land. In most developing countries this is determined both by the influences of a market system, and most importantly, the institutional structure or framework under which the government operates.

As elaborated in the section on economic criteria, in a market system, values of urban land reflect a demand for limited supply of the scarce resource, land. Usually, the areas in greatest demand are those that have the most economically productive and profitable land uses. These areas attract people who compete to place similar profitable activities in these same locations and who desire to live within easy access to such activity areas. This increases demand which is reflected in higher land prices. Land values decrease as locational demand diminishes.

This market system is further characterized by a profit motivation called speculation on the part of the private sector who withhold favorable land from sale. This forces prices to go even higher. As a result of this system, governmental acquisition and development of land for residential settlements are either poorly located in relation to access to activities, or acquired and developed at high costs in better locations.

In many cases this situation is reinforced by an existing weak institutional and political framework that does not permit overcoming these free market traits and inhibits governmental intervention. For instance, the governmental structure can be characterized by a strong over centralization of authority and resources. This results in a preoccupation with authoritative control of regions and cities rather than development. Under this condition the role of the city becomes more administrative with little consideration for urban development. Under other instances, the political system can operate under a framework that promotes urban development. However, this type of development generally promotes economic profit or other personal gains at the expense and or neglect of the low income groups.

There are also problems within the bureaucratic system in which departmental jurisdiction within and between municipal, state and national governments creats a confusion as to who is responsible for what.(15) For instance, there are overlaps in governmental authority such that in any one level of government different departments are responsible for aspects of housing, land, public works, etc., with no real coordinating or controlling mechanism. Even a planning unit is usually without authority over other departments and often cannot control compliance with a Master Plan. Therefore, housing can be considered or built by one unit of government and be denied services,

i.e.., schools, public transport, permits for water, etc., which are the responsibility of other departments. Because of these institutional characteristics, resulting in a lack of policy, scattering of activities and responsibilities, adequate governmental response to acquiring and developing land for low income housing is impeded. The consequences of the land market situation and the politican and institutional framework is the erection of slum, squatter, and illegal settlements. These settlements are located within close proximity to the city and are generally of poor quality with inadequate standards of services; they are considered a disgrace to the community.

Political solutions for governments to alleviate the urban conditions resulting from these settlements range from upgrading to establishing new settlement projects utilizing site and service schemes. The advantages of upgrading are that the residents are not relocated from employment opportunities but maintain low cost housing, acquire security of tenure and gain improved access to facilities and activity areas. However, these upgrading schemes do not add to the housing stock and many have difficult sites.

An alternative is for governments to develop new settlement projects such as site and service schemes which expand housing stock at minimal cost and adequate locations that satisfy the residents needs.

Since governments are generally responsible for housing at adequate locations, an alternative institutional structure is necessary with appropriate powers and capacity to implement policy and deal with the problems created by the land market, speculation and rapid urban growth, i.e.., squatting, illegal development and urban sprawl. An alternative could be the establishment of a separate public "Land Acquisition and Development Agency" mandated to assist low income needs. This type of agency would be an independent, autonomous entity established for the purpose of guiding and controlling land use development in general, and promoting affordable urban residential development for low income groups in particular. This purpose could be achieved by ensuring available land for development while controlling the location, timing, scale and type of development. To accomplish these goals the agency would be responsible for the functions of (1) long range planning; (2) providing land assembly through acquisition if necessary for immediate residential development or land banking according to established housing policies; (3) developing land or arranging sales to developing companies; (4) monitoring implementation schedules and regulations; and (5) funding/financing for infrastructure, land, low income assistance for credit, lot sales, building materials, and administrative, planning and management costs.

To be successful this agency will have to perform its functions effectively. This implies that it be able to utilize adequate devices for intervention and maintain sources for adequate funding. These intervention devices would pertain to urban land development controls including both direct measures of public intervention in the land market, and indirect measures of legal land use controls and fiscal incentives (See section of Land Development Controls). Adequate funding sources would include national governments, loans from local and foreign banks, land bond issues, earnings from projects, etc. (16) It should also be operated under a political system that serves everyone; not corrupt or that serves only the ruling class. This implies the possibility of a monitoring system for this purpose.

In closing, this alternative institutional structure of a Land Acquisition and Development Agency addresses two principal problems apparent in developing countries for governments to adequately supply and develop land. Through its intervention in the land market, land becomes more available and affordable for low income groups by stabilizing land prices. Finally, through its impact on the institutional framework of the country, jurisdictional responsibility and authority for acquisition and development of land for low income housing, it provides better coordination among departments. This should facilitate governments to supply sites and develop low

income housing according to desired growth patterns.

ADDITIONAL COMMENTS

From the previous discussion there are numerous aspects for government or other organizations to consider for site selection of low income settlement projects. Those mentioned under the categories of physical, social, economical, and policy criteria are basic minimum qualities to be considered to increase the probability of success of the project.

However, these criteria are not all encompassing. Every geographical location or country has its own characteristics because of cultural, financial, environmental or political reasons. Therefore, the criteria for site selection and administrative structures may need to be revised, to reflect its own unique qualities. For instance, some physical aspects may not be of concern while others such as social aspects may change allowing differences in accessibility requirements in terms of distance and facilities required. In addition, some aspects, not previously mentioned, may be important as well. For example, depending on the region, seismic characteristic, elevation advantages, etc., may also need to be considered.

CHAPTER II.

EXISTING METHODOLOGIES FOR SITE SELECTION EVALUATIONS

A. Matrix

Apparent from the discussion is that any one single factor cannot determine acceptability of a site for low income housing. They are all interrelated and decisions are made accordingly. This must be reflected in any evaluation procedure. This can be done in various levels of detail and complexity. At the simplest level, criteria can be established for site selection and each "weighted evenly". One method for this, is to use a matrix and check off each criteria to insure that the site has at least the basic qualities. An example of this is seen in Figure 4. This method gives a visual sense of where one site's potential lies in relation to another, but lacks detail and accuracy especially among sites with roughly equal potential with only slight differences and/or lie in different areas. To improve on this, another type of matrix can be used that designates an "initial score" for each criteria ranging, for instance, from 0 to 4. The higher the score, the better the development potential for the given criteria. The scores for each quality can then be totaled for each site and compared. An example of this is seen in Figure 5. This numerical system of indicating a degree of potential for each criteria gives more information and confidence in decision making especially among sites whose potentials cannot be easily evaluated.

FIGURE 4

A SITE EVALUATION CHART

CRITERIA			SITES			
			A	B	C	ETC.
Environment & Physical Criteria	Convenient Shape		●			
	Absence of Steep Slopes		●			
	Adequate Soils		●	●		
	Absence of Flooding		●	●		
	Suitable Environment Conditions		●	●		
Accessibility*	Less than 500M from existing transport route		●			
	Less than 3 km. from major employment centers		●			
	Less than 3 km. from existing market or shops			●		
	Less than 5 km. from existing secondary school		●			
Infrastructure	Local Water Supply		●			
	Existing Sewers nearby					
	Existing Electricity nearby					
	Existing Access (roads)		●	●		
Costs	Acquisition	Low		●		
		Moderate	●			
		High				
	Development	Low				
		Moderate	●			
		High		●		
Other						

* Actual distances should be adjusted to specific region.

SOURCE: Alan Turner, THE CITIES OF THE POOR, St. Martin's Press, New York, 1980, Figure 9.7, pp. 270.

FIGURE 5

THE EVALUATION MATRIX

	Site I	Site II	Site III	Site IV
A. Size (expansion potential)	3	4		
B. Accessibility to Employment	4	2		
C. Accessibility to Utilities	2	2		
D. Accessibility to Services	2	3		
E. Public Transportation	4	3		
F. Topography	4	3		
G. Soil Quality	3	4		
H. Absence of Flooding	4	4		
I. Site Cost	2	4		
J. Site Ownership	3	4		
K. Site Availability	3	3		
L. Plan Designations	3	3		
M. Mixed Use/Density Potential	2	3		
N. Acceptability to Users	3	4		
TOTAL SCORE	42	46		

SOURCE: M. L. Rivkin, "Techniques of Site Selection" for USAID, Shelter Workshop, 1979-80, p.35, p--10.

A more sophisticated matrix attaches "weighted scores" to each quality. In this way it acknowledges that certain criteria are more important or have a higher priority than others. Depending on the region, for instance, topography may be more important than a proximity to employment sources, or roads may be more important than proximity to an existing electrical supply. Therefore, location decisions in reality must involve trade offs among criteria. This can be accounted for by giving weighted values (percentages) to each assumed criteria relating its importance or priority to others. These values can then be combined with the assigned developmental potential or "initial score" of each criteria, and summed to arrive at a "total weighed score". (See Figure 6) This score can be computed for each alternative site and ranked accordingly and/or related to an acceptable minimal value or standard.(17)

An important factor in this type of analysis is that each region, country, city, etc., represents a unique situation and combination of influences. To account for this, acceptable distances or basis for arriving at an initial score for developmental potential of each criteria, as well as, priority, weighting (%) of each criteria will vary accordingly to account for this.

FIGURE 6

RATING SITE DEVELOPMENT POTENTIAL (Example: Al Berka #5)

CRITERIA	Criteria Weight %	Initial Score (0-4)	Weighted Score
Topographic Conditions	15	3	45
Environmental Hazards	10	4	40
Accessibility to Water System	12	4	48
Accessibility to Sewerage System	8	4	32
Accessibility to Electricity System	8	4	32
Accessibility to Primary Road Network	10	4	40
Accessibility to Major Work Places	10	1	10
Proximity to Central Business District	5	3	15
Ownership	12	4	48
Land Price	10	2	20
TOTALS		33	330

Source: Dames & Moore, Center for International Development and Technology (CIDAT), CAIRO METROPOLITAN AREA LAND USE/ INFRASTRUCTURE DEVELOPMENT STUDY, FINAL REPORT. USAID Contract No. AID/OTR-1-1853, September 1981, Table 3-3, pp. 3-16

B. The Bertaud Model

Because of the number, complexity and interrelationships of the variables involved in the development of low income settlement projects, tools have been and are being developed to assist in its planning processes. One such tool is the "Bertaud Model". This tool aids technical staff, administrators, policy makers, user groups and international agencies responsible for low income settlement projects in developing areas to facilitate and accelerate decisions in various phases of project formulation, implementation, and appraisal. This is by dealing specifically with physical design and project financing questions, important for formulating feasible settlement projects. The Bertaud Model also uses computer programs that establish mathematical relationships to project components. Therefore, consequences of changing components can be easily and quickly identified.

These specific features of the model reflect a recognition of the importance of "affordability" for responsible institutions and households, (regardless of political and social acceptability), as well as participation of the beneficiaries. This recognition is based on the rapid growth of the poor in urban areas which increases demand for housing solutions compounded by the limited resources of both governments, institutions, and the urban poor. This phenomena necessitates responsible agencies to finance

only public services, i.e.., infrastructure, while the majority of costs, i.e.., land costs, etc., must be recovered from the beneficiary. Through participation by the beneficiary, an understanding of what the income group can afford, their upper limits, along with their preferences and priorities, trade offs can be made, among components (sizes of plots, and levels of services), that can reduce costs.

In considering affordability, the Bertaud Model assists in answering questions important for making decisions that are significant to a feasible settlement project. These particularly concern funding, financial terms, cost recovery, project design, and site selection. These are reflected in the five programs or submodels, that make up the Bertaud Model. Each covers a significant aspect. For instance, program 1 analyzes relationships among basic variables in a settlement project which have layouts approximate to a grid. When changes are made in some variables, the consequences and changes are identified in the others. Program 2 analyzes variables which affect circulation space and cost of on-site infrastructure in more complex layouts. Program 3 analyzes the consequences of differential land pricing. It identifies, for example, what cross subsidies are possible that still cover project costs and allow for lower income groups to participate. Program 4 helps analyze the impacts of a graduated monthly loan payment which reflect expected increases in household

incomes. Finally, Program 5 helps identify subsidies implied by alternative settlement options together with their institutional cash flow options (18). Each is a computer program consisting of an equation or set of equations that represent relationships that help establish realistic priorities among project variables.

Of the five programs, Program 1 is the most appropriate for assisting in decisions for project formulation, including site selection, as well as early stages of design. This is because the program, by analyzing the financial consequences of change in the major variables of a project, can identify whether the basic features of a project, including location, are likely to be cost effective and workable, or close enough to be made so by detailed design, differential land pricing, graduated monthly payments, and acceptable low subsidies. In addition, precise data is not needed. Only typical data or reliable estimates from experience are necessary for localities and general types of layouts.

The twenty major variables of the Bertaud Model are listed in Figure 7. They are used to calculate the most useful determinants for project formulation that has highest likelyhood of a feasible project. When values have been stipulated for all the other variables, the Financial Variables category calculates the capital investment affordable per household for housing (k), while the Design

FIGURE 7

PROGRAM 1 - AFFORDABILITY

The Principal Trade-Offs Between Project Variables

PROJECT VARIABLES	SYMBOLS
I. FINANCIAL VARIABLES	
1. Monthly payment	f
2. Yearly interest rate (%)	I
3. Recovery period (yrs.)	N
4. Downpayment (%)	h
5. Capital affordable per household*	k
II. DESIGN STANDARDS AND UNIT COSTS	
5. Capital affordable per household*	k
6. Land cost per m^2	e
7. On-site infrastructure cost per m^2 of project area	c_1
8. Off-site infrastructure cost per m^2 of project area	c_2
9. Construction cost per m^2 of floor area	a_1
10. Connection cost per plot	a_2
11. Special feature cost	a_3
12. Community facilities cost	a_4
13. Core house size (m^2)	b
14. Number of households sharing community facilities	y
15. Persons per plot	i
16. Gross residential density(persons per hectare)*	d
III. PROJECT LAYOUT VARIABLES	
16. Gross residential density*	d
17. Circulation space (%)	p
18. Parks and open space (%)	m_1
19. Community facilities space (m^2 per person)	m_2
20. Plot size (m^2)	j

* Linking variables

SOURCE: PADCO, THE BERTAUD MODEL, prepared for the World Bank, December 1981, p. 9.

Standards and Unit Cost category allocates (k) among the other various cost items which make up the total cost of the project and calculates an affordable gross residential density (d). Finally, the Project Layout variables use (d) and calculates an affordable plot size (j). Of the three variables, density (d) is a key parameter since it is the means or link that equalizes the capital affordable per household with project costs.

In general, any of the variables included in the program can be solved for as long as values for the other are given. However, the model is programed to calculate outputs for affordable capital available (k), gross density (d), and plot size (j) in that order of priority since it seems practical to base design standards on household affordability. Therefore, the program generally begins with (k) and calculates (d) and (j). This can be reversed, however, to begin with (j) and calculate for (d) and (k).

In addition to these outputs, if the other variables are stipulated, the program can also calculate the variables of affordable core house costs (a_1, a_2, a_3), affordable on-site infrastructure costs (c), and affordable land costs (e). This last variable is especially important for site selection purposes, since it is a principal cost component of a settlement project.

Sometimes typical data or estimates are not available or more accuracy is needed for the major variable of specific

circulation space and on site infrastructure. In such cases the model can make use of nine additional variable (21-29) that can calculate more precise values as long as the specific type layout is known and values for detailed layout design variables are stipulated, i.e.., street width, block width, plot ratios, and contractor costs for infrastructure and circulation. (See Figure 8)

Program 1, generally is characterized as a way of assisting in project formulation by a trial and error process. It makes trade offs and adjusts project variables in the model according to weighted importance priorities, and costs to arrive at the most acceptable mix or compromise that is financially feasible. For instance, if (k) is fixed, it can reduce other standards, i.e.., infrastructure, land costs, etc., to increase plot size to an acceptable level, or reduce plot sizes to maintain higher service standards. This trial and error process is characteristic of the other four submodels of the Bertaud Model as well.

The usefulness of Program 1 of the Bertaud Model can be illustrated in numerous ways. One is that its outputs determine a range of feasibility among the principal variables of monthly payments (f), density (d), and plot size (j) and indicates the effect one has on the other. For instance, ad (d) increases, (f) and (j) will decrease and vise versa. The amount of change in (f) will be dependent on the changes made in the financial variables,

FIGURE 8

Variables Used in Program 1 in the Calculation of More Precise Values for Circulation Space and On-Site Infrastructure Cost

	VARIABLES	SYMBOLS
20.	Plot size (m^2)	j
21.	Width of primary streets (m)	u
22.	Width of secondary streets (m)	v
23.	Block length (m)	w
24.	Plot ratio (length: front)	x
25.	CIRCULATION SPACE (percentage)	p
26.	Network length per m^2	t
27.	Net work cost per linear m	c_3
28.	Circulation cost per m^2	c_4
29.	ON-SITE INFRASTRUCTURE COST PER m^2	

SOURCE: PADCO, THE BERTAUD MODEL, prepared for the World Bank, December 1981, p. 23.

and the design standard and unit cost variables, while the amount of change in (j) will depend on the changes made in the project layout variables.

In addition, the program is also beneficial in demonstrating the consequences of present housing development standards. Are the costs that they imply feasible or beyond the level of affordability for the specific low income group? Generally, it illustrates the need for a more affordable mix of standards whether smaller acceptable plot sizes and/or reduced service standards.

For the purposes of this thesis, however, this program is particularly useful as a tool for site selection by assisting in the location of feasible, and affordable project sites. This is through its calculation of affordable land prices. For instance, existing sites designated for low income housing can be evaluated to determine whether the location is feasible for shelter solution possibilities given the constraint on land price. Can trade offs be made among major variables that can still maintain affordability, i.e.., reduce plot sizes or service standards? Related to this, the program can aid in locating new sites as well. For instance, to what extent must housing types and costs be reduced to achieve preferred locations on higher priced land. Also, if assuming minimum plot sizes, service standards, financial terms, the program can assist in locating feasible project

sites with affordable land prices that are less than or equal to the maximum price identified in the program.

Though the Bertaud Model is useful to identify the range of financially feasible solutions for involved institutions and individual households, it is still only a tool for exploratory purposes. Because of this, not only its benefits need to be understood but is limitations as well. For instance, it deals only with physical features and some financial aspects of low income settlements. It does not take into account all the constraints, desires, needs, land forms etc., since they cannot all be represented in mathematical formulas. Therefore, the Bertaud Model cannot determine whether the consequences of its solutions are culturally, physically, socially, economically, and even politically acceptable or desirable. For the selection of sites for low income settlement projects this leaves many concerns unanswered. For instance, excluded are the relationship of acceptable accesses to social services, transportation, job opportunities, markets, etc; the impacts on the adjacent areas including the increase or decrease of land values; and the surrounding systems, i.e.., transportation, infrastructure, etc., in nearby areas; sufficient information about residential demand for housing in a given location; the image of the project in a particular area to the community; the institutional feasibility of acquiring necessary permits; and the political attitudes and preferences about the site for the

decision makers to support the site location or not. Analysis and implications of these points and others, with their trade-offs are important to the success of the project and require close coordination and cooperation among relevant institutions and close participation of the people affected.

An understanding of these limitations of the Bertaud Model and their implications imply that caution should be taken to introduce relevant political, locational and design constraints, initially, that are derived from analysis of the attitudes of decision makers and the beneficiaries. Then for acceptable and desirable sites, the model can be utilized imputting minimum plot sizes, maximum monthly payments, and affordable land prices that will indicate whether the site is affordable or requires subsidies and/or reductions in costs of components through reducing standards or plot sizes; or an alternative site with lower land costs if necessary.

C. Existing Organizational Participation in Site Selection

Generalizations about theoretical criteria for site selection of low income settlement projects and methodologies for their evaluations are important for understanding the difficult problem of finding acceptable locations. However, it is also valuable to have an idea of what organizations or institutions are involved in this problem and how. From examples, it becomes apparent that the realities of site selection by these institutions can be similar, different, or constrained from what would be considered a rational planning criteria to acquire the best site for those affected.

Institutions involved in selection can be considered through their participation, on a direct or indirect level. The most important are those that consider selection on a direct level. They generally consist of the local responsible and executing agencies of the particular countries, including both private organizations and public agencies. This is because housing is the primary responsibility of the individual country and only on the local level can political, institutional, socio-economical, and cultural land issues can be resolved.

One example of an institution directly involved in site selection is the "Fundacion Salvadoreña de Desarrollo y Vivienda Minima", in the small but highly populated country of El Salvador in Central America. This private

organization is noted as one of the most successful developers of low income housing and is used as a reference model for other organizations to emulate. Based on his experience, the former director of the Fundacion, Mr. Mauricio Silva, was able to identify a general set of criteria and priorities that continually surfaced. For him, the critical issues for site selection in order of priority, were: 1) Availability of land; 2) Institutional constraints; 3) Location; 4) Costs. He noted that in San Salvador, the land market was extremely tight such that the availability of land became the major limitation for site selection. Secondly, the institutional constraints of acquiring appropriate permits such as for the extension of water line to the site, was also a significant problem. Without this, it wold not be worthwhile to consider the proposed site alternative. Following these two restricting criterias, locational acceptability was evaluated. For the Fundacion, this pertained to access to socio-economic opportunities and other activity centers from the site as well as the advantages or disadvantages of proximity to the primate city of San Salvador or other secondary cities. For the Fundacion, costs were the last criteria and least restrictive. For instance, innovative design could provide a flexibility that reduced costs of development.

Though these elements are relatively constant, their general priorities are not automatic. They can change in order of priority and based on their interrelationships,

trade-offs can be made that provide an acceptable site to benefit best those affected, both institutionally and individually.

Appart from the major criteria related to, other concerns, though not directly identified, are considered. For instance, soil conditions were not critical factors to the Fundacion in site selection. This is because soil conditions in their region are generally grid and do not pose major problems. Any, of this kind, are included in development costs. In addition, these locational issues must consider the needs and constraints of the "responsible" institution, the beneficiaries and the government policies. It is important to be aware that many times these concerns may differ and present possible conflicts. For instance, the Fundacion developed a site close to an illegal settlement away from the city center. Though the site was beneficial to the government policies that promoted the elimination of illegal settlements, it was not an acceptable alternative to the beneficiaries which created problems for the Fundacion in the short run. The costs of the plots and services were more expensive than the illegal settlement. Legal tenure was not a priority. Thus, the demand for the project was insufficient to recover costs and reach the desired income groups. They continued to go to illegal settlements. However, in the long run, if the illegal settlement is removed by the government, the benefits to the institution

would increase as the demand for the project would increase by eliminating the alternative. According to the former director, these issues were the major determinants of site location for the Fundacion.

Differing from the local private organizations, local public agencies such as housing and planning ministries, may be more restrictive in their rational site selection determinants. For instance, in many cases they lack the land development controls, such as powers of eminent domain, expropriation, and/or preemption, to direct site selection and keep land costs to a minimum. In addition, politics can play an important part. For example, some governments have a maximum ceiling on land payments for site acquisition. Many times this results in sites disastrously located on poor land at the worst locations. Also, profits may be a determining motive in site selection. Strategic locations for sites can provide monetary gains for the most powerful individuals or major land owners by increasing the value of their land by reaping benefits from being in close proximity to infrastructure lines constructed to project site at the governments expense. Because of these factors, public agencies in order to be effective in housing the poor, require the successful implementation of land controls and a caution that public interests are central to site selection, not private individuals.

Other institutions get involved on a limited basis in the site selection process. These are primarily the international organizations who give assistance to the local agencies in developing settlement projects. The most exempliary of these, is probably the World Bank; also known as the International Bank for Reconstruction and Development (IBRD), that gives financial assistance and technical aid for urban and regional development. An important part of this, is for low income settlement projects. However, based on conversations with knowledgeable personnel from this institution, their influence on site selection is limited. This is because they do not finance land acquisition but only development costs. In addition, project officers are placed typically, in the role of appraisers of a project submitted by a country for financing. At this point, the site is already chosen and the evaluation is based on the merits of the entire project package. Therefore, generally, their impact in site selection lies in the acceptance or rejection of funding for a submitted project. For instance, if a site is considered unacceptable for reasons such as excessive development costs incurred, it does not generally assist in site selection of a new site, but would require the local government to comply with recommendations and submit the revised project package for approval. Because of this procedure, direct participation in site selection is the exception rather than the rule. They only assit if

requested by the local government or responsible institution.

Because the World Bank is only indirectly involved with site selection, it does not have a well documented locational criteria and methodology of selection. It does, however, have personnel knowledgeable on aspects of development including site selection for low income settlement projects. It is generally learned intuitively through experience retained on an "ad hoc" basis with no standard set criteria, guidelines, or checklist established. In this way, it is dealt with case by case by involved personnel.

Other public and private international institutions, such as the Agency for International Development (AID); the Foundation for Cooperative Housing (FCH), and the Planning and Development Collaborative Inter. (PADCO), assist with the site selection in a similar fashion (or even to a less extent) as the World Bank.

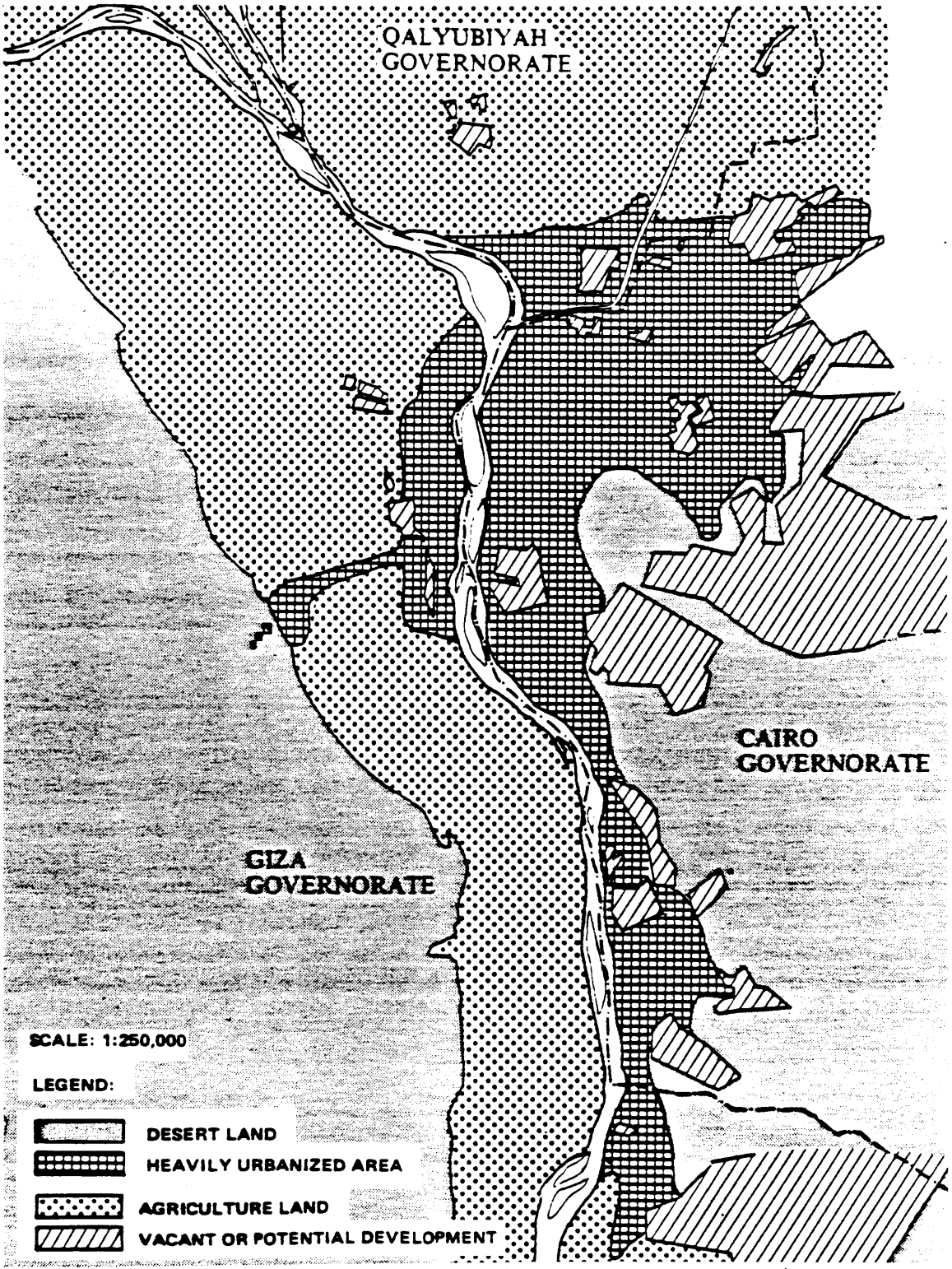
CHAPTER III. CASE EXAMPLE: CAIRO, EGYPT

A process for site selection of low income settlement projects can be illustrated more clearly through an adaptation of a real setting or case example. For this, a study of the locality of the Cairo Metropolitan area in Egypt will be utilized.

In a locality such as this the site selection process begins by obtaining an inventory of potentially suitable sites within the study or urban area. This means gathering information that identifies existing developed or urbanized areas, land which is undevelopable because of topography or soil conditions, land constrained from development because of ownership status. From this information, along with minimum size requirements, (for the Cairo study, greater than 10 hectares or 25 feddens), vacant land and potentially available sites can be determined. For the Cairo Metropolitan area, this type of information inventory identified twenty-five potentially suitable sites as illustrated in Figures 9 and 10.

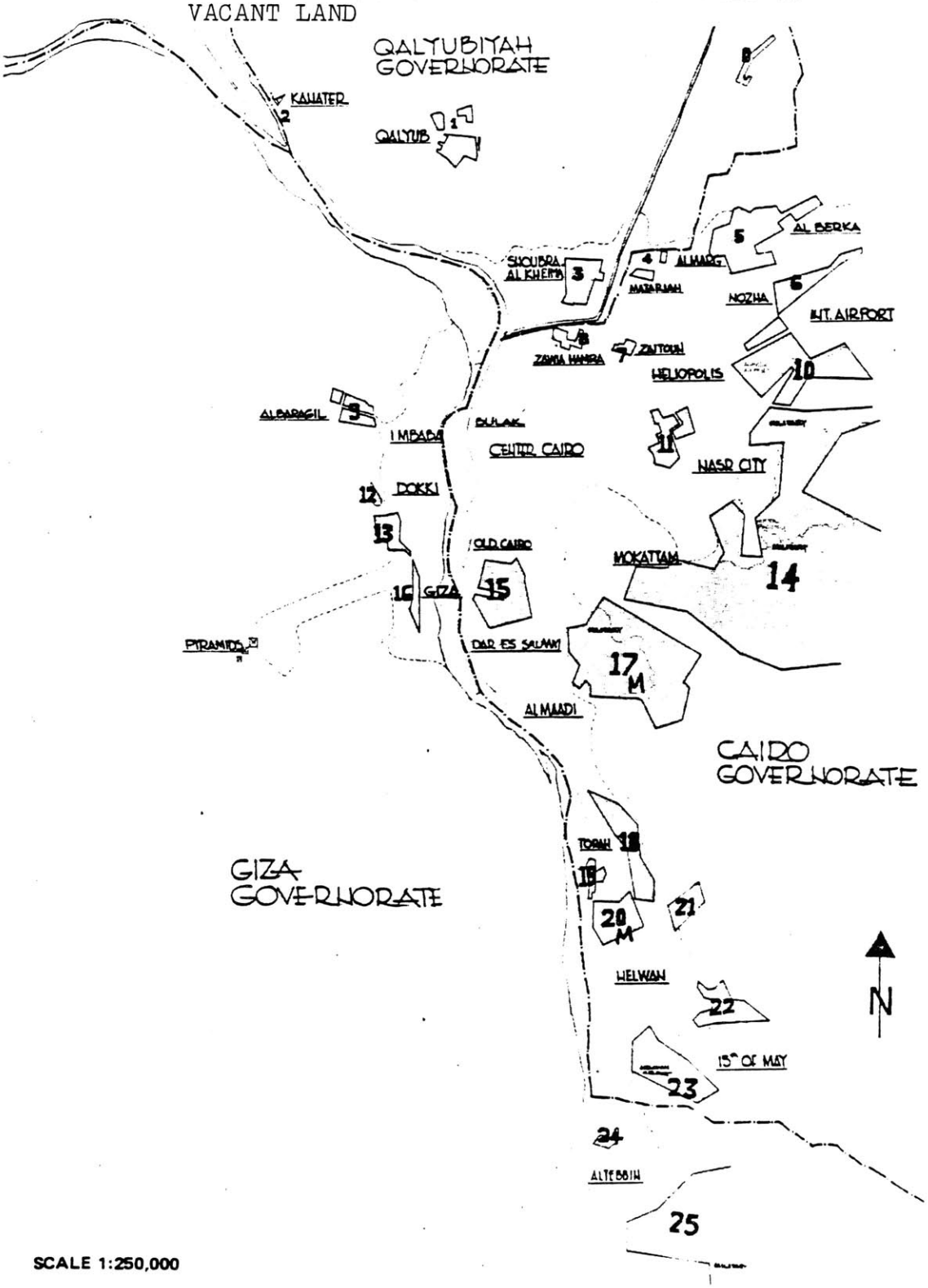
Following this, it is now important to acquire additional information from which to assess these sites development potential. This includes data about the proposed settlement project (if it is known) and critical urban features. Relevant project data (as elaborated in the section on project criteria) pertains to limits on its population and/or densities, the proposed number of lots,

FIGURE 9: CAIRO METROPOLITAN AREA-URBANIZATION



SOURCE: Dames and Moore, (CIDAT), CAIRO LAND USE/ INFRASTRUCTURE DEVELOPMENT STUDY, September 1981, Figure 2-2, pg. 2-4.

FIGURE 10: CAIRO METROPOLITAN AREA-MAJOR PARCELS OF VACANT LAND



SOURCE: Dames and Moore, CAIRO LAND USE/INFRASTRUCTURE DEVELOPMENT STUDY, September 1981, Figure 2-8.

the subdivision type, utility and road standards, and target income groups; while the urban features include existing and proposed water and sewage systems, areas served by public transportation, location of industrial and commercial activities, major roads and land and development costs. This inventory of the urban features is particularly important in understanding the urban growth patterns and infrastructure potential of the available sites from which to access their development potential.

Tools for acquiring this inventory of information for identifying available sites and their development potential include: aerial photography, land use maps, land vacancy maps, location inventories of utilities and services, master plans for land uses and utility systems, reviews of development controls currently in place, land capability analysis (i.e., topography, soil conditions, bearing capacity, environmental hazards, etc.), land ownership data, land cost data. (19)

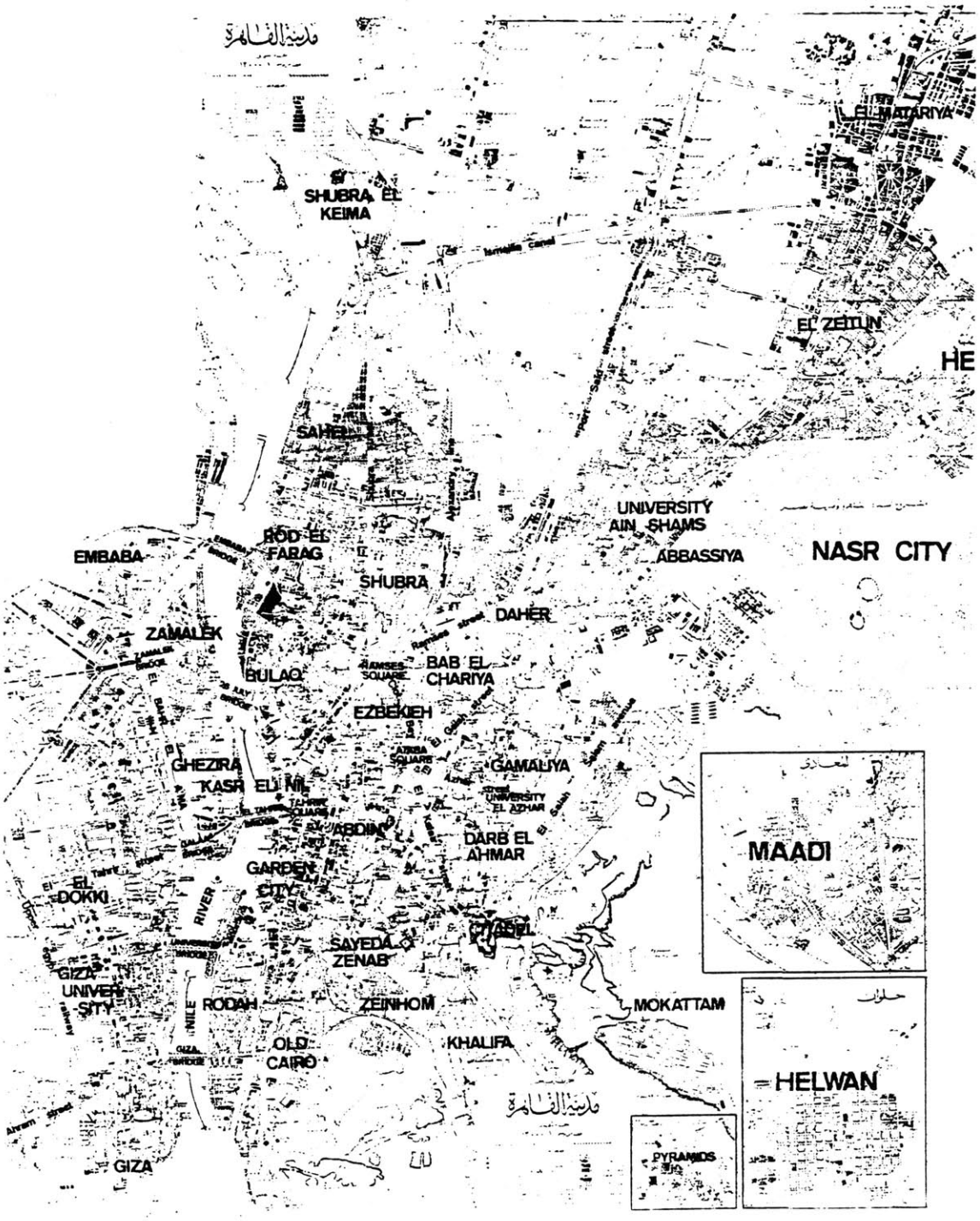
This type of information inventory process identifies significant characteristics about the greater Cairo region and their influences on the available sites necessary for assessing their development potential. For instance, located at the mouth of the Nile River, Cairo is the capital of Egypt, and is an international center of major importance in Africa and the Middle East both politically and economically. It is also becoming a prominent

financial center.

The greater Cairo region (G.C.R.) is comprized of the entire Governorate or cities of Cairo, and portions of Giza on the west and Qaliubiah on the north. They form an almost continuous urbanized area with Giza and Cairo separated by the Nile River. (In the United States this is similar to Boston, Cambridge, and Newton in Massachusetts). In addition, the population of the Cairo region, as estimated by the National Urban Policy Study, 1982, was approximately 6.8 million in 1976 and 8 million in 1981. By the year 2000, this should increase to 16.5 million, an increase of 141% since 1976. Because of this there is and will continue to be a tremendous need for housing in the region. Relevant project data for low income settlements in Cairo consist of land available in small plots with 4 to 5 persons per dwelling; and minimum utilities, i.e. main roads, water, and electricity. Improvement will be made progressively.

The urban features identify the following characteristics of the Cairo urban landscape. The economic locations within Cairo are, first of all, similar to other urban centers with development districts and important economic activity clustered on or along major transportation routes (see Figure 11 for reference to locations). Industrial locations are principally located in the Central Business District (C.B.D.) along the river front and at two other

FIGURE 11: MAJOR DISTRICTS OF CAIRO



SOURCE: Ministry of Transport, GREATER CAIRO TRANSPORTATION PLANNING STUDY, VOL. A., May 1973, Figure 2-4.

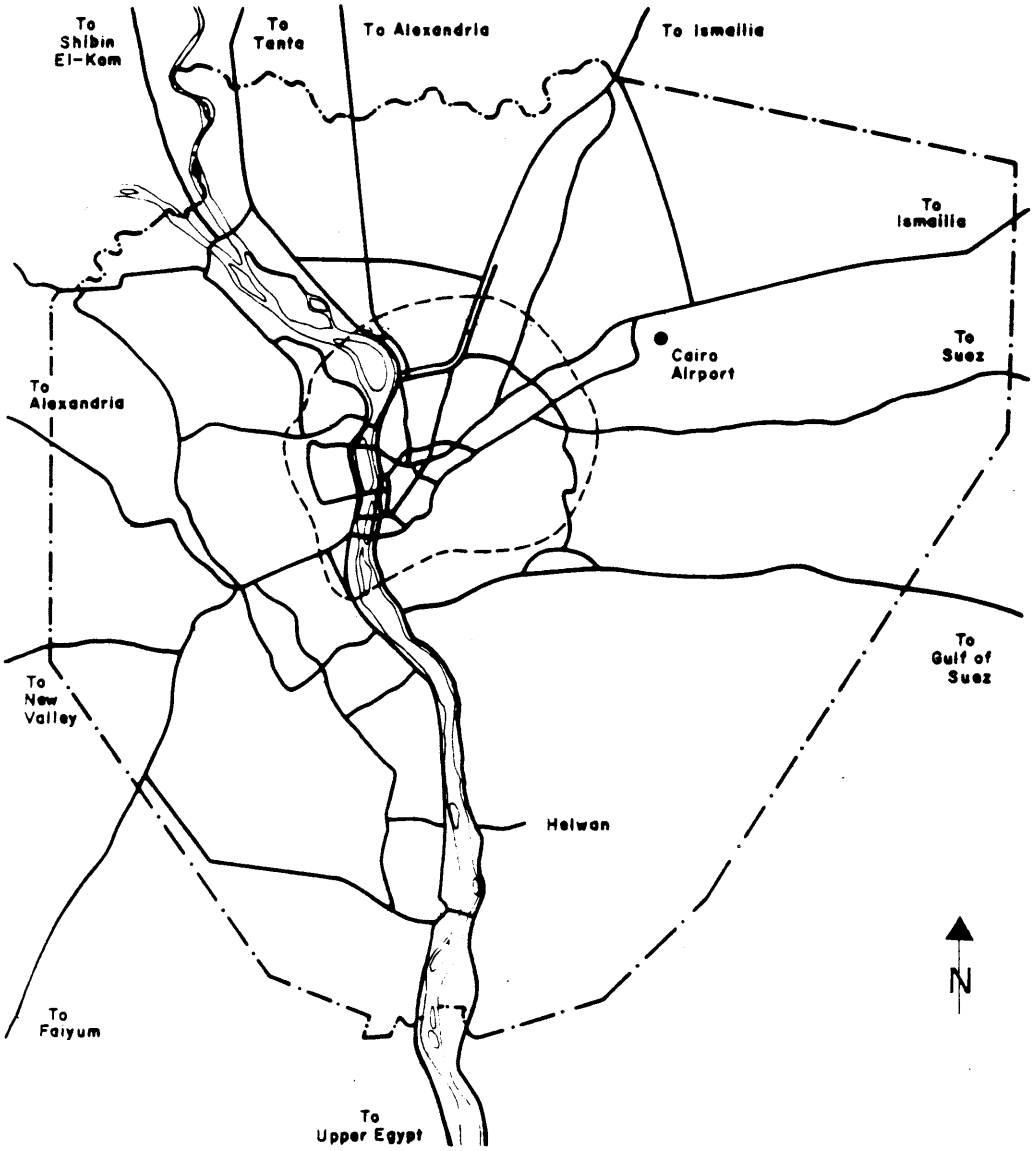
major areas or poles in Shubra Al Kheima, Mostorod, and along Ismailia Canal up to Abu Zaabal in the north, and Helwan/Tebbin on the south. Commercial and trade activites are also heavily concentrated within the C.B.D., that is, within the triangle formed by Ramses, Tahrir, and Alaba Squares for modern trade, and the corridors connecting them and the adjoining Mouski District, for traditional trade. In addition, Giza, on the west, has a significant employment base with consumer goods, factories, and private services. Finally, the main markets are located in Rod el Faraq, Ataba, Bab el Luk and Tewfikiya in the city center; in Giza and Embaba in the periphery with a fish market on Port Said Road (20).

Important to development potential is the accessibility to infrastructure and public utilities. This pertains predominantly to sewage, water, road and transportation networks. In Cairo, sanitation, first of all, is administered by a separate regional authority extending over part of the territory of all three governorates. It is served by thee sewage networks: the Cairo System in the central and east, the Giza System in the west, and the Helwan System in the South. In the Cairo region this sewage system is over loaded, disposing more than five times the combined capacity of the three systems. Water needs, secondly, are administered by a regional water authority. It is responsible for five water supply systems serving the Cairo region: the Cairo-Heliopolis system in

the central and eastern areas; the Cairo-Maadi system in the south central areas; the Giza-Embaba system in the west; the Helwan system in the south; and the Shoubra Al Kheima System in the north. As with sewage, the capacity of the system is being strained by the population demands. Thirdly, the road capacity of Cairo presently is thought to be inadequate. There are limited number of high volume roads and little separation between through and local traffic. There is a substancial need for additional modes of transportation, widening of some streets, and extending rapid transit to the periphery (21). The existing road system of Cairo is illustrated in Figure 12.

Of particular importance to site selection is the cost of land and development construction costs. For Cairo, this means looking at the difference in agricultural land and desert land. For instance, land costs on agricultural land on the urban fringe vary between 50 L.E./m^2 when far from the road (more than 100 meters) to 100 L.E./m^2 and up in locations with good access and close to existing utilities. With a flow area ratio of 3.5 (lot coverage of 85%, four floors) the cost per dwelling is between L.E. 750 and 3000 per dwelling for floor areas between 50 and 100 m^2. Utility costs, however, are minimized though with poor quality and main streets are free. These costs are estimated at L.E. 100/dwelling. For desert land, utility and roads are the important cost components since land in desert areas is free. Using 1980 prices, utility costs,

FIGURE 12: GREATER CAIRO REGION-EXISTING ROAD NETWORK



SOURCE: General Organization for Physical Planning (G.O.P.P.), PLANNING OF THE ENTRANCES TO THE CAIRO URBAN AREA, April 1976, Figure II-5, pg. II-14.

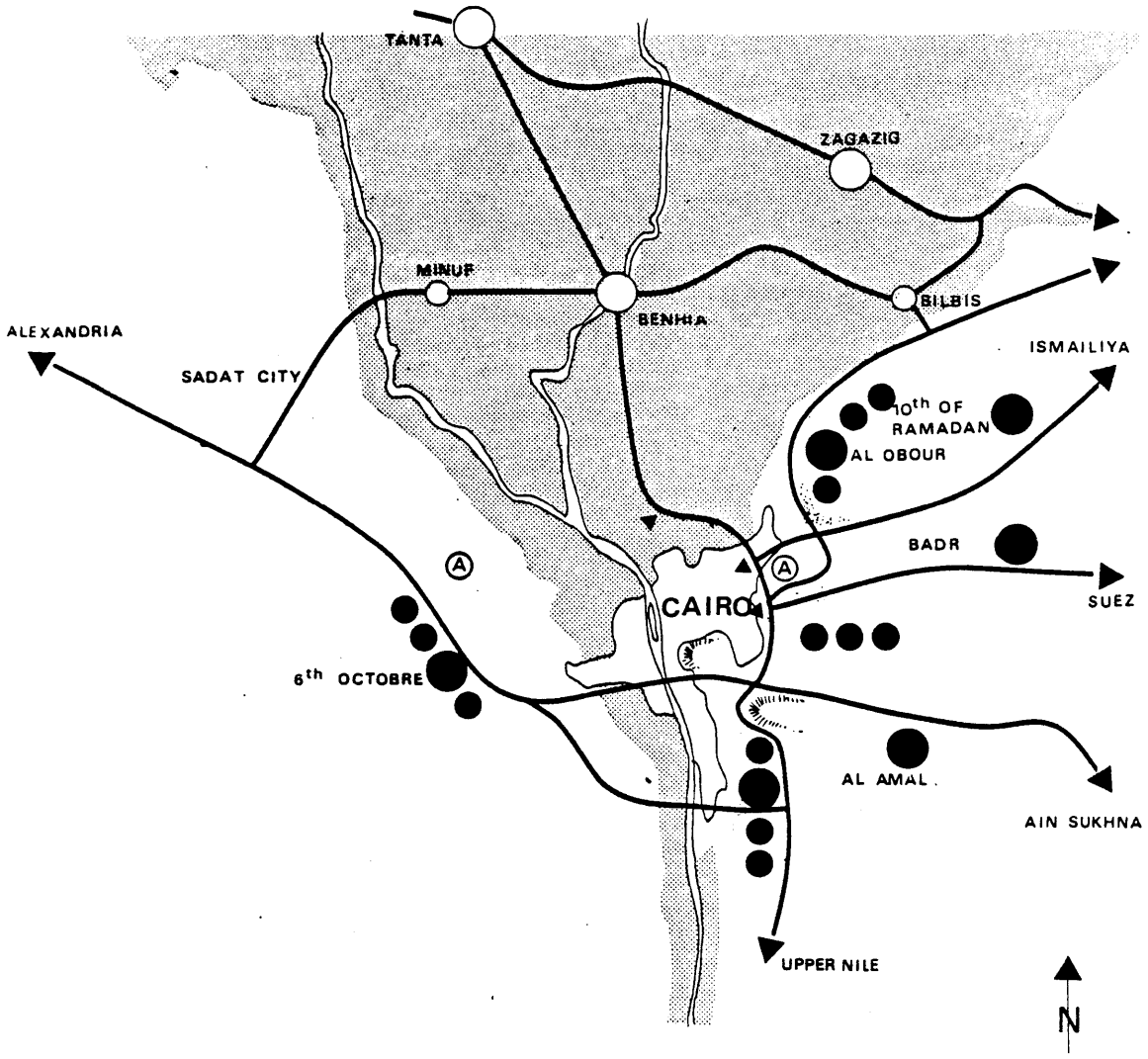
i.e. water, sewage, electricity, telecommunication, roads, are estimated at L.E. 750 per capita, or L.E. 3000 to 3750 per dwelling. This is compared to the total costs for agricultural land which vary between L.E. 850 and L.E. 3100 (22).

Of particular importance are the existing and proposed development growth patterns of the Cairo region. Up to the present, development has predominantly spread north-northeast, on agricultural land. This is particularly true of the low income sector with higher incomes locating on free desert land. A reason for this is that the total cost of a dwelling on agricultural land is cheaper than on desert land since there are no underground aquafiers on desert land. Therefore, water must be supplied from distant intake areas, i.e. Nile and Delta aquafrier, which increases development costs. Also, for low income, agricultural land is available in small plots, in existing continuity with existing urbanizations, and close to major employment areas. Finally, the law prohibiting the changing of agricultural land to other uses is not enforced, making this land flexible in its supply. Because of this, precious agricultural land is being wiped out. To counter this trend, the government is proposing to slow down and stop urban growth in the northern arable land. This is by producing strong development poles in the desert areas. One mean for this is by proposing a highway system based on an outer ring road circling Cairo to limit

future development; an inner ring road to serve the heavily urbanized area; a southern ring road on the eastern side of the Nile extending south between Maadi and Helwan and circling back to Cairo, and finally, a system of radials and other highways. This is supported by a concept of new settlement and corridors (see Figure 13). It proposes stages of development consisting of 1) three satellite cities of Al Obour, 15th of May, and 6th of October that act as anchorage points for new settlements; 2) four new towns of 10th of Ramaden, Al Bade, Al Amal, and Sadat City to give direction to development corridors; and 3) the agricultural areas, i.e. Delta, being a green space. This last stage involved completing only the eastern section of the outer ring road, and canceling the western section which crosses agricultural land. All these stages will be supported by land use controls that establish zones that accept urbanizations, another that accepts urbanizations under certain conditions and another that prevents development (23).

A final influence on site selection in the Cairo case is an implementation constraint highlighted by the fact that the range of available sites span more than one governorate jurisdiction. Each governorate has control over land development within its own boundaries and there are also numerous agencies within each governorate involved and competing for development locations and uses. For efficiency in implementation it is necessary to achieve a

FIGURE 13: LONG RANGE URBAN DEVELOPMENT SCHEME



SOURCE: General Organization for Physical Planning (G.O.P.P.), GREATER CAIRO REGION, STRATEGY PLAN, April 1982, Figure 5.1, pg. 5.2.

level of coordination among the three governorates jurisdiction and involved agencies. This could mean either vesting responsibility for the entire system within a single agency or establishing a coordinating body to make collective decisions. Also, facilitating implementation would be the effective use of existing development control mechanisms. For Cairo this pertains particularly to their legal powers of expropriation when necessary, and enforcing betterment taxes to control land prices.

Based on such an information inventory, a preliminary analysis of the available sites can be made according to their relationships to the "existing" urban features of Cairo. These (as elaborated in the chapter on Planning Criteria) include physical characteristics, accessbility to employment, infrastructure and transportation, land and development costs. This kind of analysis for two of the sites, Number 0, "El Khanka", and Number 16, "El Ownraniah West", is summarized in Figures 14 and 15. For instance, El Khanka, located in the southern limit of the Giza urban area, presently has good physical features, is readily accessible to employment in Giza and central Cairo, infrastructure, and transportation (in proximity to main route to the pyramids). Consequently, it has a high land price with relatively low development costs. El Ownraniah, located in the eastern portion of the Qalyubiyah Governorate, has good physical features also, but presently does not have convenient access to infrastructure,

FIGURE 14

Property No. 0 - El Khanka

Location:	The property is located at the western side of El Khanka neighborhood, in the eastern part of Qalyubiyah Governorate.
Area:	180 feddans.
Designation:	Nonagricultural land suitable for development.
Ownership:	Private ownership.
Topographic Conditions:	The land is flat and considered very suitable for development.
Sewerage:	The property is not covered by the Cairo sewerage system, but could be served by a local system.
Water:	The property is not serviced by the Cairo water supply system.
Major Roads and Transportation System:	The subject property is not covered, nor it is scheduled to be covered, by any major road network. However, it is presently serviced by the auxiliary roads which service the El Khanka neighborhood.
Business Activities, Social Services, and Accessibility to Major Workplaces:	Because the property is close to El Khanka neighborhood, it will benefit from the existing business activities and social services . Any housing development will also have access to several workplaces in the neighborhood.
Environmental Hazards:	The property does not have any known environmental constraints which would affect its development for housing.
Development Costs Category (not including land acquisition):	Relatively high cost per feddan (LE64,000) because of infrastructure gaps. Sum for 180 feddans = LE 12 million, infrastructure, earthwork, and engineering.

SOURCE: Dames & Moore (CIDAT), CAIRO METROPOLITAN AREA LAND USE/ INFRASTRUCTURE DEVELOPMENT STUDY - Final Report, for USAID, September 1981, Appendix E.

FIGURE 15

Property No. 16 - El Owraniah West

Location:	Close to the southern limit of the Giza urban limit.
Area:	240 feddans.
Designation:	Agricultural land.
Ownership:	Mixed public/private.
Topographic Conditions:	Flat.
Sewerage:	The property is already served by the existing system.
Water:	The property is already served by the existing system.
Major Roads and Transportation System:	The property is close to existing road networks and is adjacent to the Pyramids Road.
Business Activities, Social Services, and Accessibility to Major Workplaces:	The Cairo and Giza business districts are nearby.
Environmental Hazards:	No environmental hazards.
Development Cost Category (not including land acquisition):	Medium low cost per feddan (LE 42,000). Sum for 240 feddans = LE 10 million, engineering, earthwork, and infrastructure.

SOURCE: Dames & Moore (CIDAT), CAIRO METROPOLITAN AREA LAND USE/ INFRASTRUCTURE DEVELOPMENT STUDY - Final Report, for USAID, September 1981, Appendix E.

transportation and only limited employment opportunities in the vecinity. Therefore, it has a low land price and a relatively high development cost because of the distance to existing infrastructure sources.

An evaluation of these site characteristics can give a preliminary view of the sites development potential. This can be achieved either graphically through maps and overlays, or more scientifically, through a matrix. Of the two methods, the matrix format has the advantage of allowing each site to be compared with the other on the basis of established criteria appropriate for the particular region (in this case, Cairo, Egypt). Each criteria can be given the same relative importance or weight and either checked off as in Figure 4 or scored on a range of 4-0 as in Figure 5. In the first instance, it identifies which of the criteria are favorably represented by the site while the latter gives a range of favorability, i.e., 4:excellent, 3:good, 2:fair, 1:poor, 0:site exclusion. (The scale can be reversed). The results are then summed for a total score and either be compared to an acceptable range or sites numerically ranked. If desired, criteria can also be weighted more heavily than others, i.e., land costs, and for access to employment, etc. reflecting instituional, geographical, social or economic priorities, and scored accordingly as illustrated in Figure 6.

In the Cairo example this weighted priority method was utilized in this preliminary evaluation. The results of the matrix for the two sites are illustrated in Figure 16. At this level, these two sites are extremes in desireable and least desireable potential for the study area.

This type of preliminary evaluation that relates sites to existing conditions, though informative and with a purpose, in many cases is not enough. It will give only a partial idea of the development potential of the sites that can many times arrive at unrealistic results. Such is the case of Cairo. For evaluating development potential of sites in Cairo, it is necessary to also consider the additional factors of future urban growth patterns and policies, the land market factors, and the ability of the government to develop settlement projects. In the case of El Ownraniah West, these concerns present restrictions which compromise its preliminary positive development potential. For instance, the site is on private agricultural land. Future development policies of Cairo prohibit (or looks unfavorable upon) development on this type of land use. In addition, if alternative uses are permitted, this highly accessible land will quickly go to competitive and more economically profitable uses than housing, raising land prices considerably. Therefore, the only solution for the government to develop this land for housing would be for it to act quickly if not immediately, to purchase and develop land. This is unrealistic in the case of Cairo! It would

FIGURE 16

WEIGHTED DEVELOPMENT POTENTIAL SCORES

CRITERIA	Weight %	Initial Score (0-4)/Weighted Score	
		(16) "El Omraniah West"	(0) "El Khanka"
Topography	15	4/60	4/60
Environmental	10	4/40	4/40
Water	12	4/48	2/24
Sewage	8	4/32	1/ 8
Electricity	8	3/24	1/ 8
Roads	10	4/40	2/20
Workplace	10	4/40	3/30
C.B.D.	5	4/20	4/20
Ownership	12	2/24	2/24
Land Price	10	1/10	2/20
TOTALS		34/338	25/254

SOURCE: Dames & Moore (CIDAT), CAIRO METROPOLITAN AREA LAND USE/INFRASTRUCTURE DEVELOPMENT STUDY, Final Report, for USAID, September 1981, Appendix F.

also necessitate walk-up units as opposed to sites and services since in Cairo they can be developed much more quickly at reduced costs per capita.

In the case of El Khanka, poor preliminary development potential is mitigated by the other factors of consideration. For instance, though located in the northeastern sector some distance from the urban center of Cairo, it will in the future, be in close proximity to the proposed new town of "El Obour" as elaborated in the strategic planning concept. This means that infrastructure, transportation, and employment opportunities will be extended into this area improving access and reducing development costs. Therefore, this site will have tremendous development potential in the future. To take advantage of this, the most opportunistic strategy would be to acquire the land in the immediate future before land prices and demand for land increase and develop it when infrastructure networks are established for the new town. With the time element and the reduced land and development prices that are possible, a small lot subdivision project of sites and services is feasible for this site.

The significance of these additional concerns is that the development of settlement projects take time to complete, and the political and market situations and proposed growth concepts will impact and/or constraint project

feasibility and, therefore, its success. Though the existing urban features indicate a degree of short range potential, future long range potential is important for a realistic evaluation. In the case of Cairo, these additional factors in fact, reverse the desireability of the two sites for development derived from the existing conditions.

Although this evaluation for development potential reaches some conclusions about the desireability of the available sites to the settlers, a final consideration of affordability for those affected, i.e., institution and residents, still needs to be evaluated in more detail for the most desireable sites. The Bertaud Model is a particularly useful tool for doing this. Using realistic estimates of land and development costs, it assists in determining if costs can be minimized within the reach of the settlers ability to pay. In the Cairo example, the maximum affordable payments by the targed low income groups is L.E. 30/year for land for housing (24). Furthermore, for desert land to be feasible, it will have to be as affordable as agricultural land. This means that for the desert settlements only minimal utilities and road networks should be supplied (at least in the first stage) to minimize total average costs per dwelling.

With this type of process, as exemplified through the Cairo case example, sites can be identified, analyzed, determined

and evaluated for their development potential and design constraints. This is important for increasing the possibility of a successful project. The format, however, implies that locational needs are of greater priority than issues of affordability. If the site is affordable but locational needs are not met, the likelyhood of success of the project is reduced, particularly for the lowest income group because of the added costs overtime in transport, etc.

This type of format should be performed by either or both the personnel of the responsible local agency and/or the international consultants in considering sites for projects of this type.

CHAPTER IV.

CONCLUSION

Site selection is an important phase or aspect of the development process for low income settlement projects. Though all phases have their importance, site selection is one concern that has particular impact on the success of the project. This is because location affects the residents' ability to acquire their needs and their affordability of the project. If the site is not acceptable to the settlers, they will not live there, at least for very long. Therefore, site selection should be regarded with seriousness within a structured framework of analysis.

In the selection process it is important to consider and evaluate a range of criteria. Generally, it is not uncommon, particularly by public organizations, to consider land costs as the principal factor. The cheaper the site the more acceptable. However, utilizing this factor alone has generally led to inappropriate choices, because of increased costs of living at a location with poor access, physical features, and/or environmental hazards. For this reason other criteria as elaborated in the thesis are necessary.

In the evaluation process it is also important to understand that sites are not perfect and that there are no two sites similar in advantages and disadvantages.

Generally, for instance, the better sites with good physical featues and/or access, have higher land costs. In addition, one site may have poor physical features but good access while another may have the opposite. This situation means that "trade-offs" are necessary among key planning elements for a selection that best provides for the needs of the settlers but which is also affordable. This places an importance on priorities based on cultural, social, economic, and political characteristcs of the region and of the beneficiaries of the project.

To facilitate the site selection process, methods and tools are available. For instance, a matrix method of evaluation is convenient and advantageous because it is visually readable, and sites evaluations can be readily summarized and compared to alternative sites. In addition, mathematical models such as the "Bertaud Model" are also valuable tools. However, precaution must be taken to understand their limitations. In isolation, it can not guarantee a successful project. For instance, the Bertaud Model deals with affordability and utilizes limited data. Other important information such as the extent of accessibility and other locational characteristics, cannot be incorporated into the model to make a realistic assessment of alternative sites. This limitation implies a selection "process" for greater prospects of a successful project. Selection should first consider identification of sites, analysis and evaluation based on locational

qualities and then, with the assistance of mathematical models, evaluate ranges of affordability for the most desireable sites.

In addition, though it is desireable to select a site for low income settlement projects from a creditable plannning process to ensure best prospects of success, the realities of developing countries do not dictate or allow this to happen. This is because of an existing free land market which, when uncontrolled, tends toward higher land prices because of speculation. This is reinforced by an existing political framework and its response to control it. The public institutions are, for example, excessively bureaucratic which makes them slow to respond. Sometimes, they also have conflicting responsibilities which creates confusion, competition and power struggles not condusive to a planning process. This framework is reinforced by decision makers who take advantage of the land market and select sites based on their own personal monetary motives regardless of the needs and desires of the low income beneficiaries. These political conditions create problems in implementing land controls necessary to acquire land at desireable and affordable locations.

An option to alleviate this situation is the establishment of a "Land Acquisition and Development Agency" concerned for the needs of the low income sector. This institution could facilitate land acquisition and development of

suitable sites through the use of a viable planning process. However, it would require the support of the government to implement appropriate land development controls and adequate funding to accomplish its objectives.

In closing, appart from the technical issues of site selection for settlement projects that are necessary to satisfy the needs of the low income at affordable prices elaborated in this work, there is another factor that is potentially more influencial in site selection and needs mentioning: the political objectives of the decision makers. Housing for the poor is a tremendous problem for the government particularly in developing countries and can be politically explosive. Therefore, governments sometimes, in order to survive politically, must demonstrate that they are doing something about this issue. They consequently, pick a highly visible site for maximum political impact. This is at the expense of technical considerations. These sites are generally poor sites with high development costs and/or high costs because of reduced accessibility. In the long run, these sites may never get developed and if they do, they may be unsuccessful. As a result, new sites will be needed later when the political impacts wear off and realities set in.

This situation implies that just as there are trade-offs among the technical factors there is a need for trade-offs between the political and technical factors as well. When

there are political objectives involved, they should be weighed and evaluated against the technical aspects of the site which may, in the long run have more positive political impact, than it would have otherwise.

NOTES

1. Horacio Caminos and Reinhard Goethert, URBANIZATION PRIMER, (Cambridge, Ma, 1978), pp. 105-106.

2. Caminos, pp. 65, 105.

3. American Society of Planning Officials (ASPO), SOILS AND LAND USE PLANNING, (Chicago, Ill., 1966), p. 12.

4. Caminos, p. 68.

5. Donald A. Davidson, SOILS AND LAND USE PLANNING, (New York, 1980), p. 60.

6. W. H. Ransom, SOIL STABILIZATION, A PREVIEW OF PRINCIPLES AND PRACTICE, Tropical Building Studies No. 5, Department of Scientific and Industrial Research, Building Research Station, (London, 1963), p. 5.

7. Tomas Sudra, LOW INCOME HOUSING SYSTEM IN MEXICO CITY, Ph.D., Thesis, MIT, Cambridge, 1976, p. 407.

8. Johannes F. Linn, "Policies for Efficient and Equitable Growth of Cities in Developing Countries", World Bank Staff Working Paper No. 342, July 1979, pp. 186-187.

9. Sudra, pp. 335-336.

10. Harvey M. Rubenstein, A GUIDE TO SITE AND ENVIRONMENTAL PLANNING, (New York, 1969, first edition, 1980, second edition), pp. 26-1, 33-2.

11. Caminos, p. 76.

12. Orville Grimes, HOUSING FOR LOW-INCOME URBAN FAMILIES, (Baltimore, 1976), pp. 71-72.

13. Planning and Development Collaborative International, Inc. (PADCO), GUIDELINES FOR FORMULATING PROJECTS TO BENEFIT THE URBAN POOR IN DEVELOPING COUNTRIES, Vol. 1, prepared for AID, (Washington, D.C., April 1976), pp. 18-19.

14. PADCO, GUIDELINES, p. 26.

15. United States Agency for International Development (USAID), FOCUS ON URBAN DEVELOPMENT: PERCEPTIONS, PROBLEMS, APPROACHES, AND NEEDS, (Washington, D.C., October 1972), pp. 73-83.

16. Dames and Moore (CIDAT), CAIRO METROPOLITAN AREA LAND USE/INFRASTRUCTURE DEVELOPMENT STUDY (FINAL REPORT), (for USAID, September 1981), pp. 4:8-17.

17. For more complete discussion of this alternative, see Dames and Moore document, Section 3.3.

18. PADCO, "The Bertaud Model", Technical Paper No. 2, for World Bank, (December 1981), p. 4.

19. Malcolm D. Rivkin, Techniques for Site Selection, prepared for USAID Shelter Workshop, 1979-1980, pp.35. p-2-5.

20. Ministry of Transport, GREATER CAIRO TRANSPORTATION PLANNING STUDY, Vol. A., May 1973, pp. 2-20,-24.

21. Dames and Moore, pp. Appendix G.

22. General Organization for Physical Planning (G.O.P.P.)et al, GREATER CAIRO REGION, STRATEGY PLAN, April 1982, pp. 6.1-3.

23. General Organization for Physical Planning (G.O.P.P.)et al, pp. 5.3-5.

24. Dames and Moore, pp. Appendix J-1.

BIBLIOGRAPHY

Abrams, C., MAN'S STRUGGLE FOR SHELTER IN AN URBANIZING WORLD, the MIT Press, Cambridge, MA, 1964.

American Society of Planning Officials (ASPO), SOILS AND LAND USE PLANNING, Soil Science Society of America, Chicago, Illinois, 1966.

Bartelli, L.J., Klingebiel, A.A., Baird, J.V., and Heddleson, M.R., SOILS SURVEYS AND LAND USE PLANNING, published by the Soil Science Society of America and American Society of Agronomy, Madison, Wisconsin, 1966.

Caminos, H. and Goethert, R., URBANIZATION PRIMER, MIT Press, Cambridge, MA, 1978.

Chana, Tara S., SITE AND SERVICES HOUSING PROJECTS IN KENYA, Thesis M.C.P., MIT, 1975.

Dames and Moore (CIDAT), CAIRO METROPOLITAN AREA LAND USE/ INFRASTRUCTURE DEVELOPMENT STUDY (FINAL REPORT), for USAID, September 1981.

Davidson, Donald A., SOILS AND LAND USE PLANNING, Longman Group Limited, Inc., New York, N.Y., 1980.

De Chiara J. and Koppelman, L., MANUAL OF HOUSING/PLANNING AND DESIGN CRITERIA, Prentice-Hall, Inc., Englewood Cliffs, N.J., 1975.

Doebele, William A., "The Chartwell Notebooks: Two Cautionary Tales on Public Land in Developing Countries", In Dalton Kehoe and Others (eds.), PUBLIC LAND OWNERSHIP: FRAMEWORKS FOR EVALUATION, Lexington, MA, D.C. Helath, 1976.

Dunkerley, Harold, et al, "Urban Land Policy Issues and Opportunities - Vol. 7, Staff Working Paper No. 283", World Bank, Washington, D.C., May 1978.

Flores-Rangel, Maria G., LAND OWNERSHIP PATTERNS AS DETERMINANT OF THE AVAILABILITY AND ACCESSIBILITY OF URBAN LAND FOR RESIDENTIAL USE. CASE STUDY OF MERIDA, VENEZUELA, Thesis, MCP, MIT, January 1981.

Gakenheimer, R., "The Urban Transportation Plan: A Composite Case Study", 1978.

General Organization for Physical Planning (G.O.P.P.), et al, EL-OBOUR MASTER PLAN STUDY, PHASE A/B, AREA ANALYSIS, Prepared for the Ministry of Reconstruction and State for Housing and Land Reclamation, Cairo, Egypt, 1980.

General Organization for Physical Planning (C.O.P.P.), et al, GREATER CAIRO REGION, LONG RANGE URBAN DEVELOPMENT SCHEME, STRATEGY PLAN, prepared for the Ministry of Development, State Ministry for Housing and Land Reclamation, Cairo, Egypt, April 1982.

General Organization for Physical Planning (G.O.P.P.), et al, PLANNING OF THE ENTRANCES TO THE CAIRO URBAN AREA, SUMMARY REPORT, prepared for the Ministry of Housing and Reconstruction of the Arab Republic of Egypt, Advisory Committee for Reconstruction, April 1976.

Grimes, O., HOUSING FOR LOW-INCOME URBAN FAMILIES, John Hopkins University Press, Baltimore, 1976.

Grindley, William and Merrill, Robert, SITES AND SERVICES: THE EXPERIENCE AND POTENTIAL, International Bank for Reconstruction and Development (IBRD), International Development Association, Washington, D.C., May 1973.

Herbert, John D., URBAN DEVELOPMENT IN THE THIRD WORLD, POLICY GUIDELINES, Praeger Publishers, New York.

IBRD, "Housing", Sector Policy Paper, World Bank, May 1975.

Linn, Johannes, F., "Policies for Efficient and Equitable Growth of Cities in Developing Countries", World Bank Staff Working Paper No. 342, July 1979.

Masaya-Marotta, Fernando, POPULAR URBAN SETTLEMENTS IN GUATEMALA: GUIDELINES FOR PHYSICAL DEVELOPMENT, Thesis, M.Arch.A.S., MIT, June 1980.

Ministry of Transport, Arab Republic of Egypt, GREATER CAIRO TRANSPORTATION PLANNING STUDY, VOL. A., May 1973.

Nez, George, "Low Cost Housing Potential Locations", USAID, 1973.

Oh, Byungho, URBAN TRANSPORTATION PLANNING IN LOW INCOME AREAS, Ph.D., Thesis, MIT, January 1980.

Parker Jr., George R., PHYSICAL GUIDELINES FOR POPULAR URBAN SETTLEMENTS IN DEVELOPING COUNTRIES, Thesis, M.Arch., MIT, June 1970.

Planning and Development Collaborative International, Inc. (PADCO), GUIDELINES FOR FORMULATING PROJECTS TO BENEFIT THE URBAN POOR IN DEVELOPING COUNTRIES, VOL. 1, BACKGROUND GOALS, AND PROJECT OPPORTUNITIES, prepared for Agency for International Development, Office of Urban Development Bureau for Technical Assistance, Washington, D.C., April, 1976.

PADCO, "The Bertaud Model, A Model for the Analysis of Alternatives for Low-Income Shelter in the Developing World", prepared for Urban Development Department, Technical Paper No. 2, World Bank, December 1981.

Popko, Edward, SITES AND SERVICES POLICIES FOR LOW INCOME HOUSING IN COLOMBIA, Thesis, Ph.D., Urban Studies, MIT,1980.

Ransom, W.H., SOIL STABILIZATION, A PREVIEW OF PRINCIPLES AND PRACTICE, Tropical Building Studies No. 5, Department of Scientific and Industrial Research, Building Research Station, Her Majesty's Stationary Office, London, 1963.

Rivkin, Makolm D., "Techniques of Site Selection", prepared for USAID, Shelter Workshop, 1979-80.

Rubenstein, Harvey M., A GUIDE TO SITE AND ENVIRONMENTAL PLANNING, John Wiley and Sons, Inc., New York, 1969 (1st. ed.), 1980 (2nd. ed.).

Ruck, Harold A., IMPACT OF TOPOGRAPHY ON LOW INCOME SETTLEMENT PROJECTS, A MODEL APPROACH, Thesis, M.Arch.A.S., MIT, June 1980.

Stone, P.A., THE STRUCTURE, SIZE AND COSTS OF URBAN SETTLEMENTS, the University Press, Cambridge, Great Britain, 1973.

Sudra, Tomas, LOW INCOME HOUSING SYSTEM IN MEXICO CITY, Thesis, Ph.D., Urban Studies, MIT, Vol. I., and II, 1976.

THE URBAN EDGE, "Site Selection", published by the Council for International Urban Liason, 3/2, Washington, D.C., February, 1979.

Turner, Alan, THE CITIES OF THE POOR, St. Martin's Press, New York, 1980.

United Nations, DISASTER PREVENTION AND MITIGATION, LAND USE ASPECTS, VOL. V., Office of the United Nations Disaster Relief Organization, Geneva and New York, 1978.

United Nations, IMPROVEMENTS OF SLUMS AND UNCONTROLLED SETTLEMENTS, Department of Economic and Social Affairs, ST/TAO/SER.C/124, New York, 1971.

United Nations, LAND FOR HUMAN SETTLEMENTS, Department of Economic and Social Affairs, ST/ESA/69, New York, 1977.

United States Agency for International Development (USAID), FOCUS ON URBAN DEVELOPMENT: PERCEPTIONS, PROBLEMS, APPROACHES, AND NEEDS, Bureau for Technical Assistance, Urban Development Staff, Washington, D.C., October 1972.

USAID, PROPOSED MINIMUM STANDARDS, IDEAS AND METHODS, Exchange No. 64, 602.2, Housing Codes and Standards, Dept. of Housing and Urban Development, Office of International Affairs, Washington, D. C., May 1966, June 1970 (Reprint).

Van Huyck, Alfred, PLANNING FOR SITES AND SERVICE PROGRAMS, Agency for International Development, Office of International Affairs, Washington, D. C., July 1971.

Way, D.S., TERRAIN ANALYSIS: A GUIDE TO SITE SELECTION USING AERIAL PHOTOGRAPHY INTERPRETATION, Dowden, Hutchinson and Ross, Inc., Stroudsburg, Pa., (Community Development Series), 1973.

World Bank, "Sites and Serivces Projects", a World Bank Paper, April 1974.

World Bank, "Urbanization", Sector Working Paper, June 1972.

World Bank, "Urban Transport", Sector Policy Paper, May 1975.