A SITE AND SERVICES MODEL, BANGKOK, THAILAND

by

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B. Arch. Chulalongkorn University (First Class Honor)
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June 1981

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MASSACHUSETTS INSTITUTE OF TECHNOLOGY
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Submitted to the Department of Architecture on May, 1981 in partial fulfillment of the requirements for the Degree of Master of Science in Architecture Studies at the Massachusetts Institute of Technology

ABSTRACT

This thesis is divided into 2 parts. The first part is the study of low-income housing situation, government housing policies, and the evaluation of the existing low-income housing dwelling environment in Bangkok. The work is based on surveys, evaluations and comparisons of four low-income housing systems which are "pay land rent" squatter settlement before and after upgrading, "pure" squatter settlement, public housing and self-help housing. The physical environment of each of the housing system is analyzed/compared in terms of land utilization/circulation efficiency and the level of series. The housing situation and the government housing policies are discussed and analyzed. Based upon the first part of the study, a site and services model is proposed to compared with the government existing one being developed. The comparison are illustrated the wasteful practices in site and services projects in terms of land utilization and circulation and negative social, economic and administrative effects occuring. Finally, a model is proposed for site and services projects which is applicable for various conditions.

The case study analysis and the comparison of existing and proposed projects are based on the methodology developed in the Urban Settlement Design for Developing Countries Program under the direction of Professor Horacio Caminos.

Thesis Supervisor: Horacio Caminos
Title: Professor of Architecture, M.I.T.
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The thesis is divided into 2 parts. The first is the description and evaluation of existing low-income dwelling environments and the second is the description and sequence analysis of National Housing Policy in the Bangkok Metropolitan area. The focus of the study is presented as a proposal for a site and services model located in Bangkok.

The study is derived from my field research carried out in the summer of 1980-81. Surveys and field research included socio-economic and physical aspects of the low-income settlements. Additional information in terms of maps, reports and National Housing Policy had been collected from various authorities and institutes including the Department of Town and Country Planning, the National Statistic Office of the Prime Minister, the National Housing Authority, the Bangkok Metropolitan Municipality, the Asian Institute of Technology, and Chulalongkorn University. The case studies and the National Housing Policies are utilized as supporting and complementary references for the proposed model. The existing site and services is utilized as a comparison with the proposed model. The case studies analysis and the comparison of existing and proposed projects are based on the methodology developed in the Urban Settlement Design for Developing Countries Program under the direction of Professor Horacio Caminos.

I gratefully acknowledge the guidance and support of Professor Horacio Caminos during the two years of the study. I also sincerely appreciate the assistance, encouragement, and friendship of Reinhard Goethart at various stages of the study, to Happy and members of my class of 1981: Hseuh-Jane Chen, Triada Kitsiou, Mayank Shah, Mohamed el Sioufi, and Joseph Morog and the class of 1980 and 1982 for their companionship and comments. I give all credit to my sister, Jarin Kiatfuengfoo, for her assistance in the field survey and photography.

I am also indebted to many people at the Department of Town and Country Planning, the Bangkok Metropolitan Municipality, the National Housing Authority especially Samart Jiratikasam, Ubonwan Ocharoen, Sitichok Yodpayung and many other who directly or indirectly contributed to this study.

I also wish to extend my gratitude to Linda Laplante for her friendship and assistance when it was needed most.

I here express my deep appreciation to Herbert Ng, for his encouragement, patience and support.

Finally, my debt to my parents and family members for their love, guidance and support, is expressible.
INTRODUCTION

For the past 20 years, the pressures of urbanization have had a great effect on Bangkok, the capital of Thailand. Bangkok's rapid population growth is a result of both natural growth and immigration. At the present time, 10% of the total population of Thailand (4.4 million) live in Bangkok. The immigration rate continues to increase because of three main reasons: the first is the good economic condition due to the rapidly increasing industrial productivity as a result of the National Development Plan; the second is the centralization of transportation, national administration, education, culture, religion; and the third is the arid land, adverse weather and the change of seasonal monsoons. This fast population growth in Bangkok has given rise to immense social, economic, and physical problems which become worse because of the government's limited resources.

The housing situation is a major issue because both natural growth and immigration are mainly focused on the low-income sector. Consequently, there are currently 300 slum settlements and all exhibit a deteriorated condition. These settlements are attributed to the scarcity of developed urban land, high cost of construction, unavailability of construction materials, inadequate capital and lack of institutional finances. The government administration was cognizant of these needs to provide both quality and quantity of dwelling for low-income people and was actively pursuing a pragmatic housing policy. The policy implement was in the form of massive walk-up apartments, constructed throughout the city. This housing policy faced many problems: the high cost of construction, the heavy government subsidy to the residents, the difficulty of residents' adaptation to the new way of living and the resale of housing intended for low-income to higher income people.

As the result of the ineffective initial policy, a new policy was adapted for slum upgrading and site and services development with expandable core houses. Site and services is a national policy which is implemented in all urban areas. There are three site and service projects in the Bangkok urban area: Tung Song Hong, Rad Krabang, and Rang Sit. The site and services project at Tung Song Hong is a pilot development now underconstruction which aims to achieve reduced government subsidy, lower costs of construction and appropriate housing affordable by low-income people. Moreover the site and services project provides flexibility and variety which allows people to organize their lots so that they can easily adapt themselves to the new environment. The World Bank provides technical assistance to the site and services project at Tung Song Hong.

This study concentrates on the analysis of the housing situation of low-income sector and the initial site and services project at Tung Song Hong. Selected case studies representing the main housing systems of the very low and low-income groups have been studied as a reference to the major problems and the needs of the people. The case studies are compared and evaluated in terms of land utilization, density and circulation efficiency. Included in the
case studies are squatter settlements (both illegal and those that pay a land rent), Public housing, and self-help housing. The initial site and services project at Tung Song Hong is studied more in detail in terms of physical planning: land utilization, land subdivision, circulation pattern and infrastructure networks. The studies clearly show that in this project the physical design has not achieved the policy aims of cutting down construction and maintenance costs.

As the result of the studies, a modified layout is designed at Tung Song Hong to compare with the one being built. Essentially the redesigned layout is concerned with reducing costs of urban development and public responsibility by optimizing the physical design elements of the settlement. The design aims toward an efficient layout: to minimize public area, circulation areas and lengths, infrastructure and utilities length, and to maximize private and usable area. Private responsibilities are stressed and community resources are utilized at a maximum. The project also considers the existing problems in low-income housing. The layout concept is appropriate to the other site and services projects and is readily adaptable to different site conditions.

In summary, this study is intended to develop guidelines for those involved in planning of residential developments and as a reference in the formulation of housing policies.
HOUSING DEMAND AND SUPPLY

The growth of Bangkok's housing supply has been characterized by private formal sector output catering only to the high and middle-income groups. The most important source of low-income housing supply is squatter settlement which accommodates over a million people or 25% of Bangkok population. At present, there are about 300 squatter settlements and some small squatter settlements scattering throughout the city. The population growth rate of Bangkok is 6.2% per annum as a result of the increase in immigration and the increase in natural growth rate. During the past few years, the average number of new households has been about 30,000 a year, while only 17,000-20,000 building permits for residential construction have been built annually. This means that 10,000-13,000 units have been built without permits.

The national housing movement started in 1950. During the first period from 1950-1972, there were 4 agencies working on low-income housing separately and effort duplicated without specific objective. During the second period from 1973-1974, the National Housing Authority (NHA) was formed as a single agency to cope with the low-income housing problems. The third period from 1975-1977 the NHA planned the first 5-year plan for 1976-1980. They estimated that by 1980 there would be a shortage of about 160,000 units for households earning less than US$ 250 a month. They used the arithmetical approach to measure the housing shortage by establishing a minimum standard for housing. This created a severe housing shortage because most of the existing low-income housing did not meet the standards. The arithmetical terms were: new construction=total households-good housing stock (meet the standard). Then the policy is to construct new public housing in sufficient numbers.

In 1976 the NHA planned to construct 16,000 housing units each year in Bangkok. After 2 years of implementation, the government heavily subsidized for low-income housing and built middle and high income housing aiming to make profit in order to balance the budget. But this last goal was a failure because the government housing could not compete with that of private sectors.

Since 1978, the NHA policies have moved into new directions. The first was to upgrade the existing deteriorated settlements. Slum upgrading program could be distinguished by three main components; physical, socio-economic and land tenure. The second direction was to provide sites and services with expandable core houses as new housing supply which costs less than public housing mainly of walk-up apartments.

In the first direction, the major problem is security of land tenure. The common characteristic of the land tenure in these settlements is that people pay land rent to landlord with various intermediate states of tenancy existing in the form of lease-hold contracts ranging from a year to a maximum period of 30 years. Traditionally and even today to become one's own landlord is still a much valued goal. And consequently, The NHA set up ideal goal to convince the landlords to extend 30 year leases to the tenants. But only a few cases were succeeded. Land tenure security will continue to be crucial part of upgrading policy.

For the second direction, a presently affordable policy to provide housing supply with land tenure security is site and services with expandable core houses. In the long run this policy alone cannot satisfy urgent housing needs of the immigrants. Therefore the Fourth National Social and Economic Development Plan stresses decentralization and the creation of major centers in every region as a primary solution for immigrant problem and the uncontrolled growth of the capital.
LOW INCOME HOUSING LOCATION

The location of the early public housing projects is at the center and inner ring of the city. Due to the rapid growth of the urban area, the present location of public housing projects is at the periphery. The locations of site and services projects are also at the periphery of the city because of the scarcity and high cost of land in the city. Another reason is the new scheme to establish new communities adjacent to the industrial area at the periphery of the city.

SQUATTER SETTLEMENT LOCATION

Low-income group provides the main source of labor for all economical sectors such as commercial, industrial, construction and domestic services. They settle in the areas that they can find or change job easily and try to commute to work within walking distance to reduce transportation cost. As a result, approximately 300 squatters "pay land rent" settlements are concentrated in the center and inner ring of the city.

PUBLIC HOUSING LOCATION 1:500000
In 1979, the government minimum wage was US$ 810 per year. The absolute poverty line was US$ 822 per household per year as reported by the World Bank. The National Housing Authority classified the income groups as follows: below US$ 900 as very low income; between US$ 900-1800 as low income; between US$ 1800-3000 as middle income; and the rest as high income. Bangkok residents who have income below the absolute poverty line is counted about 10% of city population and about 54% of total urban poverty population in Thailand. The low-income group is counted about 33% there-
fore the total low-income group is 43% of total population in Bangkok. From the recent socio-economic survey, the percentage of low-income group is increasing rapidly and creates an urgent need of low-income housing.

As the result of this situation, low-income housing deserves a serious study. This study will concentrate mainly on low-income housing types with their needs and problems.

There are 7 different low-income housing systems as follows:

1. The first system is the squatter which is the most common form of settlement for low-income groups. In 1979 approximately 1 million people or 25% of the total population lived in squatters scattering all over the city. Squatters have been considered as a deteriorated area with polluted environment. Most of the dwellings in the squatter are temporary wooden structures built on unfilled land with inadequate utilities. There are 2 subsystems of squatters. The first is pure squatters which people usually build on government owned land without paying rent and which groups together in large settlement. There are also small pure squatters of 20-50 families each that have houses built on small private of government-abandoned strip of land such as along the railroad right of way or in the canal. The second is pay land rent squatter with usually 200-300 families grouped together and houses built on small lots belonging to private landlords.

2. The second system is the institutional housing. The National Housing Authority is the only government agency that provides subsidized walk-up apartments. Recently, the NHA also provides squatter upgrading program and site and services project. The Asian Institute of Technology is the only private institution that organizes the first self-help housing for low-income groups as the experimental project.

3. The third system is the tenement which is the subdivision of large house or shop house into small cubicles and rent to the low-income people.

4. The fourth system is the workers' housing which employers provide for their employees. There are 5 subsystems: the first is workplace site housing which workers construct on the factory sites with second-hand materials; the second is factory site dormitories which young single share together; the third is domestic and maintenance staff quarter of which middle and high income residential compounds contain for maid, gardener; the fourth is institutional worker housing which usually consists of barrack-type houses constructed for workers; the fifth is itinerent construction worker housing which workers moving their families from site to site build from the available construction materials.

5. The fifth system is the boat house. They live on boats that are used for transporting goods for short distances, this type usually occupies permanent location on the canals in the city.

6. The sixth system is the privately owned housing. Commonly, it is a old housing stock more than 30 years old which is occupied by more than 4 generation and is used by multi-families per dwelling unit.

7. The seventh system is the rural housing which are houses in the rural area. The low-income people commute daily from their houses by train, bus and boat to their work places in the city.

This thesis emphasizes only on the major systems of low-income housing which are the squatter settlement and institutional housing and studies in detail in four case studies.
## NATIONAL HOUSING POLICIES, BANGKOK

<table>
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<tr>
<th>PERIOD</th>
<th>SPONSOR AND OBJECTIVE</th>
<th>PROJECT SIZE</th>
<th>LOCATION</th>
<th>DWELLING</th>
<th>STORY NO. OF UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-1972</td>
<td>Department of Public Welfare, Government Housing Bank, Bangkok Metropolitan Municipality</td>
<td>10-1000</td>
<td>scatter over the city</td>
<td>Walk-up Apartment</td>
<td>4-5 456</td>
</tr>
<tr>
<td></td>
<td>without specific policies</td>
<td></td>
<td></td>
<td>Row Houses</td>
<td>2 522</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Duplex Houses</td>
<td>2 1145</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Detached Houses</td>
<td>2 1739</td>
</tr>
<tr>
<td>TOTAL UNITS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3862</td>
</tr>
<tr>
<td>1973-1974</td>
<td>The National Housing Authority (NHA) was formed in 1973 to respond to all public housing work</td>
<td>1000-5000</td>
<td>in the inner ring</td>
<td>Walk-up Apartment</td>
<td>4-5 5744</td>
</tr>
<tr>
<td></td>
<td>from the 3 existing agencies and continued to work on them in the first 5-year period</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL UNITS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5744</td>
</tr>
<tr>
<td>1975-1977</td>
<td>The NHA planned the first 5-year program for 1976-1980 to accelerate the production of supply to meet the housing demand</td>
<td>20-6500</td>
<td>Most of the projects are located in the city. Exceptionally for 3 new communities development projects will be located in the city skirt (Klong Jund, Bang-Pre-Bang Bo, Rangsit)</td>
<td>Walk-up Apartment</td>
<td>4-5 15144</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>High rise Apartment</td>
<td>12 2434</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Row Houses</td>
<td>1-2 7795</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Duplex Houses</td>
<td>1-2 7680</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Detached Houses</td>
<td>1-2 1956</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Shop Houses</td>
<td>2-3 319</td>
</tr>
<tr>
<td>TOTAL UNITS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>35328</td>
</tr>
<tr>
<td>1978-1979</td>
<td>The government had been financed the deficits arising from the sale of units at less than costs. In 1974 about 30% of the NHA units were occupied by ineligible families who pay key money to the legal families for buying the unit. Dissatisfaction within the government of the NHA's heavy subsidies has recently led to revise policies in housing development.</td>
<td>200-800</td>
<td>in the inner of the city and periphery</td>
<td>Walk-up Apartment</td>
<td>4-5 1720</td>
</tr>
<tr>
<td></td>
<td>a.) new housing communities</td>
<td>3000-20000</td>
<td>four new communities are located in the periphery</td>
<td>Site and Services</td>
<td>1-2 300</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rangsit 45 kg from city</td>
<td>S &amp; S with core houses</td>
<td>1-2 2700</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lat kra bang 30 kg from city</td>
<td>Houses</td>
<td>1-2 3369</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bang Pre- Bang Bo 65 kg from city</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tung Song Hong 20 kg from city</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>150 communities are under this plan. Most of the communities are in the inner and center of the city. Few of them are located in the periphery.</td>
<td>The existing dwelling</td>
<td>1-2 4000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>are row and detached</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>houses, shanties, rooms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b.) rehabilitation of existing housing communities of slum upgrading.</td>
<td>200-1600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>c.) assisting private sector developers by giving intensives for increasing housing construction.</td>
<td>200-800</td>
<td>in the inner of the city and periphery</td>
<td>Walk-up Apartment</td>
<td>4-5 1720</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL UNITS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12164</td>
</tr>
<tr>
<td>TOTAL UNITS 1952-1979</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>48865</td>
</tr>
</tbody>
</table>
### Housing Situation: National Policies

#### Finance

<table>
<thead>
<tr>
<th>TENURE</th>
<th>UNIT AREA m²</th>
<th>PERSON/HA</th>
<th>INCOME GROUP $/M</th>
<th>FINANCIAL PROGRAM</th>
<th>PUBLIC FACILITIES</th>
<th>PUBLIC MANAGEMENT</th>
<th>PEOPLE PARTICIPATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rental</td>
<td>40-60</td>
<td>750</td>
<td>0-100</td>
<td>Tenants paid rent. The NHA subsidized 60-80%</td>
<td>Some have school, play-ground, community center</td>
<td>yes</td>
<td>none</td>
</tr>
<tr>
<td>Ownership</td>
<td>150-200</td>
<td>90-200</td>
<td>100-200</td>
<td>Tenants paid installment. The NHA subsidizes 20-40%</td>
<td>Some have no public facilities</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TENURE</th>
<th>UNIT AREA m²</th>
<th>PERSON/HA</th>
<th>INCOME GROUP $/M</th>
<th>FINANCIAL PROGRAM</th>
<th>PUBLIC FACILITIES</th>
<th>PUBLIC MANAGEMENT</th>
<th>PEOPLE PARTICIPATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rental</td>
<td>40-60</td>
<td>750</td>
<td>0-100</td>
<td>Tenants paid rent. The NHA subsidized 60-80%</td>
<td>All have public facilities</td>
<td>yes</td>
<td>none</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TENURE</th>
<th>UNIT AREA m²</th>
<th>PERSON/HA</th>
<th>INCOME GROUP $/M</th>
<th>FINANCIAL PROGRAM</th>
<th>PUBLIC FACILITIES</th>
<th>PUBLIC MANAGEMENT</th>
<th>PEOPLE PARTICIPATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rental &amp;</td>
<td>40-60</td>
<td>750-1400</td>
<td>below 75</td>
<td>Tenants paid rent. The NHA subsidized 60-80%</td>
<td>Some have school, play-ground, community center</td>
<td>yes</td>
<td>none</td>
</tr>
<tr>
<td>Ownership</td>
<td>150-200</td>
<td>90-200</td>
<td>75-150</td>
<td>The NHA subsidized 50%</td>
<td>Some have no public facilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ownership</td>
<td>150-200</td>
<td>90-200</td>
<td>over 250</td>
<td>Tenants paid full cost with 10% interest.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ownership</td>
<td>150-200</td>
<td>90-200</td>
<td>over 250</td>
<td>The NHA sold for profits</td>
<td></td>
<td></td>
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<table>
<thead>
<tr>
<th>TENURE</th>
<th>UNIT AREA m²</th>
<th>PERSON/HA</th>
<th>INCOME GROUP $/M</th>
<th>FINANCIAL PROGRAM</th>
<th>PUBLIC FACILITIES</th>
<th>PUBLIC MANAGEMENT</th>
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<tbody>
<tr>
<td>Ownership</td>
<td>28-90</td>
<td>400-700</td>
<td>below 100</td>
<td>The land and dwelling construction cost would be recovered by downpayment and monthly payment form tenants. The NHA subsidised the utilities.</td>
<td>There are public facilities in new communities. There are jobs provided in the site and services project</td>
<td>yes</td>
<td>Tenants improve houses in site and services projects</td>
</tr>
<tr>
<td>Ownership</td>
<td>28-90</td>
<td>400-700</td>
<td>100-150</td>
<td>The NHA subsidised the utilities.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ownership</td>
<td>28-90</td>
<td>400-700</td>
<td>150-300</td>
<td>All cost would be recovered by tenants.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rental &amp;</td>
<td>15-200</td>
<td>750-2000</td>
<td>below 250</td>
<td>There are public facilities in new communities. There are jobs provided in the site and services project</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ownership</td>
<td></td>
<td></td>
<td></td>
<td>The NHA subsidised the utilities.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TENURE</th>
<th>UNIT AREA m²</th>
<th>PERSON/HA</th>
<th>INCOME GROUP $/M</th>
<th>FINANCIAL PROGRAM</th>
<th>PUBLIC FACILITIES</th>
<th>PUBLIC MANAGEMENT</th>
<th>PEOPLE PARTICIPATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rental &amp;</td>
<td>40-60</td>
<td>1000-1900</td>
<td>below 250</td>
<td>same as 1975-1977</td>
<td></td>
<td>yes</td>
<td>none</td>
</tr>
<tr>
<td>Ownership</td>
<td></td>
<td></td>
<td></td>
<td>Some have school, play-ground, community center</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ownership</td>
<td></td>
<td></td>
<td></td>
<td>Some have no public facilities</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: National Housing Authority, 1979
The investigation of low-income housing environments through the four case studies illustrates both negative and positive effects as follow:

a. Observations from the squatter settlement:
   
   **Negative effects:**
   - littering of garbage
   - no user participation in maintenance of walkways
   - increasing frequency of crime

   **Causes:**
   - poor definition of areas of responsibility and inappropriate layout
   - inconsistency between users, responsible agent and physical control
   - rental, no ownership

   **Positive effects:**
   - mutual-help in the construction of walkways and dwellings

   **Causes:**
   - traditional practices in most of the rural areas; friends and relatives help each other

b. Observations from public housing:

   **Negative effects:**
   - littering of garbage
   - no user participation in the maintenance of streets, walkways and playground
   - burglars and annoyance occurring

   **Causes:**
   - poor definition of areas of responsibility and inappropriate layout
   - inconsistency between users, responsible agent and physical control
   - low percentage of private land

   **Positive effects:**
   - high initial cost of construction and the long-term maintenance
   - The units are often resold to the higher income group.

   **Causes:**
   - many unnecessary details are included
   - inefficient and unpractical design
   - speculation of profit and difficulty of adaptation for low-income people to a complete new environment

The National Housing Policies for low-income groups over a 30 year period are clearly illustrated in Bangkok. The formulation and implementation of the various policies as well as the pros and cons of these policies can be seen. Observations from the National Housing Policies can be summarized as follows:

a. the first, second, and third periods: the construction of public housing in the form of walk-up or high-rise apartment

   **Negative effects:**
   - high initial cost of construction and the long-term maintenance

   **Causes:**
   - many unnecessary details are included
   - inefficient and unpractical design
   - speculation of profit and difficulty of adaptation for low-income people to a complete new environment

   The negative aspects encouraged a revision of the housing policies in the fourth period.

b. the fourth period: slum upgrading programs and site and services projects were implemented

   **Positive effects:**
   - the mutual-help in the construction of dwelling, etc.

   **Causes:**
   - well organized to provide assistance in technical, social, and economic aspects (the Asian Institute of Technology)
causes: - slum upgrading program mainly in infrastructure and utilities not in the dwelling units
-the site and services project primary provides a site, utilities and core houses

At the present time the appropriate policy in supplying housing for the low-income is site and services projects.

The study is a comparison of two site and services projects; the government existing one being developed and the proposed one. The goals of the comparison are to illustrate the following:

a. The wasteful practices in the site and services projects; in terms of land utilization and circulation. These will increase the initial government costs of construction. The limited government resource should be utilized more effectively.

b. A negative social effect; the lack of encouragement of users' participation and responsibility which will be a heavy burden to the government.

c. A negative economic effect; the higher cost of construction and long term maintenance cost. These are derived from the consideration above.

d. A negative administrative effect; more administrative cost.

Finally, a model is proposed for a site and services projects which is applicable for various conditions and locations.
The site is located at Tung Song Hong. It is a new rapid growth residential area at the periphery of Bangkok. Within 5 km radius along the high way and the road, there are temples, kindergartens, a college, schools, a health center, government agencies, a commercial center, factories, a food market, high and middle real estate development, a train station, and Bangkok International Airport.
SITE DATA

LOCATION: At Tung Song Hong, Lak-si subdistrict, Bangkhen district, Bangkok, 17 km north of the city center, 2 km south of Bangkok International Airport, 0.2 km from the Vipa Vadee Rangsit Highway and 3 km from Chaeng Watana Road.

AREA: Gross area of the site 43 Ha

SHAPE: Irregular, average length 1,400m, average width 300m

BOUNDARIES:
- North: private real estate development
- South: private real estate development
- West: privately owned land

ACCESSES:
- Existing road and bridge on the east connect with the highway. Existing road passing through private road on the north to the highway. Existing road passing through private road on the south to the highway and Chaeng Watana Road. Proposed road on the west to Chaeng Watana Road.

TOPOGRAPHY: It is almost completely flat land which is used to be rice field with clay soil.

TRANSPORTATION: Public transportation includes bus and train.

INFRASTRUCTURE:
- Water supply: underground water, feasible by NHA
- Sewage disposal: not available, feasible by NHA
- Storm drainage: irrigation and Prem Prachakorn canal
- Refuse collector: not available, feasible by NHA
- Electricity: available, feasible by NHA
- Telephone: available, feasible by NHA

LAND OWNERSHIP: The NHA purchased in 1966. The present cost is US$ 50,000/Ha

AIRPORT, ZONING:
- Under airport zoning, no building can exceed 5 storeys

GOVERNMENT REGULATION:
- Under laws of Bangkok Metropolitan Municipality area.

OTHER FACTORS:
- Views: neutral
- Smoke Odors: none
- Dust: none
- Flooding: anually flooding 0.3m above the existing soil level
- Noise: some from airport

CLIMATE:
- Winter humidity-moderate, temperature-moderate, wind northeast to southwest
- Summer humidity-moderate, temperature-high, wind southwest to northwest
- Rainy humidity-high, temperature-moderate, wind southwest to northeast, annually rainfall in every 2 years is 57 mm/hr.
## PROJECT PROGRAM

<table>
<thead>
<tr>
<th></th>
<th>EXISTING</th>
<th>PROPOSED</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL AREA</strong></td>
<td>43.0 Ha</td>
<td>43.0 Ha</td>
</tr>
<tr>
<td><strong>PROPOSED DESIGN AREA FOR A</strong></td>
<td>35.8 Ha</td>
<td>35.8 Ha</td>
</tr>
<tr>
<td><strong>COMPARISON</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>GROSS DENSITY (Person/Ha)</strong></td>
<td>695</td>
<td>730</td>
</tr>
<tr>
<td><strong>NET DENSITY (Person/Ha)</strong></td>
<td>1,193</td>
<td>1,024</td>
</tr>
<tr>
<td><strong>POPULATION</strong></td>
<td>24,860</td>
<td>26,120</td>
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</table>

**LAND UTILIZATION**

<table>
<thead>
<tr>
<th>LAND UTILIZATION</th>
<th>EXISTING</th>
<th>PROPOSED</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PUBLIC (Streets, walkways, open spaces)</strong></td>
<td>10.1 Ha 28.0%</td>
<td>5.3 Ha 14.3%</td>
</tr>
<tr>
<td><strong>SEMI-PUBLIC (Open spaces, schools, community centers)</strong></td>
<td>4.9 Ha 13.8%</td>
<td>5.1 Ha 14.4%</td>
</tr>
<tr>
<td><strong>PRIVATE AND SEMI-PRIVATE (dwellings, shops, factories, lots, cluster courts)</strong></td>
<td>20.8 Ha 58.2%</td>
<td>25.4 Ha 71.3%</td>
</tr>
</tbody>
</table>

**RESIDENTIAL AREAS**

<table>
<thead>
<tr>
<th>RESIDENTIAL AREAS</th>
<th>EXISTING</th>
<th>PROPOSED</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NUMBER OF LOTS (Assuming 10 persons/lot)</strong></td>
<td>2486</td>
<td>2612</td>
</tr>
<tr>
<td><strong>DIMENSION OF LOTS (m x m)</strong></td>
<td>4.8 x 14.6</td>
<td>5.0 x 15.0</td>
</tr>
<tr>
<td></td>
<td>4.8 x 16.7</td>
<td>5.0 x 17.0</td>
</tr>
<tr>
<td></td>
<td>3.6 x 22.2</td>
<td>5.5 x 11.0</td>
</tr>
<tr>
<td></td>
<td>6.0 x 13.3</td>
<td>6.0 x 13.0</td>
</tr>
<tr>
<td><strong>AVERAGE LOT AREA (m²)</strong></td>
<td>78.0</td>
<td>75.0</td>
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</table>

**INDUSTRIAL AREAS**

<table>
<thead>
<tr>
<th>INDUSTRIAL AREAS</th>
<th>EXISTING</th>
<th>PROPOSED</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NUMBER OF LOTS</strong></td>
<td>Instant building for rent</td>
<td>40-60</td>
</tr>
<tr>
<td><strong>AVERAGE LOT AREA</strong></td>
<td>Total area of 0.55 Ha 150-200 m²</td>
<td></td>
</tr>
</tbody>
</table>

**COMMUNITY FACILITIES**

<table>
<thead>
<tr>
<th>COMMUNITY FACILITIES</th>
<th>EXISTING</th>
<th>PROPOSED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary schools: 3000 pupils, 2 schools</td>
<td>Kindergarten: 1200 pupils, 5 schools</td>
<td></td>
</tr>
<tr>
<td>Kindergarten: 1200 pupils, 5 schools</td>
<td>Main community center, food market, hawker stalls, minibus terminal, community park, administrative office, treatment plant</td>
<td></td>
</tr>
<tr>
<td>Main community center, food market, hawker stalls, minibus terminal, community park, administrative office, treatment plant</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

**DEVELOPMENT**

<table>
<thead>
<tr>
<th>DEVELOPMENT</th>
<th>EXISTING</th>
<th>PROPOSED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Income Group (US$/year/household)</td>
<td>600-900 25.0%</td>
<td>600-900 25.0%</td>
</tr>
<tr>
<td></td>
<td>900-1800 60.0%</td>
<td>900-1800 60.0%</td>
</tr>
<tr>
<td></td>
<td>1000-3000 15.0%</td>
<td>1000-3000 15.0%</td>
</tr>
</tbody>
</table>

**DESIGNER**

<table>
<thead>
<tr>
<th>DESIGNER</th>
<th>EXISTING</th>
<th>PROPOSED</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Housing Authority</td>
<td></td>
<td>Thesis proposal</td>
</tr>
</tbody>
</table>
The accesses from Vipa Vadee Rangsit Highway pass through the eastern boundary and through the private roads leading to the northern and southern boundary. The access from Chaeng Watana road passes through private road to the southern boundary. All accesses are concentrated in the eastern boundary, which will cause inconvenience and inefficiency. This will increase a concentration of activities around accesses. As a result, the land value will not be distributed equally.

The block layout is a gridiron pattern. The lot size limited the block sizes and determined the layout of the streets. And consequently, the block is small which increases public area in terms of percentages and length of utilities. Moreover, the advantages of function diversification by allocating different lot sizes are not considered in this layout.
The access is based on consideration of convenience and efficiency of the circulation. The accesses to the site concentrating at the eastern boundary are inadequate. The new proposed access is on the western boundary connecting to the proposed road leading to Chaeng Watana road when the site will be fully occupied by 30,000 people in the future.

The block layout is based on grid pattern which minimizes public land and infrastructure network and provides flexibility in land subdivision, independent of street layout and variation of lot sizes. The allocation of different lot sizes provides diverse needs for the residents: commercial, light industrial and can be determined by the connection to the hierarchy of importance of streets. This reduces the initial cost of constructing instant building for industry and shops. Part of the existing block layout which is being built will be maintained.
The public land in this layout is twice larger than the proposed one. It leads to high construction cost of infrastructure and utilities as well as maintenance cost. The small public areas scattering all over the site do not give clearly-defined users' responsibilities and do not have physical control. These areas have a potential to be haphazard areas.

The semi-public space is not distributed equally. The location of the community facilities does not promote concentration at the central spine. The schools located at the center is unwise because this area of high land value should preferably be occupied by community facilities.

The private land utilization does not provide any opportunity for private to participate in community activities.
The utilization of public land is to minimize the circulation length per area, public responsibility, and to offer more land for private. The proposed layout has half of the public land less than the existing one by replacing the gridiron layout by the grid layout and the public open spaces by the semi-private shared-courts.

The semi-private land which are community facilities, park and market is designed to provide equally access to and emphasize these activities and importance of the central spine. The kindergartens and schools are located at boundary to avoid high land value at the center and noisy disturbance.

The private land is designed to maximize private use, responsibility and participation by allocating lots in condominium to create social interaction.
The circulation network is based on a gridiron system. The size of intervals is varied to the size of lots. This creates more public land used by percentage and increases cost of construction and maintenance. It also does not give direction to residents for access to all community activities.

The primary streets are separated into two parts, one for vehicles and one for pedestrian and bicycle. The secondary streets allow only bicycle and pedestrian and are both parallel and perpendicular to the primary street, providing direct entrances to all lots. Both primary and secondary streets layout do not promote concentration of community activities, and consequently there is no incentive for social interaction. In reality it is difficult to control vehicles not to pass through the secondary streets since there are no physical barriers.
The circulation network is based on a grid system. The size intervals is within 200 x 200 being small enough to facilitate the pedestrian circulation among the various community elements: shops, services, dwellings, and large enough to minimize land area and reduce public costs of construction, maintenance and operation of utilities and services.

The primary street is a central spine running through the center of the site. The community facilities are located in this street to create a focus of activities. A mini-bus route is also maintained on this spine. The secondary streets are perpendicular to the primary street providing entrances to all clusters and giving clear direction to the residents for access to central activities and other activities along the boundary. The peripheral streets serve as service roads for industrial lots and schools.
The layout does not reach the goals of a site and services which is intended to maximize private ownership of land and private participation and minimize construction cost.

The existing blocks show the typical layout with grouped blocks surrounded by public circulation that provided access directly to each lot. As a result of individual lot having direct connection of public circulation, the length of circulation per area is much greater than that of the proposed layout. This implies higher construction cost and is a heavy burden for government to maintain infrastructure and utilities. In addition, this design and ownership decreases the private responsibility and participation in the community. This can cause haphazard in public area such as overbuild by individuals.
**PROPOSED BLOCK**

BLOCK is a portion of land bounded and served by public lines of circulation. LOT is a measured parcel of land having fixed boundaries and access to public lines of circulation. CLUSTER is a group of lots (owned individually) around a semi-private court (owned in condominium). CONDOMINIUM is a system of direct ownership of a single unit in multi-unit arrangement. The individual owns the unit in much the same manner as if it were a single-family dwelling; he holds direct legal title to the unit and appropriate interest in the common areas and underlying ground.

The revised block layout is designed to illustrate land subdivision which allows minimization of public ownership of land, lengths of infrastructure per area served, public or government ownership, responsibility and provision of services and maximization of private ownership of land and private participation and responsibility.

The block plan shows a typical block with lots grouped around a semi-private common court that served for access to the lots as well as for other activities of their occupants. This court is owned in condominium by the owners of the lots who share its use. The court is assured of better control and maintenance by virtue of its condominium ownership, being dead-ended and with a limited number of users. More over the ownership and mutual maintenance will create the social interaction among the residents and eventually more residents will participate the community activities. And this will create private responsibility to the community as well.

**LOCALITY BLOCK LAND UTILIZATION DATA**

<table>
<thead>
<tr>
<th>AREAS</th>
<th>Hectares</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBLIC (streets, walkways)</td>
<td>0.2</td>
<td>9.2</td>
</tr>
<tr>
<td>SEMI-PUBLIC (open spaces, schools, community center)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>PRIVATE (dwellings, shops)</td>
<td>7.157</td>
<td>17.4</td>
</tr>
<tr>
<td>FACTORIES, LOTS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEMI-PRIVATE (cluster courts)</td>
<td>0.4</td>
<td>19.2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2.2</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**CIRCULATION EFFICIENCY**

| Meter/Hectare | 178 |

**DENSITIES**

| LOTS           | 210 | 2.2 | 95.5 |
| DWELLING UNITS | 210 | 2.2 | 95.5 |
| PEOPLE         | 2100| 2.2 | 950.0|

**PERCENTAGES**

| Streets/Walkways | 9.2 |
| Playground       | —   |
| Dwellings/Lots   | 71.4|
WATER SUPPLY

EXISTING LAYOUT

EXISTING WATER SUPPLY
A pipe network runs to the two separated sets of sediment tank, elevated reservoir and pumping station. Sources of water are ground water wells in the site. The rate of portable water supply will be 150 litres/man/day and the designed average pressure head is 15 m. The distribution pipes run between the lot boundaried to reduce costs of service connections but the result leads to many disadvantages as follow; 1.) They require the "instant" construction of water facilities service each lot in order to control proper installation. This will increase the initial cost of construction. 2.) Lines are on private land, creating difficulty of access for repairs, control and maintenance. 3.) Foundations, footings, or other construction may damage the network. 4.) By placing the services in a fixed point on the lot, it impairs its flexibility of use. Even though the NHA tries to reserve a strip of land for access to repair pipes, the result will be high cost of maintenance.

PROPOSED WATER SUPPLY
The network is designed as a close grid system with no dead ends. The sources of water and the collectors are the same as those of existing scheme. The distribution pipes in semi-private shared-court can be constructed by mutual-help. Gate valves to shut off water supply for maintenance can be provided at minimum and people should have access to water from other block if the interior flow is interrupted in the acceptable maximum distance of 200 m.
SEWAGE DISPOSAL

EXISTING SEWAGE DISPOSAL
A water borne sewerage runs into a treatment plant located near the irrigation canal. The distribution pipes run between the lot boundaries to reduce costs of service connection but there are actually disadvantages as described in the existing water layout.

PROPOSED SEWAGE DISPOSAL
A water borne sewerage system and a treatment plant will be used as in the existing scheme. But length of the pipes in public area is much shorter than that of the existing scheme. The lots distribution pipes in the semi-private shared-court can be built and maintained by mutual-help, and consequently lowering the government initial cost of construction and maintenance cost. The connection pipes to the lot is located in the middle of the court. This has more advantages than the existing scheme. Manholes will be provided one for every three clusters, at changes of direction, at dead ends, and at approximately 100 m intervals for cleaning purposes.

Septic tanks and pit latrine can be provided as alternative schemes. However, they are feasible only after a study of soil absorption and the dangers of ground water pollution. Compost latrine is useful, whenever the system is culturally acceptable.

<table>
<thead>
<tr>
<th>LAYOUT</th>
<th>PIPE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PRIVATE SIZE(INCH)</td>
</tr>
<tr>
<td></td>
<td>6&quot;</td>
</tr>
<tr>
<td>EXISTING (area 1.5 Ha)</td>
<td>44</td>
</tr>
<tr>
<td>PROPOSED (area 2.2 Ha)</td>
<td>38</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KEY</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot; Pipe</td>
</tr>
<tr>
<td>8&quot; Pipe</td>
</tr>
<tr>
<td>10&quot; Pipe</td>
</tr>
<tr>
<td>Manholes</td>
</tr>
</tbody>
</table>

1:2000
FLOOD PROTECTION AND STORM DRAINAGE

EXISTING FLOOD PROTECTION AND SURFACE DRAINAGE
The site is raised by landfill of 0.80 m creating a down slope toward the road in the middle of the site. In the surface drainage, a network of covered ditches and underground pipes are used. The network drains water into the irrigation canal with 2 electric pumps.

PROPOSED FLOOD PROTECTION AND SURFACE DRAINAGE
The site is raised by landfill of 0.83 m at the middle of the site and 0.30 at the boundary creating a 0.35% slope downward to the boundary. For the surface drainage, the shared-courts and streets are used as primary interceptors and the water is channeled along the shared-courts and streets in shallow ditches. The deep ditch and the irrigation canal at the boundary act as flow collectors to the Pram Prachakorn canal and also prevent water from entering.

The covered ditches along two sides of the streets are more expensive, require maintenance and therefore have been avoided in the proposed scheme. If the slopes of the streets are carefully designed and constructed, the shallow ditches will be adequate for the drainage propose. The flood protection scheme eliminates the underground pipes and electric pumps and this lowers the construction and maintenance costs as well.

<table>
<thead>
<tr>
<th>LAYOUT</th>
<th>DITCH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PRIVATE SIZE m²</td>
</tr>
<tr>
<td>EXISTING (area 1.5 Ha)</td>
<td>84</td>
</tr>
<tr>
<td>PROPOSED (area 2.2 Ha)</td>
<td>90</td>
</tr>
</tbody>
</table>

KEY
- 1.2 x 1.6 m Ditch
- 1.0 x 1.0 m Covered Ditch
- 0.5 x 0.5 m Covered Ditch
- 0.3 x 0.3 m Covered Ditch
STREET ELECTRICITY

EXISTING LAYOUT

EXISTING ELECTRICITY
The high tension is located along the primary street on 0.40 m interval poles. The low tension is distributed to the lots on the 0.20 m interval poles. The designed consumption for each lot is 15 Amp. Street lighting intensity for the main streets is not less than 0.6 ft-candle, and 0.4 ft-candle for the secondary streets.

PROPOSED ELECTRICITY
The high tension is located along the primary street and connected to the transformers at the intersections. The low tension is distributed on the secondary streets. The lot distribution low tension in the semi-private shared-court can be connected to the street low tension by mutual-help, lowering the public initial costs of construction and maintenance. The low tension pole interval is at maximum interval of 0.45 m. Both the length of low tension per area and the number of poles are less than those of the existing scheme.

The distribution low tension can be placed between the lot boundaries to reduce service connection as an alternative scheme. However this is feasible only after there is an agreement of responsibility between the residents in three clusters and proper initial structure to install the low tension on the property lines.

PROPOSED LAYOUT

<table>
<thead>
<tr>
<th>LAYOUT</th>
<th>TENSION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PRIVATE TENSION TYPE</td>
</tr>
<tr>
<td></td>
<td>LOW</td>
</tr>
<tr>
<td>EXISTING</td>
<td>685</td>
</tr>
<tr>
<td>(area 1.5 Ha)</td>
<td>39</td>
</tr>
<tr>
<td>PROPOSED</td>
<td>463</td>
</tr>
<tr>
<td>(area 2.2 Ha)</td>
<td>26</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KEY</th>
</tr>
</thead>
<tbody>
<tr>
<td>- High Tension</td>
</tr>
<tr>
<td>- Low Tension</td>
</tr>
<tr>
<td>- Poles</td>
</tr>
</tbody>
</table>

1:2000
CONCLUSIONS

The housing situation in Bangkok Metropolitan area will continue to deteriorate with the city's current growth rate. While the government's policies of slum upgrading and site and services are realistic and appropriate at the present time, there exist wasteful practices in the design of site and services projects with negative social and economic consequences.

The need for efficacy of urban layouts is imperative in directing development so as to minimize initial outlay and maximize socio-economic returns from public inputs. In the design of proper layouts, two principal components to be considered at the planning stage are land utilization and circulation, the basic characteristics of which are identified as follow:

LAND UTILIZATION:
The proposed land utilization introduce distinctly a coherent relationship between users' responsibility and physical control which basic for an effective use of the land and which is ignored in the existing project.

<table>
<thead>
<tr>
<th>TYPE</th>
<th>USER</th>
<th>RESPONSIBILITY AGENT</th>
<th>PHYSICAL CONTROL</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBLIC (streets, walkways, open spaces)</td>
<td>unlimited</td>
<td>public sector</td>
<td>minimum</td>
</tr>
<tr>
<td>SEMI-PUBLIC (schools, playgrounds, open spaces)</td>
<td>limited group of people</td>
<td>public sector/ user</td>
<td>partial/complete</td>
</tr>
<tr>
<td>SEMI-PRIVATE (cluster courts)</td>
<td>group of owners</td>
<td>user</td>
<td>partial/complete</td>
</tr>
<tr>
<td>PRIVATE (dwellings, lots)</td>
<td>owner/tenant</td>
<td>user</td>
<td>complete</td>
</tr>
</tbody>
</table>

CIRCULATION:
The proposed circulation illustrates a more efficient layout of lines of circulation and access than the existing one in terms of circulation lengths per area served.

<table>
<thead>
<tr>
<th>LINES OF CIRCULATION (streets, walkways)</th>
<th>LINES OF ACCESS (dead-end streets or loops for pedestrians, vehicles or both)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-serve for through circulation and provide direct access to lots on their sides</td>
<td>-never serve for through circulation; serve only abutters by providing direct access to the lots on their sides</td>
</tr>
<tr>
<td>-unlimited number of users</td>
<td>-limited number of users</td>
</tr>
<tr>
<td>-on public land</td>
<td>-on semi-private/private land</td>
</tr>
<tr>
<td>-long and generally connected at both ends with different circulation lines</td>
<td>-short and generally connected of one or both ends to the same line of circulation</td>
</tr>
<tr>
<td></td>
<td>-limited to a maximum length of 100m for reasons of safety</td>
</tr>
</tbody>
</table>

From the comparison of the proposed and existing layout regarding land utilization and circulation, the proposed layout is seen to be able to achieve more desirable effects and therefore serve as a model for all site and services projects by some specific design concepts described as follows:

a. The purpose: A meaningful practice of design; maximization of privately owned land and minimization of publicly owned land.

Achieved by: A grid layout and a cluster-court design with condominium ownership. These reduce publicly owned land in terms of percentage of circulation per area and provide more privately owned land.

b. The purpose: Positive social effects; the encouragement of individual responsibility and participation.

Achieved by: A clear definition of the extent of the users' territory and a provision of semi-private area and condominium ownership in shared-courts. These promote social interaction and mutual-help to maintain the shared-courts.

c. The purpose: Positive economic effects; the reduction of
initial cost of construction and maintenance
Achieved by: A grid layout and a cluster-court design and condominium ownership
These minimize lengths and areas of public streets; minimize lengths of services and utilities basic networks; permit the separation of utilities basic networks and service connections which can be developed progressively and financed separately.

d. The purpose: Positive administrative effects; less administration costs and guarantees provided by groups
Achieved by: The condominium subdivision
These make it unnecessary for the public institutions to deal with individuals but with groups of people of cooperatives.

EVALUATIONS

The four case studies represent a major dwelling systems of the low-income sector of Bangkok. They have been evaluated and compared with the existing and proposed site and services projects. The evaluations provides a comparative view of the percentages, densities and network efficiency.

The existing low-income housing systems provide the most important source of information for formulating low-income housing policies and programs; a guideline to land utilization, distribution and subdivision; also insight into issues concerning population, densities, income ranges, cultural and social values.

The proposed site and services project is based on information from the existing low-income housing systems and the National Housing Policies. The layout is designed and compared to the existing one to illustrate the more efficient scheme in the utilization of limited resources.

The proposed project has two advantages scheme. The first is the most efficient circulation. This minimizes the investment in construction of infrastructure and utility networks and reduces the public responsibility and cost of maintenance and operation because of the least circulation length per area. The optimal amount of privately owned land is also achieved, not only in terms of saleable land but also the increase of private responsibility. The system of condominium ownership is used to create social interaction among the users to share use and responsibility. As a result, these create both social and economic positive effects to overall settlementment development.

The diagrams on the following pages show a summary of the evaluations of the case studies in a comparative manner.
**EVALUATIONS**

**LAND UTILIZATION: PATTERNS, PERCENTAGES, DENSITIES CIRCULATION**

**COMPARATIVE PROJECTS AND CASE STUDIES**

The case studies are examples of existing dwelling environment in Bangkok. The existing site and services projects illustrate the government design. The proposed project used in comparing with the case studies and the existing one in the evaluation of efficiency of physical layouts.

**PERCENTAGES**

Proportion of public and private areas are indicators in determining maintenance, responsibility, user control and functional efficiency of a layout. For example, a large percentage of land for circulation results in high costs of installation per sector, indicating an inefficient layout.

**DENSITY**

The number of persons per hectare relates to both the number of lots and the types of dwellings per hectare. This determines the intensity of land use: low densities reflect higher development costs per person.

**CIRCULATION EFFICIENCY**

A relation between public circulation lengths and the area served indicates the network efficiency; a high ratio reflects a less efficient network in terms of direct capital investment and future maintenance costs.
CASE STUDIES

1a KING PETCH BEFORE UPGRAдинG 1978
Squatter "pay land rent" settlement, Popular Very low/low/middle income
1 Hectare

PERCENTAGES Streets/Walkways 9
Playgrounds -
Cluster Courts -
Dwellings/Lots 92

DENSITY Persons/Hectare 1484
20 Persons
16 Hectare

CIRCULATION EFFICIENCY Meter/Hectare 393

1b KING PETCH AFTER UPGRAдинG 1980
Squatter "pay land rent" settlement, Popular Very low/low/middle income
1 Hectare

PERCENTAGES Streets/Walkways 16.3
Playgrounds -
Cluster Courts -
Dwellings/Lots 83.7

DENSITY Persons/Hectare 1400
20 Persons
16 Hectare

CIRCULATION EFFICIENCY Meter/Hectare 554

2 KING PETCH SQUATTER
Squatter settlement, Popular, Very low/low income
1 Hectare

PERCENTAGES Streets/Walkways 11.25
Playgrounds -
Cluster Courts -
Dwellings/Lots 88.75

DENSITY Persons/Hectare 1875
20 Persons
16 Hectare

CIRCULATION EFFICIENCY Meter/Hectare 1200

3 KLONG TOEY
Public housing, Walk-ups, Low income
1 Hectare

PERCENTAGES Streets/Walkways 77.2
Playgrounds -
Cluster Courts -
Dwellings/Lots 22.8

DENSITY Persons/Hectare 2023
20 Persons
16 Hectare

CIRCULATION EFFICIENCY Meter/Hectare 655

4 LAD PHRAO
Self-help housing, Private, Row houses, low/ middle income
1 Hectare

PERCENTAGES Streets/Walkways -
Playgrounds -
Cluster Courts -
Dwellings/Lots 84.4

DENSITY Persons/Hectare 830
20 Persons
16 Hectare

CIRCULATION EFFICIENCY Meter/Hectare 759
PHOTOGRAPH: (OPPOSITE PAGE) Chao Phraya River
It is the most important river in Bangkok and the country. It is a primary source of transportation and the main source of water for both agriculture and non-agriculture users. It originates in the northern part of Thailand, passing through the central region and the capital city, and finally connects to the gulf of Thailand about 30km from Bangkok.

This section provides supporting and complementary references that have been utilized for the design of a proposed site and services project at Bangkok. It will permit one to look further into the existing low-income housing documentation of socio-economic and physical surveys of dwelling environments in Bangkok.

This section is comprised of 3 parts:
1.) Thailand national context
2.) Bangkok urban context
3.) Four case studies

This is followed by a glossary, references and explanatory notes.
APPENDIX

THAILAND

PHYSIOGRAPHIC SETTING: The Kingdom of Thailand is situated in southeast Asia, bounded by Burma and the Indian Ocean on the west, Cambodia and the gulf of Siam on the east, Laos on the north and Malaysia on the south. Lying between 95°12' and 105°13' East Longtitude and 5°37' and 20°27' North Latitude. It consists of four regions: northern, central, northeastern and southern with total area of 514,000 sqkm. The northern region consists of mountain ranges running from north to south with dense forest. The central region is a large hilly area cut by the flat and fertile Chao Phraya and other river valleys which are the most important in agricultural and economic part of country. The northeastern region consists of the Khorat Plateau with some hilly area. The southern region is on the slender part of Malay Peninsula and is a mountainous area which is flanked by the sea.

CLIMATE: It lies entirely within the tropical zone with temperatures ranging from 16°-32°C. The monsoonal wind system prevails, causing rainy and dry seasons. The southwest monsoon begins from May to October, bringing annually about 1000-1600 mm of rain. The northeast monsoon begins from November to February, bringing little rain. The hottest period is from March to May.

HISTORY: The Thai ancestors inhabited in southern China 4,500 years ago. Being threatened by Chinese armies, they migrated toward the south. In 551 A.D. they founded the Kingdom of Nan Chao which was destroyed in 1253. They fled to the plains of Indochina Peninsula and founded the Kingdom in Sukothai city. The Kingdom extended its boundary to the south and the capital was transferred to Ayudaya city in 1350. After the Burmese invasion, Rama I founded the present ruling dynasty, founded Bangkok as the new capital in 1782. Rama V carried out a virtual revolution through modernization and lead the country to survive from the European colonialism. The abdicated monarchy ended in 1932, the present government is democratic with a king as the head of the state under the constitution.

ECONOMY: In 1979, per capita GNP stood at US$ 450, the Gross Domestic Product was US$ 28,221 million and annual growth rate was 7.7%. The official foreign exchange rate was US$ 1 to 20 baht. Thailand's economy is based on agriculture with rice as the major crop. In 1961, the government established The First National Social and Economic Development Plan aimed to diversify crops, to expand irrigation and to establish new manufactures.

GOVERNMENT: Thailand has a constitutional monarchy. The National Assembly is composed of a lower and a upper Houses. The Judiciary consists of the Supreme and Lesser Courts. The government is classified into 3 levels of administrations; central, in Bangkok; local, in provinces through villages; and local units in communes. The primary units of territorial administration are 72 provinces which are subdivided into districts. Districts are subdivided into villages and then villages are subdivided into communes.

DEMOGRAPHY: In 1979, the population was 47 million with an annual growth rate of 3.3%. The density was 91.94 persons per sqkm. About 20% of the population was in urban area. People are highly concentrated in the central region of the Chao Phraya river valleys. The population is classified by ethnic group as follows; 85-90% Thais, 5-10% Chinese, 5% Malay-speaking Muslims and less than 1% khmer.

HOUSING: In 1979, there were 1,188,942 households in the municipal area of which 691,550 households were in Bangkok Metropolitan area. It was more than 50% of urban population or 10% of the total population in Bangkok with annual growth rate of 6.2%. The other main urban areas annual growth rate is 5%. From the National Housing Authority survey in 1975, the new housing demand reached to a minimum 20,000 units per year in urban areas. The NHA planned to construct total 120,000 new housing units in a five year period from 1976-1980.
URBAN CONTEXT

BANGKOK

PHYSIOGRAPHIC SETTING AND CLIMATE: Bangkok Metropolitan is located approximately in the center of the central region, 30 miles north of the Gulf of Thailand, 13°45' North Latitude and 100°28' East longitude. It is on a flat alluvial plain of the Chao Phraya river, averaging only 1 m above the sea level and a ground water table rarely more than 1 m below the surface imposes severe constraints on the development of drainage and sewerage systems. The surrounding countryside is a flat plain on which the major crop rice is grown. It is in the tropical climate with an annual average temperature of 29 °C and the mean annual rainfall is 1250 mm. The climate is dominated by monsoons. There are 3 main seasons: rainy from May to October, winter from November to January and summer from February to May.

HISTORY: Bangkok was founded by King Rama I as the new capital of Thailand in 1782. It was chosen because of its superior defensive qualities. Situated on the eastern side of a large loop of the river, the city was protected from military attack by a swampy plain to the east as well as the river. The river provided access to the sea and water for a system of canal which is used to be the principal transportation networks. In King Rama IV (1851-1910), began to contact to the west. The city had become an important commercial, educational and government center. At present, Bangkok's modern development becomes the center of cultural, political, commercial, industrial center which provides employment opportunities not to be found in other parts of the country. As a result attracts a great level of immigration and increases the urban built-up area from 13.3 sq km in 1910 to 253 sq km in 1977.

GOVERNMENT: Bangkok, the capital, is the seat of a highly centralized national government. The Bangkok Metropolitan is included Bangkok and Thonburi provinces and subdivided into 22 districts (khet) with total area of 1549 sq km in 1980 which is governed by the Bangkok Metropolitan Administration (BMA). The BMA was established in 1972 to consolidate the city management functions as follows; primary education, slaughterhouses, pawnshops, public parks, public health, markets, fire protection, garbage disposal, maintenance of local roads and waterways, urban planning and building code enforcement.

ECONOMY: In 1979 the average household income of the Metropolitan was estimated at US$ 2,400 compared to US$ 1,800 of the rest of the country. Bangkok is the main port and transportation hub, commercial, financial center and headquarters for a number of international agencies and multinational business. The 25% of industrial establishment in Thailand are located in the Metropolitan area. Bangkok contributed 27% of the national GDP in 1976. Unemployment rates have been unusually low, estimated at less than 2.5% during the first half of the 1970s.

DEMOGRAPHY: The Bangkok population was 4.8 million in 1979 with an annual growth rate of 6.2% which composed of the annual natural population growth rate of 2.9% and the annual immigration growth rate of 3.3%. The population was 400,000 in 1856 and reached 1 million in 1950. The population had climbed to 4 million in 1974. Typical immigrant are young people under thirty years of age, unmarried male or female from village in the northeastern region and central plains who move to Bangkok to seek employment as laborers or service workers. The 1970 census showed that about 35% of Bangkok's population were born outside Bangkok.

NATIONAL AND URBAN CONTEXTS SOURCES

Topography/Circulation: (accurate) Planning maps, the Ministry of Interior, 1979
Land use pattern: Growth patterns: (accurate) IBID
Photographs: Jari and Varin Kiatfumrong
-The Socio-economic survey 1975-76 Greater Bangkok Metropolitan area.
URBAN LAND USE PATTERN

SOCIO-ECONOMIC: An average household size is 6 persons. In 1979 the subsistence average for a family was US$ 2,000. The absolute poverty line in urban area was US$ 170 per capita per year or US$ 1,020 per household annually in 1976. The distribution of the incomes are as follows: 10% of the population below the poverty line considering as very low-income group, 33% of the population in low-income group, 48% of the population in middle-income group and 9% of the population in high-income group. The majority of the population are Thais, the remainder are those who have Chinese or Indian ethnic origins. Most of low-income people are settle in slum areas, accommodating over 1 million people or about 25% of Bangkok's population. Those settlements are concentrated in the city center and spread to the peripheries. The middle-income people concentrates in the commercial district. The upper-income people are in the commercial and dispersed to the suburban area.

URBAN DEVELOPMENT: The city has developed in narrow strips along the transportation arteries, leaving large land gaps undeveloped or utilized for rice paddies. It has been an uncontrolled city until late in 1969, following with three years of study, the Greater Bangkok Plan 1990 was submitted to the Thai government by the American consultants. It can be considered as the first attempt at a comprehensive urban plan in Thailand. This plan was revised many times to accommodate to the growth of the city. The latest plan was the Greater Bangkok Plan 2000. The plan targets were: limiting number of population to 7.5 million, controlling the urban built-up area to 1,000 sqkm with the highest density of 1,562.5 people/Ha by providing green belt surrounding the urban area, using multi nuclei as a urban structure to reduce the density of the central business district, improving and increasing public utilities and infrastructure. This plan has been implement along with the National Social And Economic Development Plan which aims to: develop major urban area in the regional sectors, develop satellite cities around Bangkok, develop the rural area, decrease the annual growth rate of population.

URBAN GROWTH PATTERN

A fast growing city with very high population density packed in row-rise buildings. 4-5 story row-houses are the typical buildings for commercial purpose. High-rise buildings are mostly located in the business center.

PHOTOGRAPH: (OPPOSITE PAGE) Bangkok Metropolitan Area
CASE STUDIES

The following section contains case study examples of selected low-income dwelling environment within the Bangkok Metropolitan area. The case studies have been selected on the basis of income group, housing type and location.

The selected case studies illustrate the major systems of low-income housing. These systems are squatter settlement and public and private institution low-income housing.

The selected case studies are arranged by locality as indicated in the following:

KING PETCH
A "pay land rent" squatter on private and public land developed privately and houses very low, low and middle income groups. This type of settlement is representative of 25% of total population of Bangkok mostly located in the city center or inner ring. At the present time these settlements are under the government upgrading program.

KING PETCH SQUATTER
A small "pure" squatter settlement on strips of abandoned land and houses very low and low income people. This type of settlement is representative of 2% of the total population of Bangkok and scatters all over the city.

KLONG TOEY
A public walk-up apartment scheme developed by the National Housing Authority for low and middle income sectors. This type of settlement is representative of 3.5% of total population of Bangkok and located at the inner ring and periphery of the city.

LAD PHRAO
A first self-help housing scheme developed by the Asian Institute of Technology to be a experimental tools for studying the feasibility of self-help housing in Thailand. The project is mainly for low-income groups.

A total of four case studies were evaluated and compared with existing and the proposed site and services project (see evaluation page 35)
KING PETCH

SQUATTER "PAY LAND RENT" SETTLEMENT,
POPULAR, VERY LOW/LOW/MIDDLE INCOME

1a Before Upgrading
1b After Upgrading 1978

LOCATION: The community is located along the Mahanark canal in the city center. The two major accesses are Charoenphol and Rama I road. It is one of the mixed commercial and residential areas in the heart of Bangkok Metropolitan area. The settlement covers an area of 12.8 hectares.

ORIGINS: The community was established at the fringe of the city about 200 years ago by Cambodian Muslim migrants. 67% of the land in the community belongs to the government; the remainder is privately owned. After World War II, the expansion of the city engulfed this area and it became a mixed commercial and residential center. The community changes from a rural village to an uncontrolled urban low-income settlement which provides temporary and permanent shelter for immigrants. During the last 20 years, newly established commercial areas within 1 kilometer surrounding the community have provided more jobs to the residents; consequently, the community continues to grow rapidly.

PHOTOGRAPH: King Petch
(TOP) The settlement before upgrading; notice the littering and garbage in the canal and the deteriorated walkway.
(BOTTOM) The settlement after upgrading; the improvement of the canal and a new walkway.
LOCALITY PLAN

LOCALITY CIRCULATION PATTERN

LAYOUT: The community is comprised of three areas: Ban Khrua, Wat Phrayayang and Charoenphol. The locality is divided by the Charoenphol road into distinct east-west sides. The Mahanark canal further divides the community into the north-south sections. The northern boundary is a congested mixed commercial and residential area with 2 markets, 6 schools and a temple. The southern boundary along the Rama I road is a commercial with 2 markets, a vocational training school and again a temple. The western boundary is a mixed commercial and residential area with 2 schools and 3 temples. The eastern boundary is a newly developed commercial and entertainment area adjacent to the National Stadium. A characteristic of the locality is the growth along the canal further development inward into the inland. Vehicles cannot pass through the community because the rapid construction of new houses encroaches on the public circulation. The pedestrian circulation layout is perpendicular to the canal because it is used as the main transportation but now is converted into a drainage collector.

LAND USE: The locality is predominantly residential with commercial activities along the major pedestrian routes. A number of domestic and light industries are scattered throughout the neighborhood. There are very few vacant lots. The 3 mosques and 2 Buddhist temples from community centers and provide open spaces for children playgrounds. Most of the area is connected directly to piped water but pressure is frequently low. Electricity is also provided. The pit latraine and septic tank are primary method of sewage disposal. Both the storm water and overflow sewage is drained directly into the canal but garbage along the pedestrian walkways blocks the waterflow which results in flooding in the rainy season and in dry season the area is water-logged creating unhygienic conditions. The refuse disposal system and fire protection are inadequate.

CIRCULATION: The primary approach to the area is Charoenphol road. The secondary approach is the Rama I road. Water transportation is also used. The internal circulation is only for pedestrians which is composed of narrow, unstable, elevated wooden walkways. Accidents frequently happen because of the broken walkways and lack of street lighting. Vehicles occur only on the peripheral roads. Public bus transportation is adequate and convenient, both on Charoenphol and Rama 1 roads.
POPULATION: Presently the community houses approximately 14,800 people in 1,500 detached and semi-detached houses. There are 1.8 families per house because relatives and families usually stay in the same house and the average household size is 5.5 members. 60% of the population are under 15 years old. 48% of the population are male. 13% of the population are illiterate.

INCOME: The average annual household income is US.$ 138 in 1977. The household income distribution is as follows: 20% of very low income, 50% of low income, 20% of middle income, 10% of high income. The majority of the people work within the 30-minute driving distance. The employment distribution is as follow: 45% of private business employees, 15% of government employees, 20% of self-employees. The unemployment rate is 15% which mostly occurs in the population of 20-30 years of age.

LOCALITY SEGMENT: The segment is representative of the urban area that has uncontrolled residential area, schools, religious areas with cemeteries, and mixed commercial and residential areas. It is one of the very high density (900-1,600 persons/hectare) areas in Bangkok Metropolitan area. It is a mixed-income area. The low-income people provide needed-labor to this area and consequently, the community grows rapidly. 90% of the lots are rented and have shanties, row-houses, and a number of detached and semi-detached units. The majority of units contain 2-3 rooms with a verandah. Toilet facilities are attached to the units. Bathe area and kitchens are in the open space. Within the segment the King Petch squatter settles on the Mahanark canal opposite to the King Petch squatter (pay land rent). It is representative one of the many newly settlements which appeared during this past 10 years when the immigrants intruded small abandon pieces of private and government owned land.
SLUM INITIAL PROBLEMS

The initial slum upgrading program started in 1977, and was under the responsibility of the National Housing Authority. The present slum upgrading plan is for 1979-1983. The objectives of the plan are as follows: to cope with the problem of insufficient housing supply, to decrease government spending on new housing, to improve the socio-economic situation of the residents, to improve the environment of the area, and to ensure the residents security of tenure. There are 3 levels of upgrading: the first level is upgrading as permanent residential areas, the second level is upgrading as long-term temporary residential areas, the third level is upgrading as short-term temporary residential areas.

In 1976, the National Housing Authority surveyed 108 slum areas in Bangkok. There were four major reasons for selecting the King Petch community as the initial pilot project for slum improvement. First, more information on land tenure and maps of the area were available than any other areas; second, it is a medium-sized central city community close to employment; third, it is the third largest slum area; and fourth, it is considered that the community's integration and level of organization would reinforce an improvement program.

The major physical problems faced by the community were as follows: inadequacy of the internal circulation network and deteriorated wooden walkways, low pressure and inadequate water supply, inadequate fire protection, inadequate drainage and waste disposal. Garbage was usually thrown into the open space and the canal. In addition the sewage disposal was unhealthy, consequently, contaminated the soil, water and air. All these problems contributed to health hazards. During the National Housing Authority survey in 1976, 44% of the families had had a member sick. The major types of illness reported by residents were colds and skin diseases and moreover there were multination, intestinal infection and respiratory diseases in children.

The major socio-economic problems faced by the community were as follows: a high unemployment rate of women and young people, a high rate of people earning inadequate income, lack of knowledge in health-care and an abuse of time of young people.

The land security problem faced by the community was that the residents had only short-time leases for 1-2 years, which was a very brief time to provide for any kind of security.
LOCALITY CONSTRUCTION TYPES

<table>
<thead>
<tr>
<th>Construction Type</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shack</td>
<td></td>
</tr>
<tr>
<td>Mud/Wattle</td>
<td></td>
</tr>
<tr>
<td>Wood</td>
<td></td>
</tr>
<tr>
<td>Masonry Wood</td>
<td></td>
</tr>
<tr>
<td>Concrete</td>
<td></td>
</tr>
</tbody>
</table>

The chart shows (1) approximate percentage of each construction type within the total number of dwellings and (2) building group that generally produces each type.

Quality of information: Approximate

LOCALITY UTILITIES AND SERVICES

<table>
<thead>
<tr>
<th>Utility/Service</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Supply</td>
<td></td>
</tr>
<tr>
<td>Sanitary Sewage</td>
<td></td>
</tr>
<tr>
<td>Storm Drainage</td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td></td>
</tr>
<tr>
<td>Refuse Collection</td>
<td></td>
</tr>
<tr>
<td>Public Transport</td>
<td></td>
</tr>
<tr>
<td>Paved Roads/Walkways</td>
<td></td>
</tr>
<tr>
<td>Telephone</td>
<td></td>
</tr>
<tr>
<td>Street Lighting</td>
<td></td>
</tr>
</tbody>
</table>

LOCALITY COMMUNITY FACILITIES

<table>
<thead>
<tr>
<th>Facility</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Police</td>
<td></td>
</tr>
<tr>
<td>Fire Protection</td>
<td></td>
</tr>
<tr>
<td>Health</td>
<td></td>
</tr>
<tr>
<td>Schools, Playgrounds</td>
<td></td>
</tr>
<tr>
<td>Recreation, Open Spaces</td>
<td></td>
</tr>
</tbody>
</table>

The chart illustrates the approximate availability of utilities, services, and community facilities at three levels: NONE, LIMITED, ADEQUATE.

Quality of information: Approximate

1b KING PETCH
After Upgrading 1980

PHYSICAL IMPROVEMENT: The upgrading programs comprised the improvement of utilities, infrastructure and community center facilities. The utility and infrastructure programs were as follows: the access network consisted of walkways that would generally follow the existing circulation pattern and were constructed of precast concrete except for elevated narrow types which are wooden platforms supported on concrete posts; the drainage system was provided along the walkways and the existing drains were rehabilitated; the water supply consisted of adding new distribution pipes along the walkways, and increasing water pressure by providing additional wells; sewage disposal focused mainly on improvements in septic tank effluent pipes in order not to contaminate the soil, ground water and canal; refuse disposal collection points and containers were provided and 20 garbage carts were used to carry garbage from the streets to collection points by the community groups; electricity and street lighting were only improved in essential components such as replacement of poles and rewiring; fire protection schemes included the provision of 2 mobile diesel pumps with adequate hose lengths to reach the canal and fire extinguishers which would installed at strategic locations in the area; and two community centers were built.

SOCIO-ECONOMIC IMPROVEMENTS: The need for socio-economic improvement was essential and urgent. There were many reasons: 57% of wives were unemployed or stayed home as housewives; most of the unemployed were 21-30 years of age; 20% of the household heads were in unstable jobs or underemployed and consequently 35% of the households earned insufficient income to live. Therefore The National Housing Authority provided six improvement programs: the first was the adult career training program, such as handicraft, dress-making etc., the second was the day care program; the third was the health care and family planning program; the fourth was the food cooperative program; the fifth was the provision of a small-scale business loan program; and the sixth was community organization and participation program to reinforce community self-help efforts.

LAND TENURE IMPROVEMENTS: 67% of the land in King Petch community was owned by the Treasury's Estate Department. These lands were currently under short-term leases, normally for one year. Responsibility for these lands would be transferred to The National Housing Authority which would issue 20 year leases to the tenants and increase the rents to amortize the recoverable costs.

COST AND RECOVERY: The estimated average cost of physical upgrading per family was US$210. The capital cost of improvement would be recovered directly from the residents through plot leases for the construction cost of the walkways, drainage system, canal dredging and refuse disposal equipment. Costs would be recovered indirectly from monthly utility charges for electricity and water supply, and from general government revenues for the fire fighting equipment.
BEFORE UPGRADING 1978

LOCALITY BLOCK: The block used to be defined by a main street, a walkway along the canal and winding internal walkways. All the lots are clearly defined with fences of walls of the dwelling units as private area. Semi-private areas are dead-end walkways. There are 96 dwelling units and a number of them are old houses at least 30 years old occupied by extended families. The dwelling were constructed of wood frame, wood wall and tile roof which later, replaced by galvanized corrugated zinc roof. It consists of 2-3 rooms which are subdivided into spaces with light partitions or curtains, a toilet, and a veranda. The wide internal walkway and the walkways along the canal are social gathering places with grocery and food shops.

LOCALITY BLOCK LAND UTILIZATION DATA

<table>
<thead>
<tr>
<th>AREAS</th>
<th>Hectares</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBLIC (streets, walkways, open spaces)</td>
<td>0.057</td>
<td>9.0</td>
</tr>
<tr>
<td>SEMI-PUBLIC (open spaces, schools, community centers)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PRIVATE (dwellings, shops, factories, lots)</td>
<td>0.567</td>
<td>88.0</td>
</tr>
<tr>
<td>SEMI-PRIVATE (cluster courts)</td>
<td>0.016</td>
<td>1.0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>0.64</td>
<td>100.0</td>
</tr>
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</table>

NETWORK EFFICIENCY

Network length (streets, walkways) = 393

DENSITY Persons/Hectare 1484

CIRCULATION EFFICIENCY

Meter/Hectare 393
LOCALITY BLOCK: The block is defined by public primary and secondary circulation. The small vehicle streets and main walkway along the canal on the front and the back and the internal walkways on the side are secondary circulations. The upgrading circulation scheme was planned to have more direct and wider perpendicular secondary walkways to connect the primary circulations so that people would not get lost and reduced the chances to commit crime in the small winding walkways. The primary walkway along the canal is a community social gathering place with small food shops, handicraft work shops etc. There are different kinds of activities during the whole day such as children playing, people talking and gathering in the outdoor food stalls.

AFTER UPGRADING 1980

LOCALITY BLOCK LAND UTILIZATION DATA

<table>
<thead>
<tr>
<th>Type</th>
<th>Total</th>
<th>Area Hectares</th>
<th>Density N/Ha</th>
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<tbody>
<tr>
<td>LOTS</td>
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<td>140</td>
</tr>
<tr>
<td>DWELLING UNITS</td>
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<td>141</td>
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<tr>
<td>PEOPLE</td>
<td>406</td>
<td>0.29</td>
<td>1400</td>
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<tr>
<td>AREAS</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>PUBLIC (streets, walkways, open spaces)</td>
<td>0.473</td>
<td>16.3</td>
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<tr>
<td>SEMI-PUBLIC (open spaces, schools, community centers)</td>
<td>-</td>
<td>-</td>
<td></td>
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<tr>
<td>PRIVATE (dwellings, shops, factories, lots)</td>
<td>0.382</td>
<td>92.5</td>
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<tr>
<td>SEMI-PRIVATE (cluster courts)</td>
<td>0.045</td>
<td>1.2</td>
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<tr>
<td>TOTAL</td>
<td>0.29</td>
<td>100.0</td>
<td></td>
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NETWORK EFFICIENCY

| Network length (streets, walkways) | 554 |
| Areas served (total area)          | 56  |

CIRCULATION EFFICIENCY

<table>
<thead>
<tr>
<th>Density</th>
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DENSITIES

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<td>0.29</td>
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<tr>
<td>DWELLING UNITS</td>
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<td>0.29</td>
</tr>
<tr>
<td>PEOPLE</td>
<td>406</td>
<td>0.29</td>
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PERCENTAGES

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<tr>
<th>Type</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
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<td>16.3 %</td>
</tr>
<tr>
<td>Playgrounds</td>
<td>-</td>
</tr>
<tr>
<td>Cluster Courts</td>
<td>1.2 %</td>
</tr>
<tr>
<td>Dwellings/Lots</td>
<td>82.5 %</td>
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LOCALITY BLOCK LAND UTILIZATION

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<thead>
<tr>
<th>Pattern</th>
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<tr>
<td>Public: streets/walkways</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Semi-Public: playgrounds</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Semi-Private: cluster courts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private: lots</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dwelling</td>
<td></td>
<td></td>
<td></td>
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DENSITY

<table>
<thead>
<tr>
<th>Density</th>
<th>1400</th>
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</table>

0 10 50m

1:1000

N

CIRCULATION EFFICIENCY

meter/Hectare

554

PERCENTAGES

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Streets/Walkways</td>
<td>16.3 %</td>
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<tr>
<td>Playgrounds</td>
<td>-</td>
</tr>
<tr>
<td>Cluster Courts</td>
<td>1.2 %</td>
</tr>
<tr>
<td>Dwellings/Lots</td>
<td>82.5 %</td>
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</tbody>
</table>

DENSITIES

<table>
<thead>
<tr>
<th>Type</th>
<th>Total</th>
<th>Area Hectares</th>
<th>Density N/Ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOTS</td>
<td>43</td>
<td>0.29</td>
<td>140</td>
</tr>
<tr>
<td>DWELLING UNITS</td>
<td>41</td>
<td>0.29</td>
<td>141</td>
</tr>
<tr>
<td>PEOPLE</td>
<td>406</td>
<td>0.29</td>
<td>1400</td>
</tr>
</tbody>
</table>

AREAS

<table>
<thead>
<tr>
<th>Type</th>
<th>Area Hectares</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBLIC (streets, walkways, open spaces)</td>
<td>0.473</td>
</tr>
<tr>
<td>SEMI-PUBLIC (open spaces, schools, community centers)</td>
<td>-</td>
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<tr>
<td>PRIVATE (dwellings, shops, factories, lots)</td>
<td>0.382</td>
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<tr>
<td>SEMI-PRIVATE (cluster courts)</td>
<td>0.045</td>
</tr>
<tr>
<td>TOTAL</td>
<td>0.29</td>
</tr>
</tbody>
</table>

NETWORK EFFICIENCY

| Network length (streets, walkways) | 554 |
| Areas served (total area)          | 56  |

LOTS

Average area, dimensions = 56 m²
PHYSICAL DATA
(related to dwelling and land)

DWELLING UNIT
- **type**: SHANTIES/ROOMS/HOUSES
- **area (sq m)**: 55
- **tenure**: RENT/ILLEGAL OWNERSHIP

LAND/LOT
- **utilization**: PRIVATE
- **area (sq m)**: 60
- **tenure**: LEGAL RENT/OWNERSHIP

DWELLING
- **location**: CITY CENTER
- **type**: DETACHED
- **number of floors**: 1-2
- **utilization**: SINGLE & MULTIPLE
- **physical state**: BAD

DWELLING DEVELOPMENT
- **mode**: INCREMENT
- **developer**: POPULAR
- **builder**: SELF-HELP/ARTISAN
- **construction type**: WOOD/SHACK
- **year of construction**: 1920'S

MATERIALS
- **foundation**: WOOD
- **floors**: WOOD
- **walls**: WOOD
- **roof**: GALVANIZED SHEET/CERAMIC TILES

DWELLING FACILITIES
- **well**: 1
- **shower**: 1
- **kitchen**: 1
- **outside rooms**: 1-4
- **other**: COVERED PORCH

SOCIO-ECONOMIC DATA
(related to user)

GENERAL: SOCIAL
- **user's ethnic origin**: THAI/CHINESE
- **place of birth**: CENTRAL REGION
- **education level**: PRIMARY SCHOOL

NUMBER OF USERS
- **married**: 2
- **single**: 2
- **children**: 5
- **total**: 9

MIGRATION PATTERN
- **number of moves**: 1
- **rural - urban**: 1940
- **urban - urban**: -
- **urban - rural**: -
- **why came to urban area**: -

GENERAL: ECONOMIC
- **user's income group**: LOW
- **employment**: SELF-EMPLOYED
- **distance to work**: 1-5 KM
- **mode of travel**: WALKING

COSTS
- **dwelling unit**: $ 500-1,500
- **land - market value**: $ 500,000/HA

DWELLING UNIT PAYMENTS
- **financing**: SELF FINANCED
- **rent/mortgage**: $ 6-10/MONTH RENT LAND
- **% income for rent/mortgage**: 8%

PHOTOGRAPHS: (OPPOSITE PAGE) King Petch
(TOP LEFT) The existing condition of the deteriorated walkway; note the broken wood panels and accumulation of garbage and sewage along the sides.
(BOTTOM LEFT) The walkway underconstruction; a reinforced concrete structure.
(RIGHT) The present walkway; it becomes a social gathering place with food and grocery stores along the sides and serves as a children's playground.
2 KING PETCH SQUATTER

ORIGINS: In 1978, the group of food stall owners who habitated temporarily in the vocational training school were evicted because the school needed to expand the new academic buildings. Some inhabitants still wanted to sell food in the school settled adjacent to the retaining wall outside the school boundary along the Mahanark canal. The shanties multiplied very quickly because plenty of jobs were available; employment areas were easily accessible by walking or cheap public transportation; and because the initial settlers recommended the area to friends and relatives. After 2 years there are 21 households. The Metropolitan Municipality has a plan to move them out because the dwellings block part of the water transportation.

LOCATION: The King Petch squatter is located on the Mahanark canal in the city center opposite to the King Petch (pay land rent). The major accesses are the roads from Rama I and Charoenphol roads. There is a direct water transportation from Mahanark canal which connect the country major river. The settlement covers a water surface of 0.09 hectares.

LAYOUT: The site is on the Mahanark canal along the outside retaining wall of the vocational training school. There is a surface 0.08 m. wide of retaining wall which people use as a walkway. People built shanties on stilts over the canal and attached to the retaining wall. The canal is narrow which allow only one row of continuous shanties to build without blocking all the water transportation. Some of the households have opened food shops, work shops and junk shops along the walkway. It is an illegal settlement, public utilities are not available at all. People take advantages from the school lighting along the fence and some of them connect electricity from school. Most of the dwellings have ceramic-earth jars in front of the dwellings in order to store water which they need to buy and carry far away. Both drinking, and usable water is from these containers. The dwelling units have toilets drain directly into the canal. The kitchens are outside for good ventilation and easy drain. People bathe outside.

LAND USE AND CIRCULATION: The settlement has a high density of population with only a gap between dwellings. There are no facilities. The only internal circulation is the walkway over the retaining wall and every dwelling connects directly to it. Vehicles cannot pass through the site. The major approaches are streets from Rama I and Charoenphol roads. The minor approach is from the canal.

INCOME: From the survey, the average household income is US$ 1,200. The range of the income is from low to very low. All of the residents have jobs in this area within walking-distance. There are two major types of occupations. The first are different kinds of self-employed hawkers. The second is unskill labor.

POPULATION: There are 21 dwelling units with average household size of 7 persons. Most of the residents were evicted from other areas or migrated from rural area. Now they are also afraid to be evicted from this squatter. The children can not go to school because they do not have legal house registration to apply for school. Some of children work eventhough it is illegal.
LOCALITY BLOCK:
The block is defined by two public circulation, a canal and a walkways on the front and back, and the boundary of dwelling units on the side. There are 21 dwelling units in the block and were built with only a narrow gap under the roof between two adjacent units. The total settlement area can be classified as private area. The walkways are the only type of public area to which every unit has a direct access. The residents bought cheap second-hand materials or got materials from the refuse disposal. The dwelling units are generally in poor conditions, made of wood panels, wood frame and galvanized corrugated zinc roof. The dwelling consists of one or two rooms with toilet, a verandah for kitchen of bathing and a covered front porch for opening small shop and storing water jars.

LOCALITY BLOCK LAND UTILIZATION DATA

<table>
<thead>
<tr>
<th>AREAS</th>
<th>Hectares</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBLIC (streets, walkways)</td>
<td>.009</td>
<td>11.25</td>
</tr>
<tr>
<td>SEMI-PUBLIC (open spaces, schools, community centers)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PRIVATE (dwelling, shops, factories, lots)</td>
<td>.072</td>
<td>88.25</td>
</tr>
<tr>
<td>SEMI-PRIVATE (cluster courts)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td>.079</td>
<td>100%</td>
</tr>
</tbody>
</table>

CIRCULATION EFFICIENCY

Network length (streets, walkways) = 1200
Areas served (total area) =

LOTS
Average area, dimensions = 34 sqm
APPENDIX

PHYSICAL DATA
(related to dwelling and land)

DWELLING UNIT

- type: SHANTIES/ROOMS/HOUSES
- area (sq m): 15-30
- tenure: ILLEGAL OWNERSHIP

LAND/LOT

- utilization: PRIVATE
- area (sq m): 20-40
- tenure: ILLEGAL

DWELLING

- location: CITY CENTER
- type: DETACHED
- number of floors: 1
- utilization: SINGLE
- physical state: BAD

DWELLING DEVELOPMENT

- mode: INCREMENT
- developer: POPULAR
- builder: SELF-HELP
- construction type: WOOD/SHACK
- year of construction: 1978

MATERIALS

- foundation: WOOD POSTS
- floors: WOOD
- walls: WOOD
- roof: GALVANIZED SHEET

DWELLING FACILITIES

- wc: 1
- shower: 1 OUTSIDE
- kitchen: 1 OUTSIDE
- rooms: 1
- other: COVERED PUNCH

SOCIO-ECONOMIC DATA
(related to user)

GENERAL: SOCIAL

- user’s ethnic origin: THAI
- place of birth: CENTRAL REGION
- education level: PRIMARY SCHOOL

NUMBER OF USERS

- married: 2
- single: -
- children: 3
- total: 5

MIGRATION PATTERN

- number of moves: 2
- rural - urban: 1976
- urban - urban: -
- urban - rural: -
- why came to urban area: EMPLOYMENT

GENERAL: ECONOMIC

- user’s income group: VERY LOW
- employment: SELF-EMPLOYED
- distance to work: 2-4 KM
- mode of travel: -

COSTS

- dwelling unit: $ 100-130
- land - market value: NONE

DWELLING UNIT PAYMENTS

- financing: SELF FINANCED
- rent/mortgage: -
- % income for rent/mortgage: -

PHOTOGRAPHS: (OPPOSITE PAGE) King Petch Squatter
A "pure" squatter settlement along the public canal in the city center. This type of settlement grew rapidly in the last ten years because of migration.

CASE STUDY SOURCES

Locality plan: (accurate) Air photo-survey, 1979
Land use pattern: (accurate) IBID
Circulation pattern: (accurate) IBID
Segment plan: (accurate) IBID
Block land utilization: (approximate) Field survey, 1980
Typical dwelling: (approximate) IBID
Physical data: (approximate) IBID
Socio-economic data: (approximate) IBID
Photographs: Jarin and Varin Kiatfuengfoo, 1980
General information: Field survey, Varin Kiatfuengfoo, 1980
LOCATION: The Klong Toey public housing is located in the industrial area of the inner ring in Bangkok Metropolitan area. It lies opposite to the Klong Toey squatter settlement which is the largest squatter area in the city. The area is accessible by one major road, Arj-Narong road which runs along the railroad that leads to Bangkok port. The whole area is owned by the Port Authority. In 1978 started the construction of rapid transit route from the port passing in the front of the site.

ORIGINS: The port's rapid growth, its location and job opportunities had attracted people from different parts of Thailand. As a result, in 1950's the development of the port accentuated the growth of the squatter settlement, forming the largest squatter area in the city, with 36,500 people in 1975. The Port Authority had a development plan for the whole area. The authority wanted to move the residents to the new community because it was considered as a sub-standard area with inadequate utilities, facilities, deteriorated housing which created unhealthy physical conditions and crime rate. The National Housing Authority considered it too sub-standard to be upgraded, and proceeded to plan new housings. Therefore walk-up apartments for total 7,500-8,000 units will be built. This case study covers the first phase of the project which was finished in 1978.

PHOTOGRAPHS: Klong Toey (TOP) A street in the rainy season; note the pooling in the inadequately drained areas. Garbage is thrown everywhere illustrating the lack of users' responsibility in maintaining community facilities (BOTTOM) The main access to the community; a food market. The residents and nearby low-income people sell food as a means of income.
LAYOUT: Two 5-story apartments are grouped in pairs with open courts, 3 m wide between them. The buildings are laid parallel with the Arj-Narong road in the southern boundary. The Hua-Lumpong canal and the squatter along this are adjacent to the northern boundary. The eastern boundary is the Port Authority. The layout of the project is to provide usable spaces between buildings by having one major vehicle road cutting through the middle of the site and others roads, passing along the the perimeter and the sides of the buildings. Unfortunately, as a consequence of the layout, the residents had no responsibility over the spaces. Instead of being useful spaces, they become areas where people throw garbage. Open spaces on the ground floor under the buildings are used as hawker stalls and playgrounds instead of the outdoor open spaces.

CIRCULATION: The only road to the area is the Arj-Narong road with a main access and three minor accesses. Most of the internal streets are for vehicle. Some of these streets are finished with concrete surface and some are unfinished. There are no paved walkways so that people have to walk along the streets. The public transportation is available on the Arj-Narong road. Most of the streets are deteriorated despite that they are only 2 years old due to irresponsibility of the residents toward the community.
POPULATION: All residents in the project are from the Klong Toey squatter. The average household size is 7 persons and most of the households are extended families. Some of them feel that the apartment unit is too small. Some of them converted part of the unit into small shops for grocery, dress making, beauty salon etc., to earn extra income.

INCOME: The purpose of the project is to provide housing for families which have income less than US$ 900/year. 56% of the residents have jobs around this area which they can walk to work. The rest commute conveniently with the public bus transportation. The people’s occupations are distributed as follows: 29% of unskilled labor, 22% of skill labor, 19% of self-employees and hawkers, 21% of government and private employees. 23% of total residents work for The Port Authority.

During the survey, there are some complaints from the residents that they cannot afford to pay steadily their rent which they never had to do.

LOCALITY SEGMENT: The segment is representative of the typical rented-walk-up apartments that The National Housing Authority constructed during these last 7 years. The residents are all low-income. They try to maximize the utilization of the space by setting up stalls. This area therefore becomes a mixed residential and commercial area due to the real economic need of the residents.
The chart shows (1) approximate percentage of each construction type within the total number of dwellings and (2) building group that generally produces each type.

Quality of information: Accurate

LOCALITY UTILITIES AND SERVICES
- WATER SUPPLY
- SANITARY SEWERAGE
- STORM DRAINAGE
- ELECTRICITY
- GAS
- REFUSE COLLECTION
- PUBLIC TRANSPORTATION
- PAVED ROADS, WALKWAYS
- TELEPHONE
- STREET LIGHTING

LOCALITY COMMUNITY FACILITIES
- POLICE
- FIRE PROTECTION
- HEALTH
- SCHOOLS, PLAYGROUNDS
- RECREATION, OPEN SPACES

The chart illustrates the approximate availability of utilities, services, and community facilities at three levels: MORE, LIMITED, ADEQUATE.

Quality of information: Accurate
**LOCALITY BLOCK** These apartments were rented to the residents. The pair of buildings contain 208 units. Each unit contains one bedroom, a multi-purposed area, a kitchen, a bath and toilet. They are single-loaded corridor buildings with open courts in the middle. It is quite noisy and has poor cross-ventilation because the two buildings are too close. The open spaces surrounding the buildings are places where people throw garbage from their apartments regardless of having garbage disposal shafts, due to a lack of responsibility to the community.

**LAND UTILIZATION DIAGRAMS**

**PERCENTAGES** Streets/Walkways 77.2
- Playgrounds -
- Cluster Courts 3.7
- Dwellings/Lots 19.1

**DENSITY** Persons/Hectare 2023
- 20 Persons

**LOCALITY BLOCK LAND UTILIZATION DATA**

<table>
<thead>
<tr>
<th>DENSITIES</th>
<th>Total Number</th>
<th>Area Hectares</th>
<th>Density H/ha</th>
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<td>1.95</td>
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<td>DWELLING UNITS</td>
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<th>Percentages</th>
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<tr>
<td>PRIVATE</td>
<td>.019</td>
<td>3.7</td>
</tr>
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</table>

**NETWORK EFFICIENCY**
- Network length (streets, walkways) = 655
- Areas served (total area) = 655

**CIRCULATION EFFICIENCY**
- Meter/Hectare = 655

**PATTERN**
- Public: streets/walkways
- Semi-Public: playgrounds
- Semi-Private: cluster courts
- Private: lots
- Dwellings

**LOCALITY BLOCK LAND UTILIZATION**
1:1000
CASE STUDY SOURCES
Locality plan: (accurate) Air photograph, NHA maps, 1978
Land use pattern: (accurate) IBID
Circulation pattern: (accurate) IBID
Segment plan: (accurate) IBID
Block land utilization: (accurate) IBID
Physical data: (approximate) Field survey, 1980
Socio-economic data: (approximate) IBID
Photographs: Jarin and Varin Kiatfuengfoo, 1980
General information: Field survey, Varin Kiatfuengfoo, 1980

SOCIO-ECONOMIC DATA (related to user)
GENERAL: SOCIAL
user's ethnic origin: THAI
place of birth: CENTRAL REGION
education level: PRIMARY SCHOOL
NUMBER OF USERS
married: 4
single: -
children: 5
total: 9
MIGRATION PATTERN
number of moves: 4
rural - urban: 1960
urban - urban: -
urban - rural: -
why came to urban area: EMPLOYMENT
GENERAL: ECONOMIC
user's income group: LOW
employment: HARBOUR EMPLOYEE
distance to work: 3-5 KM
mode of travel: WALKING
COSTS
dwelling unit: $ 4500
land - market value: $ 312,500/HA
DWELLING UNIT PAYMENTS
financing: SUBSIDY/SELF FINANCED
rent/mortgage: $ 15/MONTH RENT
1/4 income for rent/mortgage: 15%

CASE STUDY SOURCES
Locality plan: (accurate) Air photograph, NHA maps, 1978
Land use pattern: (accurate) IBID
Circulation pattern: (accurate) IBID
Segment plan: (accurate) IBID
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Photographs: Jarin and Varin Kiatfuengfoo, 1980
General information: Field survey, Varin Kiatfuengfoo, 1980

SOCIO-ECONOMIC DATA (related to user)
GENERAL: SOCIAL
user's ethnic origin: THAI
place of birth: CENTRAL REGION
education level: PRIMARY SCHOOL
NUMBER OF USERS
married: 4
single: -
children: 5
total: 9
MIGRATION PATTERN
number of moves: 4
rural - urban: 1960
urban - urban: -
urban - rural: -
why came to urban area: EMPLOYMENT
GENERAL: ECONOMIC
user's income group: LOW
employment: HARBOUR EMPLOYEE
distance to work: 3-5 KM
mode of travel: WALKING
COSTS
dwelling unit: $ 4500
land - market value: $ 312,500/HA
DWELLING UNIT PAYMENTS
financing: SUBSIDY/SELF FINANCED
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DWELLING UNIT PAYMENTS
financing: SUBSIDY/SELF FINANCED
rent/mortgage: $ 15/MONTH RENT
1/4 income for rent/mortgage: 15%
4 LAD PHRAO
SELF-HELP HOUSING, PRIVATE, ROW HOUSES, 
LCW/MIDDLE INCOME

LOCATION: The community is located 14 km. 
from the city on the paved minor road, 
with a drainage canal along one side, 1.5 km 
from the major road. The only one access is 
the major Lad Phrao Road. It is a new rapid 
growth residential, commercial and services 
area. The community covers an area of 1.7 Ha.

ORIGINS: This community is the first project 
of the self-help housing project which The 
Asian Institute of Technology set up in 1978. 
it is intended as a teaching tool and an expe-
riment in developing new housing arrangement 
for low-income people in Bangkok with the 
co-operation from the National Housing Authority 
who provides staffs and advisors. For the 
necessity legal organization the promoter re-
istered the self-help housing group as a com-
pany with non-profit status. The director and 
shareholders worked voluntarily and the company 
only employed the full-time professionals, 
consultants, social promoters and skilled 
workers for assisting the people. This com-
pany intended to be only an intermediary organi-
zation and provides necessary access to tech-
nical and financial resources and legal owner-
ship for housing. The company received donor 
funds which would be revolving funds used 
initially to purchase land and construct 
infrastructure and then, after being reimbursed 
by the residents, reinvesting them in the next 
project.

PHOTOGRAPHER: Lad Phrao 
(TOP) The construction of the dwelling by mutual-help. 
(BOTTOM LEFT) The artist painted the dwelling wall in 
coloration of the first finished group of dwelling. 
(BOTTOM RIGHT) Women and children work as well as men 
in the mutual-help construction of dwelling.
LAD PIRA 67

CIRCULATION: A main road through the middle of the site serves as a community spine. All the clusters of houses are located along the spine. Each cluster has a road 6.00 m wide opened to the spine. Electricity, water supply, drainage, sewage lines are located on the spine and extend into the cluster road. The community facilities are located at the end of the spine. There is a pedestrian way 0.80 m wide in the perimeter of the entire site.

LAND USE: The primary use of the community is residential. The commercial area adjacent to the road is going to be sold to the public as to recover the infrastructure costs. There will be community facilities area which includes a community hall, a market, a factory and workshops, a clinic, a playground and an open air pavilion.
POPULATION: The company selected families by sending out 2,000 application forms and brochures in the area surrounding the site; 1,000 replies were received and consequently 200 families were selected by interviews. The criteria for selection was: real household and per capita income, current housing situation and ownership, job location, ability to pay, building skills and willingness to work and attend education courses.

INCOME: The average income of the families is US$ 155/month. The residents paid for the land and building materials. They gave 20% down payment on the house in two ways; the first is from the people for 1,500 hours of labour which equal to US$ 450, the second is from the people's saving which equals to US$ 200. The monthly payment are US$ 32 with 12% interest to the Housing Welfare Bank. The infrastructure costs will be recovered from selling 15 shop houses to the public.

LOCALITY SEGMENT: The community has a gross density of 706 people/hectare. The site subdivided into 200 lots and the average lot size is 5.00x12.00 sqm. One cluster groups together 16-20 lots. There are 11 clusters. Houses on the lots are built by mutual help. Each group of 16-20 families build houses. A lottery system would be used to assign owners. The infrastructure utilities are water supply, electricity, garbage disposal, sewage, drainage, telephone and constructed by a contractor.
CASE STUDY: JAII

LOCALITY UTILITIES AND SERVICES

- WATER SUPPLY
- SANITARY SEWERAGE
- STORM DRAINAGE
- ELECTRICITY
- GAS
- REFUSE COLLECTION
- PUBLIC TRANSPORTATION
- PAVED ROADS, WALKWAYS
- TELEPHONE
- STREET LIGHTING

LOCALITY COMMUNITY FACILITIES

- POLICE
- FIRE PROTECTION
- HEALTH
- SCHOOLS, PLAYGROUNDS
- RECREATION, OPEN SPACES

The chart illustrates the approximate availability of utilities, services, and community facilities at three levels: NONE, LIMITED, ADEQUATE.

Quality of information: Accurate

LOCALITY CONSTRUCTION TYPES

<table>
<thead>
<tr>
<th>Construction Type</th>
<th>0%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHACK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MUD/WATTLE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WOOD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MASONRY WOOD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MASONRY CONCRETE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONCRETE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONCRETE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The chart shows (1) approximate percentage of each construction type within the total number of dwellings and (2) building group that generally produces each type.

Quality of information: Accurate
LOCALITY BLOCK: The block represents one cluster. People complete the houses of each cluster in 12 months. The dwelling units are 2-story row houses without interior partition and completely finished only the second floor. The ground floor has only a finished-floor and a bath room. The structure is a bearing wall of concrete blocks and supported by 2 m concrete piles with 0.50 m spacing foundation. Most of the structural elements are prefabricated on the site.

LAND UTILIZATION DIAGRAMS

PERCENTAGES

<table>
<thead>
<tr>
<th>Streets/Walkways</th>
<th>15.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Playgrounds</td>
<td>-</td>
</tr>
<tr>
<td>Cluster Courts</td>
<td>-</td>
</tr>
<tr>
<td>Dwellings/Lots</td>
<td>84.6</td>
</tr>
</tbody>
</table>

DENSITY

Persons/Hectare 830

20 Persons

LOCALITY BLOCK LAND UTILIZATION DATA

<table>
<thead>
<tr>
<th>DENSITIES</th>
<th>Total Area</th>
<th>Area Hectares</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOTS</td>
<td>18</td>
<td>0.13</td>
<td>138</td>
</tr>
<tr>
<td>DWELLING UNITS</td>
<td>18</td>
<td>0.13</td>
<td>138</td>
</tr>
<tr>
<td>PEOPLE</td>
<td>108</td>
<td>0.13</td>
<td>830</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AREAS</th>
<th>Hectares</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBLIC (streets, walkways,</td>
<td>0.02</td>
<td>15.4</td>
</tr>
<tr>
<td>open spaces)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEMI-PUBLIC (open spaces,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>schools, community centers)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRIVATE (dwellings, shops,</td>
<td>0.11</td>
<td>84.6</td>
</tr>
<tr>
<td>factories, lots)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEMI-PRIVATE (cluster courts)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td>0.13</td>
<td>100.0</td>
</tr>
</tbody>
</table>

NETWORK EFFICIENCY

Network length (streets, walkways) = 759

CIRCULATION EFFICIENCY

Meter/Hectare 759

PATTERN

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

LOCALITY BLOCK LAND UTILIZATION

1:1000
CASE STUDY SOURCES

Locality plan: (accurate) Air photo-
graph, A.I.T. plan, 1979, Field survey
Segment plan: (accurate) A.I.T. plan
Typical dwelling: (accurate) IBID
Physical data: (approximate) Field survey, survey, 1980
Socio-economic data: (approximate) IBID
Photographs: Jarin and Varin Kiat-
Fuengfoo, 1980
General information: Field survey, 1980

SOCIO-ECONOMIC DATA

(related to user)

GENERAL: SOCIAL
user's ethnic origin: THAI
place of birth: CENTRAL/NORTH EASTERN
education level: PRIMARY SCHOOL

NUMBER OF USERS
married: 2
single: -
children: 4
total: 6

MIGRATION PATTERN
number of moves:
rural - urban: 1960's
urban - urban: -
urban - rural: -
why came to urban area: EMPLOYMENT

GENERAL: ECONOMIC
user's income group: LOW
employment: TAXI DRIVER
distance to work: 5-7 KM
mode of travel: BUS

COSTS
dwelling unit: $ 750
land - market value: $ 125,000/HA

DWELLING UNIT PAYMENTS
financing: SELF FINANCE
down payment: $ 32/MONTH
% income for rent/mortgage: 25%

PHYSICAL DATA

(related to dwelling and land)

DWELLING UNIT
area (sq m): 100
physical state: GOOD

developer: INSTITUTE
builder: SELF-HELP
construction type: CONCRETE BRICK
year of construction: 1978

MATERIALS
foundation: CONCRETE
floors: CONCRETE
walls: CONCRETE
roof: ADBESTOS SHEET

DWELLING FACILITIES
WC: 1
shower: 1
kitchen: 1
rooms: 2
other: COVERED PORCH

TYPICAL DWELLING

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GLOSSARY

The criteria for the preparation of the definitions have been as follows:


SECOND PRECEDENCE: definitions from technical dictionaries, text books, or reference manuals.

THIRD PRECEDENCE: definitions from the urban dictionary "Urban Dictionary" (U.S.D.P.) as they are used when existing sources were not quite appropriate or satisfactory.

Terms included for specificity and to focus on a particular context are indicated in parenthesis. Definitions are indicated in parenthesis. (See also: REFERENCES).

ACCESS. The pedestrian/vehicular linkages from/to the site to/from existing or planned approaches (urban streets, limited access highways, public transportation systems, and other systems such as: waters, airways, etc.) (U.S.D.P.)

ACTUAL LAND COST. "The cost of land is...set solely by the level of demand. The price of land is not a reflection of its yields or conditions; it is set by the users themselves in competition."(Turner, 1971)

AD VALOREM (TAX). A tax based on a property's value; the tax rate is fixed and if the property value is not altered, or even usually the market value, then only a valuation tax for tax purposes. (U.S.D.P.)

AERIAL DISTURBANCE. The act or process of destroying the rest, tranquility, or settled state of the site by the annoyance of airport noise, vibration, hazards, etc. (Webster-Webster, 1971)

AIRPORT ZONING RESTRICTIONS. The regulation of the height or type of structures in the path of moving aircraft. (Marmon, 1971)

ALTERNATING CURRENT (A.C.) (an electric) current that reverses its direction of flow at regular intervals. (ROTC ST 45-7, 1953)

AMENITY. Something that conduces to physical or material comfort or convenience, or which contributes satisfaction rather than money income to its owner. (Merriam-Webster, 1971)

AMPERES. Ampere (amp) are a measure of the rate of flow of electric current in a conductor. It is somewhat comparable to the rate of flow of water (gallons/lpm). A steady current produced by one volt applied across a resistance of one ohm will flow at one ampere. (ROTC ST 45-7, 1953)

APPRAISAL. An estimate and opinion of value, especially by one fitted to judge. (Merriam-Webster, 1971)

APPROACHES. The main routes external to the site (pedestrian/vehicular) by which the site can be reached from other parts of the urban context. (Keyes, 1971)

ASSESSED VALUE. A valuation placed upon property by a public officer or board as a basis for taxation. (Keyes, 1971)

ASSESSMENT. The valuation of property for the purpose of levying a tax or the amount of the tax levied. (Keyes, 1971)

BACKFILL. Earth or other material used to replace material removed during construction, such as in culverts, sewers, and pipeline trenches and behind bridge abutments and retaining walls or between an old structure and a new lining. (DePina, 1971)

BARRIER. (A boundary) as a topographic feature or a physical or psychological quality that tends to separate the ground from the free movement (to and from the site). (Merriam-Webster, 1971)

BETTERTME (TAX). A tax on the increment in value accruing to an owner because of development and improvement work carried out by local authorities. (U.S.D.P.)

BLOCK. A block is a portion of land bounded and served by lines of public streets. (U.S.D.P.)

BOUNDARY. Something (a line or area) that fixes or indicates a limit or extent (of the site). (Merriam-Webster, 1971)

BUILDING CODE. "A body of legislative regulations or by-laws that provide minimum standards to safeguard life or limb, health, property, and public welfare through provisions regarding the quality of materials, use and occupancy, location and maintenance of all buildings and structures within the city, and certain equipment specifically regulated therein."

BUILDING DRAIN. Lowest horizontal piping of the building drainage system receiving discharge from soil, waste, and other drainage pipes. It is connected to the building sewer. (ROTC ST 45-7, 1953)

BUILDING MAIN. Water-supply and fittings from the water main or other source of supply to the first branch of the water-distribution system of a building. (ROTC ST 45-7, 1953)

CEMENT POOL. An underground catch basin that is used where there is no sewer and into which household sewage or other liquid waste is drained to permit leaching of the liquid into the surrounding soil. (Merriam-Webster, 1971)

CIRCULATION. System(s) of movement/passage of people, goods from place to place; streets, walkways, parking areas. (U.S.D.P.)

CLAY. A lusterless colloidal substance, plastic when moist (crystallizes in a new lining) less than 0.0002mm in diameter. (U.S.D.P.)

CLEANUP. A plugging or similar fitting to permit access to traps or sewer lines. Cleanouts are usually used at first and other points of collection. (ROTC ST 45-7, 1953)

CLEANOUT. A work of art, a machine or other man-made object. (Merriam-Webster, 1971)

COLLECTION SYSTEM. The system of pipes in a sewage network conveying domestic, industrial, or sanitary wastes. (U.S.D.P.)

COMBINED SEWER. A sewer that carries both storm water and sanitary or industrial wastes. (DePina, 1972)

COMMUNITY. The people living in a particular place or region and usually linked by common interests: the region itself; any population cluster. (U.S.D.P.)

COMMUNITY FACILITIES/SERVICES. Facilities/services used in common by a number of people. It may include: schools, health services, public transportation, community center, etc. (U.S.D.P.)

COMMUNITY RECREATION FACILITIES. Facilities for activities voluntarily undertaken for pleasure, fun, relaxation, exercise, or recreation by all or releases from boredom, worry, or tension. (U.S.D.P.)

COMPONENT. A constituent part of the utility network. (U.S.D.P.)

CONSTRUCTION. Construction is a system of direct ownership of a single unit in a multi-unit whole. The individual owns the unit in such the same manner as if it itself were a single dwelling family dwelling. The title to the unit and a proportionate interest in the common land and areas. Two types of condominiums are recognized: horizontal, detached, semi-detached, row/grouped dwelling types; vertical, walk-up, high-use dwelling types. (U.S.D.P.)

CONDUCTORS. Materials which allow current to flow such as aluminum, copper, iron. (ROTC ST 45-7, 1953)

CONNECT. A pipe or other opening, buried or above ground, for conveying water, sewage, gas, cables, or other utilities. (DePina, 1971)

CONSERVATION EASEMENT. An easement acquired by the public and designed to protect private owned lands for recreational purposes or to limit the use of private land in order to preserve open space and protect certain natural resources. (U.S.D.P.)

CONSORTIA. A group or association of urban community organizations. (Merriam-Webster, 1965)

CORPORATION COCK/CORPORATION STOP. A water or gas conduit or conduit system connecting or disconnecting service lines to a consumer. (Merriam-Webster, 1971)

COSTS OF URBANIZATION. Include: CAPITAL costs of land and infrastructure; OPERATING: cost of administration, maintenance, etc.; DIRECT: include capital and operating production, indirect, personal effects. (U.S.D.P.)

CURRENT (See: ALTERNATING CURRENT, DIRECT CURRENT). An electric current is a movement of positive or negative electric units or single component, recognized by such observable effects as the production of heat, of a magnetic field, or of chemical transformation. (Merriam-Webster, 1971)

CycE. One complete performance of a vibration, electric oscillation, current alternation, or other periodic process. (DePina, 1971)

DAM. A barrier preventing the flow of water; a barrier built across a watercourse to confine and keep back flowing water. (Merriam-Webster, 1971)

DEPRECIATION ACCELERATION (TAX). A tax incentive system designed to allow property owners allowing a faster write-off during the early life of a building. (U.S.D.P.)

DESIGN. 1) The arrangement of elements that make up a work of art, a machine or other man-made object. 2) The process of selecting the means and concurring the elements, steps, and procedures for producing what will adequately satisfy some need. (Merriam-Webster, 1971)

DISTRIBUTION (STATION). The part of an electric supply system between bulk power sources (as generating stations or transformation station tapped from transmission lines) and the customers' service switches. (Merriam-Webster, 1971)

DISTURBED SOIL. Soils that have been disturbed by artificial process, such as excavation, transportation, construction in fall. (U.S.D.P.)

DRAINAGE. Interception and removal of ground water or surface water. By artificial or natural means. (De Pina, 1972)

DUST/DIRT. Fine dry pulverized particles of earth, grit, refuse, waste, litter. etc. (Merriam-Webster, 1971)

DWELLING. The general, global designation of a building, lodging place or residence in which people live. A dwelling contains one or more dwelling units (U.S.D.P.)

DWELLING BUILD. Four groups are considered: SELF-HELP HOUSING, where the dwelling unit is directly built by the user or occupant; low cost MULTIFAMILY UNIT, where the dwelling unit is totally or partially built by a small organization hired by the user, occupant, or developer; 'small' contractor is defined as the scale of operations and materials; mass building units are defined as the scale of operations, financially and materially; the scale reflects a more comprehensive and larger size of operations encompassing the building of large quantities of similar units, or a singularly large complex. (U.S.D.P.)

DWELLING DENSITY. The number of dwellings, dwelling units, people or families per unit hectare. Gross density the density of the buildings excluding lots, streets, etc. Net density is the density of population or number of people per area (as including only lots). (U.S.D.P.)

DWELLING DEVELOPER. Three sectors are considered in the supply of dwellings: POPULAR SECTOR: the marginal sector with limited or no access to the formal financial, administrative, legal, technical institutions involved in the provision of dwellings. The housing process (promotion, financing, construction, operation) is carried out by the Popular Sector generally for 'self use' and sometimes for profit. PUBLIC SEC-
GLOSSARY

Glossary entries:

1. **Government or non-profit organizations** - These are entities that operate for public benefit, such as the federal government or non-profit charities.

2. **Three-phase currents** - In a three-phase system, current flows through three separate wires, allowing for efficient and stable power distribution.

3. **Public Sector** - This refers to government or non-profit organizations that provide services or goods to the public.

4. **ELECTRICAL POWER** - The source or means of supplying electrical energy to consumers.

5. **CANDLE** - A device which changes the magnitude of alternating voltages and currents, generally referred to as voltage transformers.
APPENDIX

barracks or hospital) or enclosure (site) to another (other parts of the urban context).

(as in a camp) containing such a

(U.S.D.P.)

schools, playgrounds, parks, open spaces.

(Merriam-Webster, 1971)

The plan or

level, value or quality.

(U.S.D.P.)

LOCALITY. A relatively self-contained residential area/community/neighborhood/settlement within an urban

area which may contain one or more dwelling/land

systems. (U.S.D.P.)

LOCATION SEGMENT. A 400' x 400' area taken from and representing the residential character and layout of a

lot. (U.S.D.P.)

LOCATION. Situation: the way in which something (the site) is placed in relation to its surroundings (the urban context). (Merriam-Webster, 1971)

LOT. A measured parcel of land having fixed boundaries and access to public circulation. (U.S.D.P.)

LOT CLUSTER. A group of lots (owned individually) around a swapping common court (owned in condom-inium). (U.S.D.P.)

LOT COVERAGE. The ratio of building area to the total

lot area.

(U.S.D.P.)

LOT PROPORTION. The ratio of lot width to lot depth.

(RUTC 45-7, 1953)

LUMINARY. In highway lighting, a complete lighting device, including a source of light, source, a reflector, reflector, reflectance, and a mount as integral with the housing. (Defina, 1972)

MANHOLE. An access hole sized for a man to enter, particularly in sewer and storm drainage pipe systems for cleaning, maintenance and inspection. (U.S.D.P.)

MATRIX (OF BASIC REFERENCE MODELS). A set of models of urban layouts arranged in rows and columns.

(O.U.S.D.P.)

MASTER PLAN. A comprehensive, long range plan intended to guide the growth and development of a city, town or region, by designating public facilities, parks, schools, etc. in a limited group of people; physical controls -partial or complete; responsibility -public sector and user. PRIV-ATE (dwellings, lots): user -owner or tenant or squatter; physical controls -complete; responsibility -user. PUBLIC (streets, parks, etc.): user -public; physical controls -partial or complete; responsibility -user. (U.S.D.P.)

LATERAL SEWER. A device or machine that raises, transfers, or pumps fluids or that attenuates gases especially by mechanical means or pressure. (ROTC 1965, 1971)

DEFUSE COLLECTION. The service for collection and disposal of all the solid wastes from a community. (U.S.D.P.)

RESERVOIR. Large-scale storage of water; also functions as control fluctuations in supply and pressure. (U.S.D.P.)

RESIDENTIAL AREA. An area containing the basic land uses associated with the residential character of a community such as homes, schools, streets, etc. (U.S.D.P.)

RESISTANCE. The opposition to electrical flow. (Resis-tance increases as the length of wires is increased and decreases as the cross-sectional area of wires is increased.) (RUTC 45-7, 1953)

RIGHT-OF-WAY. A legal right of passage over another person's ground (land), the area or way over which a right-of-way exists such as a path or thoroughfare which one may lawfully use, the strip of land devoted to or over which is built a public road, the land
occupied by a railroad, the land used by a public utility. Rights-of-way may be shared (as streets; pedestrian and automobile) or exclusive (as rapid transit, subway, railroad, etc.) (Merriam-Webster, 1971; U.S.D.P.)

ROADWAY (HIGHWAY). Portion of the highway included between the outside lines of gutter or side ditches, including all slopes, ditches, channels, and appurtenances thereto, for proper drainage, protection, and use. (DePina, 1972)

ROW/ROOFED HOUSING. Dwelling units grouped together linearly or in clusters. (U.S.D.P.)

ROW. That part of precipitation carried off from the surface upon which it falls. (DePina, 1972)

RUNOFF. The drainage or refuse especially from a house, farmyard, or street. (Merriam-Webster, 1971)

SITE AND SERVICES. The subdivision of urban land and the provision of services required for the implementation of a community's commercial urban use. Site and services projects are aimed at the housing conditions for the low income groups of the population by providing: a) the access to a piece of land where people can build their own dwellings; b) services: the opportunities for dwelling, utilities, services, and community facilities, financing and communications. (U.S.D.P.)

SIZE. Physical magnitude or extent of the site, relative or proportionate dimensions of the site. (Merriam-Webster, 1971)

SLOPE. Degree or extent of deviation of the land surface from the horizontal. (Merriam-Webster, 1971)

SOIL INVESTIGATION. It is the process to find the soil structure and other characteristics. It may include the following stages: initial soil survey, exploratory boring, construction boring. (U.S.D.P.)

SOD PIPE. The pipe in a dwelling which carries the pipe discharge from water closets. (Merriam-Webster, 1971)

SOIL SURVEY (INITIAL). An on-site examination of surface soil conditions and reference to a GENERAL SOIL MAP. (U.S.D.P.)

SEPTIC TANK. A tank in which the organic solid matter of continuously flowing sewage is deposited and subsequently is biologically digested by anaerobic bacteria. (Merriam-Webster, 1971)

SEPTIC SYSTEM. A system of collecting, digesting, and disposing of human waste. (U.S.D.P.)

SITE AREAS. Two types are considered: CROSSOVER: includes only the portion of the site that can be fully utilized for buildings, streets, playgrounds, recreation facilities, garages, or other structures. (U.S.D.P.)

SPACE. That which is revealed to the vision or can be seen (from the site). (Merriam-Webster, 1971)

SPORTS. The activities that are carried out in an organized manner in a competitive or leisure setting. (U.S.D.P.)

SPOIL. Loose, distinguishable grains of quartz/sand (ranging from 0.05 to 0.025mm in diameter). (U.S.D.P.)

TAX EXEMPTION. A grant by a government of immunity from the taxation of personal property. In New York it is granted for a ten-year tax exemption on new buildings. (Abrams, 1966)

TAX INCENTIVE. Favorable tax treatment to induce the taxpayer to do something he would otherwise be likely to do. (Abrams, 1966)

TAXATION. The method by which a nation (state, municipality) implements decisions to transfer resources from the private sector to the public sector. (U.S.D.P.)

TELEPHONE. An electrical voice communication network interconnected all subscribing individuals and transmitting over wires. (DePina, 1971)

TENURE. The right to profit from a parcel of land through lease, tenancy, by purchase, or inheritance. (DePina, 1971)

TENURE. The right to profit from a parcel of land through lease, tenancy, by purchase, or inheritance. (DePina, 1971)

TOPOGRAPHY. The configuration of a (land) surface and man-made features. (Merriam-Webster, 1971)

TOWN. An urbanized political community. (U.S.D.P.)

TRASH. Garbage, refuse, and similar items that are discarded. (DePina, 1972)

TREATMENT WORKS. Filtration plant, reservoirs, and all other construction designed to effect the treatment of a water supply. (U.S.D.P.)

TRASHING. The process of removing trash from a place. (Merriam-Webster, 1971)

TRENCH. A long narrow excavation for laying pipes, wires, etc. (DePina, 1971)

TURBIDITY. That which is revealed to the vision or can be seen (from the site). (Merriam-Webster, 1971)

TURF. The natural or cultivated grassy surface on a piece of land. (DePina, 1971)

TURBULENCE. The irregular movement of air or water. (DePina, 1971)

TYPICAL. Typical of or characteristic of a class or category. (DePina, 1971)

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APPENDIX

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QUALITY OF INFORMATION

The quality of information given in drawings, charts and descriptions has been qualified in the following manner:

Approximate: when deduced from different and/or not completely reliable sources.

Accurate: when taken from reliable or actual sources.

Tentative: when based upon rough estimations of limited sources.

None: when the existence of services, facilities and utilities are unavailable to a locality.

Limited: when the existence of services, facilities and utilities are available to a locality in a limited manner due to proximity.

Adequate: when the existence of services, facilities and utilities are available to a locality.

METRIC SYSTEM EQUIVALENTS

Linear Measures

1 centimeter = 0.3937 inches
1 meter = 100 centimeters = 39.37 inches or 3.28 feet
1 kilometer = 1,000 meters = 3,281 feet or 0.62137 miles
1 inch = 2.54 centimeters
1 foot = 0.3048 meters
1 mile = 1.60935 kilometers

Square Measures

1 square meter = 1,550 square inches or 10.7639 square feet
1 hectare = 10,000 sq. meters = 2.4711 acres
1 square foot = 0.0929 square meters
1 acre = 0.4047 hectares

All income, cost and rent/mortgage data have been expressed in terms of the U.S. equivalent; 1 US Dollar = 20.0 Baht (May 1981)