Financial Appraisal for High-rise Apartment Project in Dhaka City
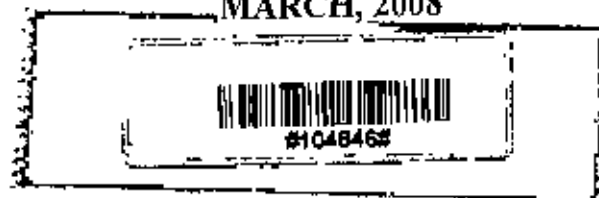
by

Khandakar Md. Wahid Sadique

A Thesis work submitted in partial fulfillment of the requirements
for the degree of Master of Advanced Engineering Management

Department of Industrial and Production Engineering

Bangladesh University of Engineering and Technology
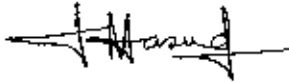
MARCH, 2008

CERTIFICATE OF APPROVAL

The Thesis work titled "Financial Appraisal for High-rise Apartment Project in Dhaka City", submitted by Khandakar Md. Wahid Sadique, Roll No.- 040308137 (P), Session- April, 2003 has been accepted as satisfactory in partial fulfillment of the degree of Master of Advanced Engineering Management on March 15. 2008.

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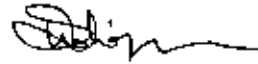
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CANDIDATE'S DECLARATION

It is hereby declared that this thesis or any part of it has not been submitted elsewhere for the award of any degree or diploma

Khandakar Md. Wahid Sadique

This thesis is dedicated to the homeless people of Bangladesh

ACKNOWLEDGEMENT

ABSTRACT

According to the Constitution of Bangladesh, the provision for basic necessities of life including food, clothing, shelter, education and medical care have been recognized as fundamental responsibility of the State (Article 15). But due to rapid increase in population and growth of urbanization Dhaka city is expanding at an unexpected rate with acute housing problem. According REHAB only 15% of its inhabitants possess own house among the one crore. 18% of its total population lives in the colony due to service. 13% of its population is living miserably in slums. 34% of its population lives in rented houses and rest of the 20% are floating population. Population of Dhaka city increases by 1,60,000.00 each year but only 10,000 can be provided shelter by government and non-government initiatives. Estimates for annual requirements for housing in urban areas vary from 3 lakh to 5.5 lakh units.

Rajdhani Unnayan Kartripakkha (RAJUK) being an autonomous body of the Government of Bangladesh is responsible for planned urbanization of Dhaka. RAJUK developed the areas like Gulshan, Uttara, Banani, Baridhara etc. in a planned manner and allocated plots to the people. Then individual plot-owner developed his plot. RAJUK has also undertaken and successfully completed Apartment Construction Project like NAM Villa project. At present RAJUK is implementing Purbachal New Town Project, the largest residential project of the south-east Asia. In this project RAJUK will preserve some places for high-rise apartment blocks for construction of apartments to settle the shelter crisis of the city. In Purbachal New Town Project RAJUK preserved six high-rise apartment block of 252.26 acre area where almost 65,000 no. of apartment of different sizes would be accommodated. Recently a foreign company has submitted a proposal to construct a apartments for the low and middle income people at the preserved areas of RAJUK of its different ongoing projects.

In this study considering the present housing demand no. of apartment units has been determined on the basis of available land requirement and project cost is estimated following the standard procedure. Down payment and monthly installment were kept within the salary range of a government official so that the y can purchase an apartment on 'hire and purchase basis' that means the price of the apartment is adjustable from his salary and financial appraisal were performed.

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CHAPTER 1

INTRODUCTION

1.1 Background

Until 1951, Bangladesh, which was almost completely a rural-agrarian country with 95.67 percent of the population living in rural areas and only 4.33 percent in urban areas is expecting that almost 40% of its total population will be living in the urban area by 2025. At present Bangladesh is a highly populated country with 150 million population in the area of 1,47,000 sq.km area with per capita income of 476 US dollar which is one of the lowest in the world [1].

Dhaka City, the capital of Bangladesh, was first established as a capital during the Mughol Empire and gradually grew up along the British & Pakistan period, is expanding very rapidly. This growth is remarkable after the liberation war of 1971, when it was established as the capital of independent and centrally ruled Bangladesh. But unfortunately the rapid growth of the city was never taken into account by the lawmakers or the rulers of the country. As a result its growth and latter development is marked with sheer lack of proper and far-reaching planning. The impact is now being felt at the end of the century. Dhaka City is now the most densely populated city of the world. Almost 29,000 persons are living per sq.km of this city. The area of Dhaka city is 1694 sq.km and its population is almost 15 million. Almost 0.15 million population is added with it each year.

According to the Constitution of Bangladesh, the provision for basic necessities of life including food, clothing, shelter, education and medical care have been recognized as fundamental responsibility of the State (Article 15) Due to rapid increase in population and growth of urbanization Dhaka city is expanding at an unexpected rate with acute housing problem. According REHAB Only 15% of its inhabitants possess own house among the one crore. 18% of its total population lives in the colony due to service. 13% of its population is living miserably in slums. 34% of its population lives in rented houses and rest of the 20% are floating population. Population of Dhaka city increases by 1,60,000.00 each year but only 10,000 can be provided shelter by government and non-government initiatives.

1.2 Housing Crisis

In many Asian developing countries, efficient housing provision has always been hampered by the supply-side constraints, one of which is the land factor. High population density, which is prevalent in Asia, makes urban land resources extremely scarce, and great land scarcity creates intensive competition for the access to land uses. Efficient land uses become a critical issue on the agenda of urban governments. Sustainability for Asian developing countries hinges on sustainability of their economic growth, which in turn, relies much on efficiency of their economic development. In the developing countries endowed with greatly scarce resources, social and environmental sustainability depends on efficient wealth creation in the first place. Inefficient economic development wastes resources unnecessarily, and poor quality economic growth adds to the tension in social relations. Without the participation of the state, the market-initiated provision of low-income housing proves to be sub-standard habitations where land uses are most inefficient. Being a developing country fighting with the poverty, Bangladesh is struggling to develop a coherent housing program for the middle-income and low-income residents. However, serious supply-side constraints hamper adequate market provision of middle-income housing, let alone low-income housing, because the state is absent from construction of effective housing markets [2].

1.3 Bangladesh Context

Low-income population usually suffers from housing shortages in the developing Countries. Because of poverty, it is reported that about one-third of Dhaka's population are squatters or live in slums. However, it becomes an issue if middle-income households could not afford decent housing of their choices, as housing is made of local materials and thus housing prices should be relative to the local economy. Most Dhaka's middle-income households do not own their housing and have to squeeze into small rented apartments usually shared with other families and the landlords. The Dhaka's housing supply system (Figure 1.1) indicates that public housing accounts for about 7 percent of the housing stock and the rest is private housing. However, the private housing market is dominated by small-scaled self-built housing, rather than developer-built housing. Many self-built housing is often referred as informal housing, which does not observe building codes if there are any [2].

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                    ┌──────────────┐
                    │   Housing    │
                    │   Supply     │
                    └──────────────┘
            ┌───────────────┴───────────────┐
   ┌──────────────────┐          ┌──────────────────┐
   │  Public Housing  │          │    Private       │
   │      (7%)        │          │  Housing (93%)   │
   └──────────────────┘          └──────────────────┘
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   │ Developer-  │ │ Self Built  │ │ Slums and   │ │ Self-built      │
   │ built       │ │ Housing on  │ │ Squatters   │ │ housing on      │
   │ Housing     │ │ subdivided  │ │             │ │ family owned    │
   │             │ │ lots        │ │             │ │ land            │
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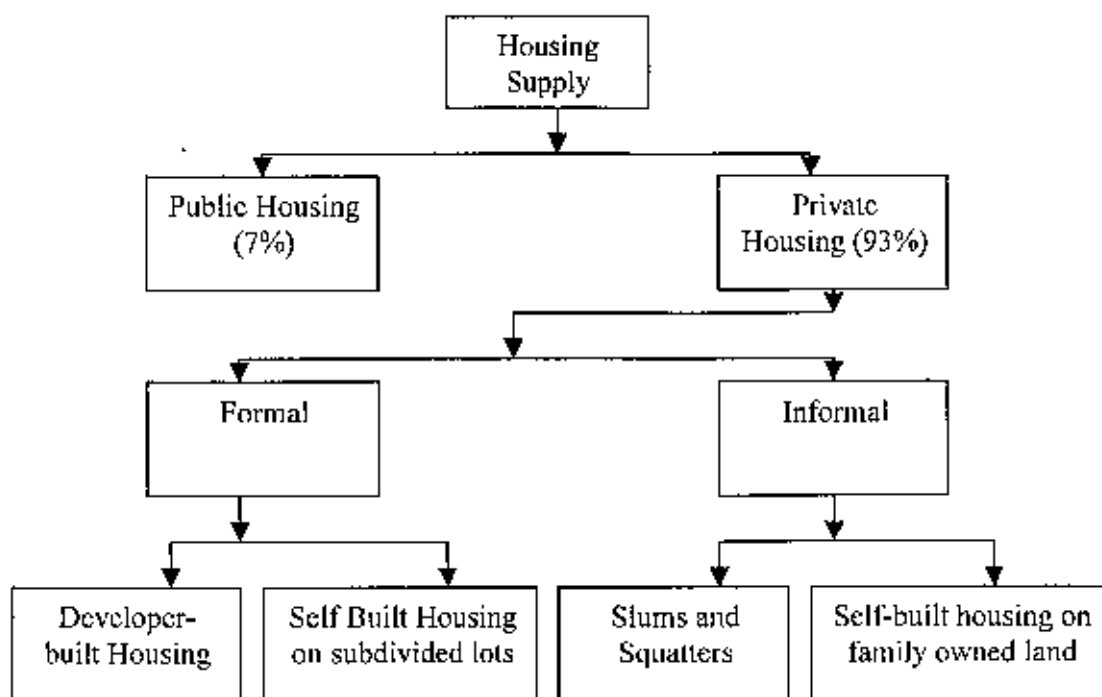
Figure 1.1 Dhaka's Housing Supply System

1.4 Housing Projects in Dhaka

According to a survey of Dhaka's housing development industry (Farzana and Zhu, 2004), developers cited unavailability of land and high land prices as reasons for shortages of developer-built housing in the market. The majorities of housing developers have to carry out development projects by forming a joint venture with individual landlords; with the latter contribute land to the developments. The ratio of land cost to the total development cost could reach as high as 90 percent. From a survey of 150 developers' housing projects, a typical housing project is composed of 21.3 apartments on average, and 82 percent of housing projects have a site area less than 1,000 sqm (Table 1.1).

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Table 1.1 Land areas of developer-built housing projects

Land Area of Housing Projects (sq.m)	Number of Housing Projects	Percentage
<335	13	8.7
400-670	72	48.0
735-1,005	38	25.3
1,070-1,340	25	16.7
1,405-1,675	2	1.3
Total	150	100

Source: Survey Conducted by Dr Jieming Zhu,Department of Real Estate,
National University of Singapore, 2003

1.5 Reasons of the Crisis

Shortages of housing are caused by shortages of land supply. The supply of serviced Green-field land is far less than the demand for it. The government is not able lead infrastructure development with its paltry fiscal capacity; large low-lying areas susceptible to inundation surround especially Dhaka city. Nevertheless, what could be blamed is that housing land in the urban built-up area, which is already occupied with infrastructure and amenities, is not used efficiently. Developer-organized housing developments are hampered by fragmented private land ownership. Large-sized housing projects are prevented from initiation by onerous, if not impossible, land assembly, which involves many landlords. Ubiquitous low-density individual self-built housing shows that the scarce land resources are under-utilized.

In the context of high population density, fragmented private or quasi-private land ownership is responsible for rampant self-built housing in Dhaka. Exorbitant transaction costs make assembly of many small land lots. The consequent self-built housing is not a sustainable mode of residential land development because of its under-utilization of land resources. Because of high population density, poverty, scarcity of valuable land in developing countries like Bangladesh there exists a vicious cycle of housing poverty as stated in the figure 1.2 below.
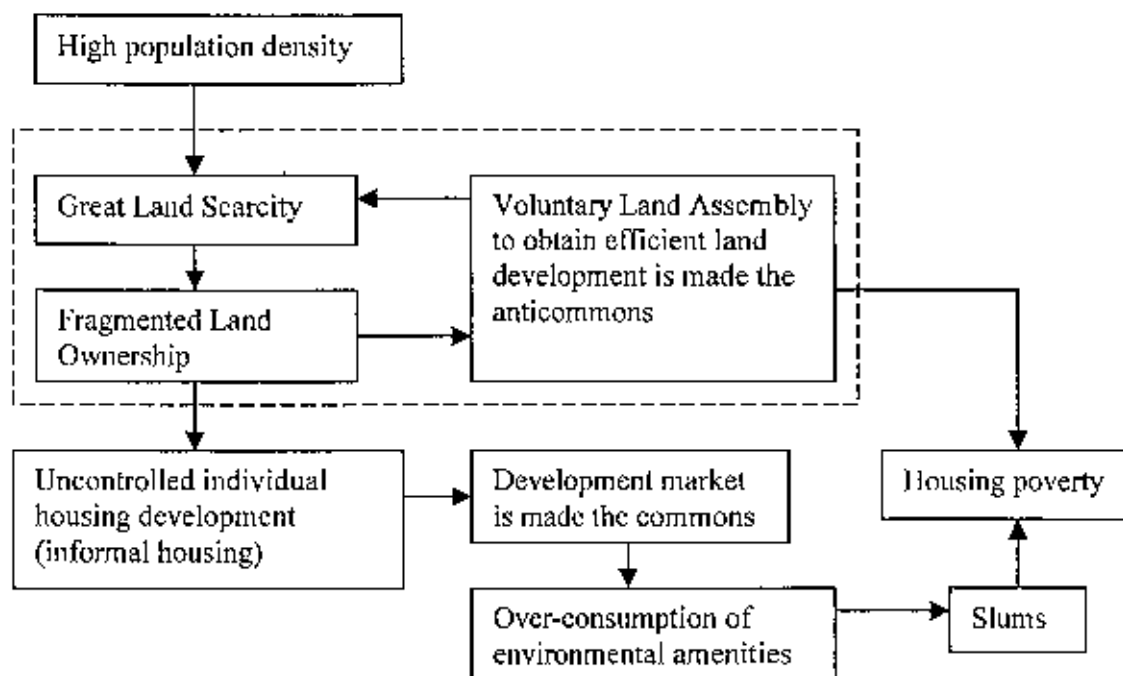
Figure 1.2 Vicious Cycle in the Housing Market leading Housing Poverty

1.6 Probable Solution

To overcome this problem state can follow two ways: firstly formulating housing policy to promote private developers to invest in housing projects and secondly government himself should take initiative to increase the number of public housing by developing large scale housing projects.

But for least developed countries like Bangladesh without government projects it is almost impossible to solve shelter crisis due to lack of large investors. One of the effective ways to increase public housing is to develop barren land into planned cities and construct high-rise apartments and provide the apartments to the people at affordable price, what RAJUK is doing since late fifties. This project is designed mainly for government agencies to develop affordable homes for middle-income group, which may initiate government step towards solving the shelter crisis.

1.7 Problem Definition

In categorizing provision of shelter as one of the fundamental responsibilities of the state, the Constitution of the People's Republic of Bangladesh recognized shelter to be among the fundamental human rights. The UN Declaration on

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Fundamental Rights also reveals that every person has a right to an adequate standard of living, which includes housing. But making shelter available to all is increasingly becoming a significant challenge. Though population growth rate in Bangladesh has plateau at 1.6 per cent, an increasing expanse of living space at this rate will also be necessary to accommodate the "demographic momentum". Statistics show that Bangladesh will need to construct approximately 4 million new houses annually to meet the future demand of the next twenty years. Estimates for annual requirements for housing in urban areas vary from 3 lakh to 5.5 lakh units [1].

Along with population growth, urbanization is considered as one of the next most alarming threat to the housing sector. Rather than being a phenomenon specific to Bangladesh, urbanization has now become an issue of global concern. The share of urban population in Asia is 37 per cent at present and is projected to be 45 per cent by 2015. In Bangladesh 25 percent of the population (some 35 million people) now live in urban areas; this proportion will be 34 per cent (75 million) by the year 2015. Dhaka, with a total population of 10 million, is now the 22nd largest city in the world. This is a consequence of high rate of in-migration to Dhaka. By the year 2015 Dhaka is projected to rank as the 5th largest city in the world, where 19 million people will have to find their house.

On the other side, with the continued growth of population land for agriculture and forest will shrink in tandem. This calls for high density settlement either in high rises or in small unit low rise apartments. The area occupied by human settlements and supportive infrastructure in Bangladesh is quite high at 30 per cent. Land is becoming increasingly inadequate to provide individual housing solution to all and as a result demand for apartments is growing rapidly. But the Government of Bangladesh has less significant role to construct apartments to eliminate shelter crisis of its population. In fact, government is more concerned about construction of quarter for government officials to provide shelter during their service period, which is a temporary solution rather than a life long solution to its citizen. Besides the government officials the State does not have any plan to provide shelter to others except some donor-aided project for the poor or special vulnerable group. As a result shelter crisis is increasing day by day to the people, especially urban population.

To solve this problem large scale of land area is required which is the scarcest resource of the country. Moreover there is an abrupt disparity in land ownership in the

country. The land ownership pattern in most urban areas in Bangladesh even in rural areas is highly skewed few people owning disproportionately large share of land. The access to land is most difficult for most of the people in urban areas due to excessive price and also its scarcity. Though the land coverage by different group explains clearly the emergence of real estate and middle income group mostly advocates its control (Table 1.2).

Table 1.2 Coverage of Land by Different Group (Dhaka)

Income Group	Approx. City Population	Coverage of land in City Residential Areas
Upper Income	2%	15%
Middle Income	28%	65%
Lower Income	70%	20%

Source Bangladesh Statistical Year Book 1996.

From the above table it is found that a large portion of land is owned by the middle income group but due to inflation of money, excessive construction material cost and lack of adequate financing facilities middle income people are unable to construct house for their individual use. As a result they are inclined to developer to build apartments.

Apart from these, in many cases those who could accommodate themselves through the apartments offered by the private developers or real-estate companies, they are also facing some problems like poor quality construction, frequent breeches of contract by the developers, unreasonable price, poor after sale service, fraudulent practices by the developers etc. So it seems very prospective to construct high-rise apartments for middle-income people at an affordable price, which may provide a reasonable solution of shelter crisis to that particular group of the society.

1.8 Rationale, Objective and Scope of the study

1.8.1 Rationale

Bangladesh faces a major housing problem. With a very low GNP per capita ($250); very high population densities (almost 3,008 persons per square kilometer in urban areas); and a high population growth rate in urban areas (4.5 percent per year), the standard shelter is correspondingly low. Approximately 77 percent of urban dwellings and over 98 percent of dwelling are not permanent. Overcrowding and

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minimal or no infrastructure support services are further problems. According to numerous Bangladesh agencies, the plight of low and middle-income households has worsened in recent years, particularly in relation to basic housing. In this regard government should take exemplary initiative to solve the acute housing problem for the low and middle-income group that could be followed by the private agencies involved in the housing sector in the long run. Due to remaining financial and bucarocratic constraints of the government agencies the problem may be resolved by both the private and public partnership. The rationale of the project study is to find out a solution of the existing housing problem for the urban middle-income group.

1.8.2 Objective

The objective of the study is to (i) improve substantially the conditions affecting the development of public and private sector housing for middle-income households, (ii) provide affordable standards of constructions and services, (iii) maximize the contribution of urban real estate investments to the local and national economy, (iv) encourage government agencies to take initiative to solve shelter problem on private and public participation, (v) encourage private housing agencies to design housing project for middle and low income group, (vi) encourage financial institutions to finance projects have been taken to meet up the middle and low income group housing problem, (vii) find out new market segment of housing business in middle and low income group and (viii) ensure maximum use of scarce and valuable land resource in planned way.

1.8.3 Scope

The scope of the project included (i) analysis of background of the problem on the basis of basic data available, (ii) an initial sector assessment, including the estimation of shelter requirements and housing demand/supply characteristics, (iii) determination of shelter requirement, (iv) cost estimate to construct apartments for the middle income group and (v) marketing of the apartments.

1.9 Methodology

In this project, at the very beginning basic data would be analyzed. Basic data includes area, population, population density, GDP, GNP, per capita income, household income and expenditure, urban and rural migration, size of urban population, urban population growth rate, urban population density etc.

Second step is to analyze the present situation of housing like demand of housing, no. of new shelter required per year, present supply system, constraint of present supply system etc.

Third step is to analyze the data regarding urban middle class and find out potential market of apartments for middle-income group. In this procedure apartment size (area) and approximate price of the apartment should be determined.

Fourth step is to design a project to solve the shelter problem of middle-income group in the urban areas. In this step construction related technical matters will be analyzed. Total cost and duration of the project will be determined in that phase.

The final step is to financial appraisal. In this step financial feasibility study of the project will be accomplished. In this step 'Cost-Benefit Analysis' will be done. Net Present Value (NPV), Internal rate of Return (IRR), Benefit-cost ratio or Profitability Index, Payback period etc will be find out and project feasibility will be determined.

CHAPTER 2

LITARETURE REVIEW

2.1 Background: Country Level

Bangladesh being the worlds 7th largest country by population is facing severe shelter crisis to accommodate her population. Due to acute shortage of land and fund it is very important for Bangladesh to ensure maximum utilization of valuable land and housing project should be taken after thorough study of demographic and financial status of the people.

2.1.1 Bangladesh at a Glance

Bangladesh is located in north-eastern part of south Asia between 20'01' and 26'38 N - latitude and 88'01 and 92'41' E-longitude. The country is bounded on west, north and northeast by India and also on Southeast and partly by Myanmar. And on the south is the Bay of Bengal. Total area of the country is 1,47,570 sq km including 18,559 sq-km forestland and 1,992 sq. km of water bodies. The land is almost flat and fertile except some hilly region, which also occupies 20% of total land. Bangladesh, being located in a tropical region has an average temperature of 24 to 38 °C but rain with dusty wind is common and also presence of high humidity, which are almost 80%. The country is divided into six divisions and each division contains several districts and at present there are 64 districts and 479 thanas for administrative purpose. These are the urban centers, which are controlled by municipalities. The capital city Dhaka and the port and 2nd largest city Chittagong are main attention for urbanization [3]. Population and pattern are presented in the Table 2.1 & 2.2 below:

Table 2.1 Area, Households and Population

Locality	Area (Sq. Km)	Households	Population
Rural	1,37,159	1,94,55,678	9,94,44,696
Urban	10,617	60,35,144	3,10,77,952
Total	1,47,776	2,54,90,822	13,05,22,598

Source: Census 2001, BBS.

Table 2.2 Population (In Million) by Sex

Year	Both Sex	Male	Female	Sex Ratio	Growth Rate (Annual)	Urban Population
2000	129.3	66.3	63.0	105.4	1.41	29.60
2001	131.1	67.1	62.9	106.6	1.54	30.00
2002	132.9	68.2	64.7	105.4	1.40	30.60
2003	134.8	69.1	65.7	105.2	1.43	31.30
2004	136.7	70.1	66.6	105.2	1.42	32.40
Source: SVRS 2004, BBS.						

2.1.2 Urbanization in Bangladesh

Urban population growth rates in Bangladesh are the highest among the South- and South-East Asian countries. For example, average annual urban population growth rates in India and Thailand in the late 1960s were 4.0% and 4.8% respectively against 6% in Bangladesh at the same period. The main reason for this population increase besides the natural growth can be enumerated as following:

1. Change in the status of towns in different levels accompanied with offices, industries, and academic institutions attracting people of various professions.

2. Attraction of socio-cultural, educational and health and others facilities in the city. The concentration of different institution also led to high growth of the educated middle class.

3. Large-scale migration following natural disasters (flood, tornado) in different years or man-made calamities like war, famine etc.

4. Deteriorating economic condition in the rural areas, increasing poverty and landlessness pushing the rural poor towards the cities. This resulted in growth of people working in the informal sector within low in come range. Household income or consumption by percentage share: *lowest10%:* 3.9% and *highest 10%·* 28.6% (1995-96 est.)[4].

Due to above mentioned reasons migration from rural area to urban area has been increased tremendously and consequently urbanization has grown up (Table 2.3).

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Table 2.3 Migration by Direction in Bangladesh

Direction	Migration Per 1000 Population		
	2002	2003	2004
Rural to Rural	10.30	10.34	13.80
Rural to Urban	11.00	17.37	6.00
Urban to Rural	2.70	2.78	13.10
Urban to Urban	39.80	34.34	38.10
Source: SVRS, BBS.			

Urbanization in its proper sense started in Bengal with establishment of British administrative centers (particularly, the district headquarters) and development of business centers on the banks of large rivers. The process, however, did not bring much change in house structures and their styles. Houses in these newly developed townships used almost the same materials as in the surrounding rural areas and yet, changes started showing up very soon. These houses were constructed usually in rows and blocks and many of them were built in European architectural design. A completely new phenomenon was the growth of slums, especially around industry centers and for the people migrating from rural areas in search of jobs and earning opportunities. Buildings in some areas adopted the designs of Muslim architecture and in many places; the influence of typical Indian structures of the Mughal period could be seen in abundance [3].

Until 1951, Bangladesh was almost completely a rural-agrarian country with 95.67 percent of the population living in rural areas and only 4.33 percent in urban areas (Table 2.4) Table shows the urbanization pattern in Bangladesh as well as urban population growth of Dhaka City. The level of urbanization was extremely low in 1951 with only 4.33% of the total population living in urban areas. It has increased gradually to 5.19% in 1961 and then very rapidly to 8.78% in 1974, 15.54% in 1981. 20.15% in 1991 and 23.39% in 2001 (BBS, 1991 and BBS, 2001).

Table 2.4 Urbanization in Bangladesh and Urban Population Growth

Year	Total Urban Population	Percent of Urban Population	Average Annual Growth Rate (%)
1951	1819773	4.33	1.69
1961	2640726	5.19	3.75
1974	6273602	8.78	6 62
1981	13535963	15.54	10.63
1991	20872204	20.15	5.43
2001	28808477	23.39	3.27
Source. BBS, 1997, BBS, 2001			

A recent study by World Bank has estimated that about 40% of the total population in Bangladesh will be living in urban area in Bangladesh by 2025 (ADB, 2000). Urban population density in Bangladesh was 2179 persons/sq.km in 1991 and the present density is estimated at approximately 3008 persons/sq.km (Table 2.5).

Table 2.5 Urban Population Density in Bangladesh

Year	Person/sq.km
1991	2,179
2004	3,008

Population density of Dhaka megacity was found to be 4795 persons/sq.km in 1991 and the present density is estimated at approximately 8573 persons/sq.km. However, the population density of DCC area is more than three times of the megacity area, as in 1991 it was 15333 persons/sq.km against estimated present density of 18055 persons/sq.km which is very high in comparison with the other countries of Asia (Table 2.6 & 2.7). With limited availability of flood-free land, further densification of population along with haphazard encroachment of peripheral land of Dhaka as well as in urban areas of Bangladesh seems inevitable [5].

Table 2.6 Urban Population Density (persons/sq.km), Dhaka, Bangladesh

Year	Urban Population Density (persons/sq.km)		
	Bangladesh	Dhaka Mega City	Dhaka City Corporation
1991	2179	4795	15333
2004	3008	8573	18055

Table 2.7 Urban Data of some Major Cities of Asia

	Bandung	Dhaka	Hué	Kandy	Makati	Penang
Metropolitan population	-	6,537,308	-	-	7,907,386	-
Municipal population	2,056,913	3,637,892	260,127	130,000	452,734	518,419
Annual population increase, 1970-1990 (percentage)	3.23	6.681	-	-	1.963	0.93
Annual projected population increase, 1990-2010 (percentage)	2.68	9.541	-	2.55	1.983	-
Land area (km2)	167.29	227.81	67.90	30.04	29.86	292,64
Built-up area (km2)	100.40	25.43	- 2	8.00	(19.00)6	-
Household income (US dollars)	5104	1245	-	-	2257	-
Source: Municipal Land Management in Asia: A Comparative Study						

Dhaka, being the primate city of the country as its share of national urban population was 25% in 1981, 31% in 1991 and 34% in 2001 respectively. Dhaka's dominance not only in terms of population, but also in terms of economy, trade, commerce, and administration is obvious. In 1991 among the thirty-four mega cities of the world having a population of more than five million, Dhaka ranked twenty-fifth (BBS, 1997) while in 2000 it ranked eleventh and it is predicted to be the world's fourth largest city by the year 2015 with an estimated population of 21.1 million (Lizin, 2002). The present population of Dhaka mega city is estimated at 11.3 million while that of Dhaka City Corporation (DCC) area at 5.94 million in the year 2004 [4].

Bangladesh although still at a low level of urbanization (25 percent), its total urban population is a huge one (30 million). In fact, it is one of the largest urban populations in the world. This population has recorded very rapid growth during the last three decades (nearly 7 percent annually), and continues to grow rapidly (at over 5 percent annually). The growth rate to decline to some extent but will still be higher than 3 percent 2020 when the urbanization level would rise to nearly 40 percent and the total urban population to over 70 million. By 2035 Bangladesh will statistically become an urbanized country, with more than 50 percent of its population being urban. This situation may even happen earlier, give certain shifts in the economy and technology-taking place.

At the present time, urbanization in Bangladesh is characterized by significant regional/ spatial variations. Dhaka region (former Dhaka District) is more than 50 percent urban, with a few other regions recording 25-40 percent, while a number of regions are way below the average of 25 percent. Even as low as 15 percent Dhaka has become only a mega city in term of population (above 10 million).

2.2 Background: Regional Level

As urbanization has started from the late sixties, urbanization in Bangladesh is still at premature stage and limited to only few cities and growth centers like Dhaka, Chittagong, Khulna, Rajshahi, Barisal, Sylhet, Bogra, Rangpur etc. But urbanization is taking place remarkably in Dhaka city, being the centre of all administrative and business operations, secondly in some extent in Chittagong for being port city and economic activities.

2.2.1 City: Dhaka at a glance

Dhaka being the capital and largest metropolitan city of Bangladesh with its employment opportunities and other commercial activities has attracted the largest number of migrants from all parts of the country. As a result the population has increased tremendously during this period (1971-80) compared to the expansion in the city area. In 1991 it was estimated that 40% percent of the total urban population live in Dhaka city. Dhaka has grown from a town of just 0.5 million people in 1957 into a metropolis of more than 7.0 million in 1991 over an areas (Dhaka metropolitan development plan-DMDP) of 1528sq.km (590 square miles) (Table 2.8 & 2.9)

Table 2.8 Population Growth of Dhaka City

Year	DCC Area		DMDP Area (RAJUK Area)		Population Density (Person/Hectare)	
	Population (000)	Growth (%/Year)	Population (000)	Growth (%/Year)	DCC Area	DMDP Area
1991 (Census)	6,100	-	7,300	-	169	48
1995	6,900	3.0	9,100	4.2	192	59
2000	8,000	3.0	10,900	3.6	222	71
2005	9,000	2.5	12,600	3.0	251	83
2010	9,900	1.5	14,200	2.4	269	93
2015	10,200	1.0	15,700	1.9	283	103

Source: DMDP

Table 2.09 Urban Population Growth of Dhaka City

Bangladesh	Dhaka	
Year	Population	Average Annual Growth Rate (%)
1951	411279	1.28
1961	718766	5.74
1974	2068353	8.47
1981	3440147	7.53
1991	6487459	6.55
2001	9912908	4.33
Source: BBS, 1997, BBS, 2001		

Dhaka's role includes full range of national government and administrative functions together with high proportions of all national industrial, commercial, cultural and recreational activities. All governmental decisions and the greater part of political activity originate from Dhaka [5].

2.2.2 Migration to Dhaka

Migration figures give a picture on the affinity of the migrants towards the bigger cities. Number of total rural to urban migration was over 2,400,000 in 1961-74. This was 6 times higher than that in between 1951-61 and constituted nearly 60% of the total urban population increase. Three big cities combined absorbed nearly 2/3rds of the whole urban-bound migrants; Dhaka alone accommodated 38.83% of the total migrants.

Table 2.10 Demographic Characteristics by Major Districts

Division/ Zila	Area	Both Sex	Male	Female
Bangladesh	147569.55	123851120	63894740	59956380
Barisal	2774.94	2348440	1196220	1152220
Chittagong	5282.98	6543860	3440640	3103220
Comilla	3085.17	4591340	2310940	2280400
Dhaka	1463.60	8618700	4795300	3823400
Faridpur	2072.72	1742720	893280	849440
Ghazipur	1741.53	2023260	1054960	968300
Mymensingh	4363.48	4460120	2291800	2168320
Narayanganj	759.57	2170740	1155300	1015440
Tangail	3414.38	3261600	1659820	1601780
Jessore	2566.68	2469680	1282480	1187200
Khulna	4394.46	2357940	1234320	1123620
Kushtia	1621.15	1737360	895300	842060
Bogra	2919.90	3015400	1561040	1454360
Dinajpur	3437.98	2640940	1361860	1279080
Pabna	2371.50	2164960	1116160	1048800
Rajshahi	2407.01	2274340	1181000	1093340
Rangpur	2307 78	2527060	1307140	1219920
Sylhet.	3490.40	2547320	1308140	1239180
Source: Census 2001, SVRS, BBS.				

2.2.3 Housing Situation in Dhaka City

Housing situation in Dhaka faces the formidable problem of providing minimum shelter of acceptable standard to everybody. The scene is depicted by the volume of slums and squatters, number of families per household. trend in household formation, etc. Before analyzing the information regarding the migration of people towards Dhaka data of the following Table 2.11 can give us an overall picture of migration of Bangladesh:

Table 2.11 Population Growth in Urban Areas and New Shelter Requirements
(1980-2000)

Urban Centers	1980 Population (Millions)	1980 Households (000's)	2000 Population (Millions)	2000 Households (000's)	1980-2000 New Housing Req. (000's)
Dhaka	3.5	515	9.3	1691	1176
Chittagong	1.43	220	4.0	727	507
Khulna	0.70	108	2.4	418	310

2.3 Potential Market Segment of the Proposed Apartment Construction Project:

2.3.1 Background

A three-tier market characterizes the residential housing sector in Bangladesh. First are those households with the highest disposable income, able to afford high-quality housing in fully serviced neighborhoods. This group represents less than 3 percent of the housing market. The second tier is the relatively narrow stratum of middle-income households. It represents 12-15 percent of housing market and composed of public servants and wage/salary earners of large private companies and public sector corporations. The third and largest of the tiers is the low-income households, for which housing is provided largely by the private sector, often under illegal and unsatisfactory neighborhood conditions. Before selecting a housing project some information regarding household size and income distribution of people should be analyzed (Table 2.12 to 2.19).

Table 2.12 Average Household Size

Key Findings	HIES-2005			HIES-2000		
	Total	Rural	Urban	Total	Rural	Urban
1	2	3	4	5	6	7
Average Household Size	4.85	4.89	4.72	5.18	5.19	5.13
Source: HIES-2005, 2000, BBS						

Table 2.13 Number of Household by Size (in million)

Number of Household by Size (in million)	HIES-2005			HIES-2000		
	Total	Rural	Urban	Total	Rural	Urban
1	2	3	4	5	6	7
1 member	0.60	0.50	0.10	0.39	0.34	0.05
2-3 members	6.51	4.74	1.77	4.56	3.63	0.93
4-5 members	12.70	9.26	3.44	10.25	8.07	2.18
6+ members	8.83	6.88	1.95	9.14	7.37	1.77

Source: HIES-2005,2000, BBS

Table 2.14 Average Earner per Household

Key Findings	HIES-2005			HIES-2000		
	Total	Rural	Urban	Total	Rural	Urban
1	2	3	4	5	6	7
Average Earner per Household	1.40	1.37	1.50	1.45	1.43	1.54

Source: HIES-2005, 2000, BBS

Table 2.15 Number of Household by Number of Earners

Number of Household by Number of earners (in million)	HIES-2005			HIES-2000		
	Total	Rural	Urban	Total	Rural	Urban
1	2	3	4	5	6	7
0 Earner	2.11	1.73	0.38	1.50	1.23	0.27
1 Earner	16.86	12.78	4.08	14.42	11.68	2.74
2 Earner	6.60	4.71	1.89	5.54	4.30	1.24
3+ Earner	3.07	2.16	0.91	2.88	2.20	o.68

Source. HIES-2005, 2000, BBS

Table 2.16 Income (Taka per Month)

Income (Taka per Month)	HIES-2005			HIES-2000		
	Total	Rural	Urban	Total	Rural	Urban
1	2	3	4	5	6	7
Income per household	7203	6095	10463	5842	4816	9878
Income per earner	5145	4449	6975	4029	3368	6414
Income per capita	1485	1246	2217	1128	928	1926

Source: HIES-2005, 2000, BBS

Table 2.17 Expenditure (Taka per Month)

Expenditure (Taka per Month)	HIES-2005			HIES-2000		
	Total	Rural	Urban	Total	Rural	Urban
1	2	3	4	5	6	7
Total expenditure per h/h	6134	5319	8533	4881	4257	7337
Consum. Expend. Per h/h	5964	5165	8315	4537	3879	7125
Food expend. Per h/h	3209	3023	3756	2477	2300	3175
Source: HIES-2005, 2000, BBS						

Table 2.18 Housing Size by Census

Locality	Year				
	1960	1973	1981	1991	2001
National	5.3	5.6	5.7	5.5	4.9
Rural	5.3	5.6	5.7	5.5	4.8
Urban	5.6	5.9	5.9	5.5	4.9
Source: Census 2001, BBS.					

Table 2.19 Living Space per Living Structure (In Sq.Ft.)

Locality	Year			
	1981	1991	2002	2003
National	288	249	222	225
Rural	284	243	223	222
Urban	326	299	210	213
Source: Census 2001, BBS.				

2.3.2 The Urban Middle Class

In Indian subcontinent the middle class emerged more as a consequence of changes in the system of law and public administration than as a result of economic and technological development. The members of the middle class belong to the learned professions. The real growth of middle class was more of a 20th C. phenomenon with the growth of government jobs in civil, military, police, railway and river services along with the growth of institutions for professional education of doctors, engineers and advocates. This growth of the professions and the number of Indians (before subdivision) in government service coincides with a steady increase in urbanization after 1900 and the faster growth of individual cities. Urbanization introduced major changes in the system of education and occupation. Traditionally,

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specific trade or occupation of each member of indigenous society was birth ascribed. Achieved characteristics are mainly economic and refer to formal education and training. Whereas in traditional system children followed their parents into their roles, education was at individual level without formal schooling. Western ideas increasingly infiltrated into the middle-class thinking through their education, in service training and the media- books, journals and press. This influenced gradual change in the concept of family, life-style and living. Metropolitan society and the job structure together created preference for nuclear family to replace the traditional joint family. Westernization encouraged both spatial and temporal compartmentalization of activities in cities as well as in domestic level. The home and work place was no longer synonymous. The cities eventually compartmentalized into residential, commercial, recreational and industrials zones. Single used areas replaced traditional mixed land use. In the domestic level the trend was to isolate spaces according to different activities like sleeping, eating, cooking, etc. Following Table (Table 2.21) may help to find out the potential buyers/customers of proposed apartment construction project [5].

Table 2.20 Income Groups in Dhaka City, 1987

Income Group	Monthly Income of HH in Taka	Proportion of Total HH in the city (%)
Lower Income Group	1000-3000	70%
Middle Income Group		28%
Lower-middle	3001-5000	
Middle	5001-10,000	
Upper-middle	10,001-20,000	
Upper Income Group	20,001-	2%

Table 2.21 Residential Space Standards for Government Officers and Employees, 2005. Salary is in Taka and corresponding area is in sft.

Category of Officer / Employee	Pay Scale Grade	Pay Scale (Tk.)	House Rent (Tk.)	Allotable Floor Areas- sft
Class I	1	23,000.00	12,650.00	1800
	2	19,300.00	10,615.00	
	3	16,800.00	9,240.00	1500
	4	15,000.00	8,250.00	
	5	13,750.00	7,562.50	1250
	6	11,000.00	6,050.00	
	7	9,000.00	4,950.00	
	8	7,400.00	4,070.00	1000
	9	6,800.00	3,740.00	
Class II	10	5,100.00	2,805.00	
	11	4,100.00	2,255.00	
Class III	12	3,700.00	2,035.00	800
	13	3,500.00	1,925.00	
	14	3,300.00	1,815.00	
	15	3,100.00	1,705.00	600
	16	3,000.00	1,650.00	
	17	2,850.00	1,567.50	
Class IV	18	2,600.00	1,430.00	
	19	2,500.00	1,375.00	
	20	2,400.00	1,320.00	500

The middle income-group combined represents approx.28 percent of the city population but cover nearly 65 percent of the residential land. Density in these areas may range from 50-400 persons/acre (124-988 per/ha). This wide range is reflection of the significant variation within the group. There is also a high disparity of income between different income levels of the Middle class. Urban middle class became a dominant power towards the end of colonial period. It gave leadership to all socio-cultural and political activities. After the independence this dominance lead to the planning of housing that only catered only to their need.

CHAPTER 3

HOUSING POLICY

3.1 Introduction

Housing could be generally termed as a habitable shelter but its meaning stretches far from merely a shelter. It is the total living environment including dwelling units, land, the neighborhood services and utilities needed for the well being of its inhabitants. Housing is one of the basic beings, which provides security and sense of belonging to the owner. The pre-requisite for health and comfort is proper housing.

Bangladesh, like many other developing countries face an acute shortage of affordable housing both in the urban and rural areas. The housing shortage was estimated in 1991 to be 3.10 million units out of which 2.15 million units in rural areas and 0.95 million units in urban areas. The shortage was projected to be 5.0 million by the end of the year 2000. The government is fully aware of the problem and various steps are being undertaken to counter it.

The National Housing authority has been the principal public sector agency engaged in solving the enormous housing problem of the country, particularly for the poor, the low and the middle-income group of people.

The end of the British rule and the partition of the subcontinent resulted in migration of million of Muslim refugees flocked into the four main cities of Bangladesh and started living on vacant government lands in these cities. They erected makeshift houses creating unplanned and unhygienic condition. The influx of these refugees also produced tremendous strain on the existing services and infrastructures. In view of this situation the then government created housing wing under the Works, Power and Irrigation Ministry in 1958. The government undertook housing programs throughout the country in order to rehabilitate the refugees and the local low and middle-income families in an organized way. The housing wing was upgraded to the present Housing and Settlement Directorate in 1971 after successful completion of the refugee rehabilitation program. To ascertain shelter for all by 2000 the Democratic government now formulating National Housing policy 2004,

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considering the present need of the country. In the light of the National Housing policy, the national Assembly has adopted and approved the National Housing Authority (NHA) Act. 2000. in accordance with the act, Housing and settlement direction (HSD) and deputy Commissioner Settlement (DCS) office have been abolished and a new organization NHA has been formed by merging these two organization. The National Housing authority Act 2000 has been implemented on the 15th July 2001 through the government notification.

The liberation of Bangladesh brought about an influx of rural population to the urban areas, Bangladesh has an agriculture-based economy and most of its rural population is dependent on agriculture. There is a huge surplus of labor in the rural areas, as only farming cannot support all the rural population. As a result, they remain unemployed or under employed for most of the year. These population along with the millions affected and uprooted by the war of 1971 migrated to the cities in search of jobs and better life. Most of them started squatting on the government owned vacant land like the road reserve; railway stations sides of railway tracks, launch terminals and market places. These poor people lived in appalling conditions, totally unfit for human habitation without the presence of any sanitary or utility facilities. As a result, an unhealthy condition was created causing serious threat to the public health and the overall environment of these cities.

3.2 National Housing Policy

Government of Bangladesh has adopted a National Housing Policy. Salient Features of National Housing Policy of Bangladesh are stated below [6]:

3.2.1 Objectives

The main objectives of the National Housing Policy are:

- Ensure housing for all with particular emphasis on the disadvantaged, destitute, the shelter less poor and the low and middle-income group of people.
- Make available suitable land for housing at affordable price.
- Developing mechanisms to discharge formation of slums and squatter settlements, unauthorized constructions and encroachments.

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- Mobilization of resources for housing through personal savings and financial institutions.
- Developing institutional and legal framework for facilitating housing.
- Providing encouragement to universities, research institutions and research centers for research on housing oriented.

To achieve the above objectives, the strategy of the government is to act as a promoter and facilitator and also as a provider to a limited extent. The salient features of the housing strategy envisage the National Housing Policy is:

- Housing will be given due priority in the national development plans.
- The role of the government in housing will be to supply service land at reasonable price and to help, create and promote housing finance institutions.
- Efforts will be made to increase affordability of the disadvantaged and the low-income groups through providing credit for income generation.
- Improvement and rehabilitation of the existing housing stock will be given priority by the government alongside new housing.
- Encroachment on public land and unauthorized constructions will be discouraged.
- Facilities incremental house building and ensure wider application of resources.
- Conservation of the natural environment and preservation of cultural heritage in new housing projects.

3.3 National Urban Sector Policy

In addition to National Housing Policy a National Urban Sector Policy has already been drafted which will provide a framework for social, economic, cultural and political-institutional sustainability. The policy envisions strengthening the beneficial aspects of urbanization and at the same time, effectively dealing with its negative consequences in order to achieve sustainable urbanization. It aims to work towards a decentralized and participatory process of urban development in which the central government, the local government, the private sector and the civil society have their roles to play [7].

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3.3.1 The major objectives of National Urban Sector Policy for Bangladesh will aim to

- Ensure regionally balanced urbanization through diffused development and hierarchically structured urban system.

- Facilitate economic development, employment generation, reduction of inequality and poverty eradication through appropriate regulatory frameworks and infrastructure provisions.

- Ensure optimum utilization of land resources and meet increased demand for housing and urban services through public-private and other partnerships.

- Protect, preserve and enhance urban environment, especially water bodies

- Devolve authority at the local urban level and strengthen local governments through appropriate powers, resources and capabilities so that these can take effective responsibility for a wide range of planning, infrastructure provision, service delivery and regulatory functions

- Involve all sectors of the community, in participatory decision-making and implementation processes

- Ensure social justice and inclusion by measures designed to increase the security of poor people through their access to varied livelihood opportunities, secure tenure and basic affordable services.

- Take into account particular needs of women, men, children, youth, the elderly and the disabled in developing policy responses and implementation.

- Assure health, safety and security of all citizens through multifaceted initiatives to reduce crime and violence.

- Protect, preserve and enhance the historical and cultural heritage of cities and enhance their aesthetic beauty

- Develop and implement urban management strategies and governance arrangements for enhancing complementary roles of urban and rural areas in sustainable development

- Ensure good governance by enhancing transparency and establishing accountability.

3.3.2 Major dimensions of the policy

1. Patterns and processes of urbanization

2. Local urban planning: at present, only four cities have their own planning commissions

3. Local economic development and employment

4. Urban local finance and resource mobilization

5. Urban management: this is needed since currently Bangladesh lacks effective management systems

6. Urban housing

7. Urban poverty and slum improvement

8. Urban environmental management

9. Infrastructure and services

10. Urban transportation

11. Health and education

12. Social structure

13. Gender concerns

14. Urban children, ages and the disabled and the scavengers

15. Urban recreation

16. Cultural and aesthetic development

17. Rural-urban linkage

18. Law and order

19. Legislation

20. Urban governance

21. Training

22. Research and information.

CHAPTER 4

PROJECT DESCRIPTION

4.1 Introduction

From the discussion of previous chapter it's clear that low and middle-income people of Bangladesh are facing tremendous shelter crisis. Shelter, as one of the basic needs of human being state should take the initiative to provide shelter to all of its inhabitants. Though government suffers severe fund crisis he may invites investors in housing project to provide affordable shelter to its population. In this chapter a project would be designed for middle income group of the country. Though middle income group is less vulnerable than the low income group, but it's relatively easier to design a project for middle income group. A project to solve the shelter crisis of low income group requires large and complex efforts which are beyond the discussion this project.

Rajdhani Unnayan Kartripakkha (RAJUK) being the prime agency for the planned development of the Dhaka city has implemented several housing projects like Banani, Gulshan, Baridhara, Uttara etc model town projects which are the prime residential areas of the country. At present RAJUK is implementing Purbachal New Town Project that will develop 6150 acres of rural land to urban area that will accommodate more than one million populations. Purbachal will be a completely new city which will be well planned with sufficient number of residential plots for different categories people including very rich to urban poor. One of the important features of Purachal project is that it has reserved six prime locations as high-rise apartment block which covers 252.26 acres of land. Important features of Purbachal project is stated below:

01. Name of the Project   :   Purbachal New Town Project

02. Sponsoring Ministry   :   Ministry of Housing & Public Works

03. Executing Agency   :   Rajdhani Unnayan Kartripakkha (RAJUK)

04. Project Tenure   :   17 (Seventeen) Years

05. Project Cost   :   Tk. 5,000 Cr.

06.	Source of Fund	:	RAJUK's own Fund
07.	Background	:	Rajdhani Unnayan Kartripakkha (RAJUK) has taken initiative to expand Dhaka in planned and sustainable way. For this reason RAJUK is implementing Purbachal New Town Project where there is a provision to accommodate 65,000 no.s of apartments at high-rise buildings for low and middle income people. Due to acute shelter crisis RAJUK should implement the apartment project immediately.
08.	Area	:	6150 acres out of which 4500 acre in Narayangaj district, 1500 acre in Kaligonj district and 150 acre in Dhaka district for link road.
09.	Plot Area	:	6000 acre: 2428.11 hectare or 24.28 sq.km or 9.375 sqm
10.	No. of Plots	:	Residential: 29,000 Commercial: 5,000 Total: 34,000.

A high-rise apartment construction project has been designed on the basis of "High-rise Apartment Block" of Purbachal project. The High-rise Apartment Block's of Purbachal covers 252.26 acres area where 65,000 units of apartment construction is possible. These apartments should be designed for middle income group generally. For initial assessment two types of apartment has been considered: Type-A of 1100 sft and Type-B of 800 sft. Each apartment building shall be 20-storied apartment building. A brief outline of the proposed High-rise apartment construction project is outlined in next paragraph.

4.2 Project Description

01.	Name of the Project	:	Construction of Affordable Apartments for Middle-Income People
02.	Sponsoring Ministry	:	Ministry of Housing & Public Works
03.	Executing Agency	:	Rajdhani Unnayan Kartripakkha (RAJUK)
04.	Project Tenure	:	10 (Ten) Years
05.	Project Cost	:	Tk. 12672.14 Cr.
06.	Source of Fund	:	RAJUK's own Fund
07.	Project Location	:	"Purbachal New Town Project" Area, RAJUK.
08.	Objective	:	a) To provide shelter to middle-income people at an affordable price. b) To reduce shelter crisis. c) To provide safe and environmental community living facilities.
09.	Background	:	Rajdhani Unnayan Kartripakkha (RAJUK) has taken initiative to expand Dhaka in planned and sustainable way. For this reason RAJUK is implementing Purbachal New Town Project where there is a provision to accommodate 65,000 no.s of apartments at high-rise buildings for low and middle income people. Due to acute shelter crisis RAJUK should implement the apartment project immediately.

4.3 Technical Matters

The design concept for the proposed affordable housing development is based on 4 main design objectives:

- To provide homes that meets certain minimum standards at the lowest possible prices.
- To provide reasonable quality living environment in a landscaped setting.
- To utilize efficient and economical construction method.
- To provide specifications that meets the expectations of purchasers.
- The development shall be distributed as follows:
  a) Type A- 1100 sft - Medium cost homes
  b) Type B- 800 sft - Low-medium cost homes

4.4 Cost Breakup

Cost of the major items of the project is presented below:

Table 4.1 Cost Break-up

Sl. No.	Cost Component	Estimated Cost (Tk. In Cr.)	Less@5%	Investment Cost (Tk. In Cr.)	% of the Total Cost
1	Land Purchase& Development Cost (LPDC)	305.23	15.26	289.97	2.29
2	Apartment Construction Cost (ACC)	11563.52	578.18	10985.34	86.71
3	Utility & Others Cost (UTC)	578.18	28.91	549.27	4.34
4	Road Construction Cost (RCC)	21.15	1.06	20.09	0.16
5	Contingency & Overhead Cost (COC)	867.26	43.36	823.90	6.50
	Total	13335.34		12668.57	100.00

Detailed Estimate is annexed at Appendix-A. The estimate is prepared on the basis of Plinth Area Rate of PWD Schedule of Rates/2006, which differs from the actual price in most of the cases. For this reason the investment cost is calculated 5% less from the estimated cost. After detail design the cost may change from the estimated one. Project cost also depends on project duration, natural calamities. and political situation, availability of local material and manpower and obviously allocation of adequate finance.

At this project the development cost per sft stands: Tk. 2076.12.

4.5 Project Magnitude

By any measure, the scheme involves a massive undertaking in terms of the magnitude and pace of construction that needs to be undertaken.

The following figures give a sense of the scale of the project:

- Number of Units : 65,132 No.s
- Types of Units : Two Types:
            Type A: 1100 sft , 29716 No.s
            Type B: 800 sft , 35416 No.s
- Construction Cost/sft : Tk. 2076.12
- Total Cost : Tk. 12668.57 Cr.
- Minimum Price of Type-A Unit Tk. 22,83,732.91
- Minimum Price of Type-B Unit Tk. 16,60,896.66
- Number of Locations (cities) : 01
- Number of sites : 06
- Number of packages : 30-35
- Total Net Floor Area : 369070.75 sqm
- Total Gross Floor Area : 1021199.55 sqm
- Total labor employed : 10,000-12,000

CHAPTER 5

FINANCIAL APPRAISAL

5.1 Introduction

The process in which a business determines whether projects such as building a new plant or investing in a long-term venture are worth pursuing is known as "investment appraisal" or "Capital Budgeting". Oftentimes, a prospective project's lifetime cash inflows and outflows are assessed in order to determine whether the returns generated meet a sufficient target benchmark. Ideally, businesses should pursue all projects and opportunities that enhance shareholder value. However, because the amount of capital available at any given time for new projects is limited, management needs to use capital budgeting techniques to determine which projects will yield the most return over an applicable period of time. Popular methods of capital budgeting include net present value (NPV), internal rate of return (IRR), discounted cash flow (DCF) and payback period. In this Appraisal process Net Present Value (NPV), Internal Rate of Return (IRR), Profitability Index and Payback Period would be applied [9][10].

5.1.1 Cash Flow

Cash Flow is a revenue or expense stream that changes a cash account over a given period. Cash in-flows usually arise from one of three activities - financing, operations or investing - though they also occur as a result of donations or gifts in the case of personal finance. Cash out-flows result from expenses or investments. This holds true for both business and personal finance. An accounting statement - the statement of cash flows - that shows the amount of cash generated and used by a company in a given period, calculated by adding non-cash charges (such as depreciation) to net income after taxes. Cash flow can be attributed to a specific project, or to a business as a whole. Cash flow can be used as an indication of a company's financial strength.

In business as in personal finance, cash flows are essential to solvency. They can be presented as a record of something that has happened in the past, such as the sale of a particular product, or forecasted into the future, representing what a business or a person expects to take in and to spend. Cash flow is crucial to an entity's survival. Having ample

cash on hand will ensure that creditors, employees and others can be paid on time. If a business or person does not have enough cash to support its operations, it is said to be insolvent, and a likely candidate for bankruptcy should the insolvency continue. Analysts to gauge financial performance often use the statement of a business's cash flows. Companies with ample cash on hand are able to invest the cash back into the business in order to generate more cash and profit.

$$\text{Net Cash Flow (NCF)} = \text{Cash Inflow} - \text{Cash Outflow} \text{------------------------- (5.1)}$$

5.1.2 Discount Rate

Discount Rate is the interest rate that an eligible depository institution is charged to borrow short-term funds directly from a Federal Reserve Bank. The interest rate used in determining the present value of future cash flows. This type of borrowing from the Fed is fairly limited. Institutions will often seek other means of meeting short-term liquidity needs. The Federal funds discount rate is one of two interest rates the Fed sets, the other being the overnight lending rate, or the Federal funds rate.

5.1.3 Profitability Index

Profitability Index is an index that attempts to identify the relationship between the costs and benefits of a proposed project through the use of a ratio calculated as:

$$\text{Profitability Index} = \frac{\text{PV of Future Cash Flow}}{\text{Initial Investment}} \text{------------------------- (5.2)}$$

A ratio of 1.0 is logically the lowest acceptable measure on the index. Any value less than 1.0 would indicate that the project's PV is less than the initial investment. As values on the profitability index increase, so does the financial attractiveness of the proposed project.

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5.1.4 Payback Period

Payback Period is the length of time required to recover the cost of an investment. Calculated as:

$$\text{Payback Period} = \frac{\text{Cost of Project}}{\text{Annual Cash Inflows}} \text{-----------------------------} (5.3)$$

All other things being equal, the better investment is the one with the shorter payback period. There are two main problems with the payback period method:

1. It ignores any benefits that occur after the payback period and, therefore, does not measure profitability.

2. It ignores the time value of money.

Because of these reasons. other methods of capital budgeting like net present value, internal rate of return are generally preferred.

5.1.5 Internal Rate of Return (IRR)

The Internal Rate of Return (IRR) is the discount rate that generates a zero net present value for a series of future cash flows. This essentially means that IRR is the rate of return that makes the sum of present value of future cash flows and the final market value of a project (or an investment) equal its current market value.

Internal Rate of Return provides a simple 'hurdle rate', whereby any project should be avoided if the cost of capital exceeds this rate. Usually a financial calculator has to be used to calculate this IRR, though it can also be mathematically calculated using the following formula:

$$CF_0 + \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(1+r)^3} + - - - - - - - - + \frac{CF_n}{(1+r)^n} = 0 \text{-------------} (5.4)$$

In the above formula, CF is the Cash Flow generated in the specific period (the last period being 'n'). IRR, denoted by 'r' is to be calculated by employing trial and error method.

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Internal Rate of Return is the flip side of Net Present Value (NPV), where NPV is the discounted value of a stream of cash flows, generated from an investment. IRR thus computes the break-even rate of return showing the discount rate, below which an investment results in a positive NPV.

A simple decision-making criterion can be stated to accept a project if its Internal Rate of Return exceeds the cost of capital and rejected if this IRR is less than the cost of capital. However, it should be kept in mind that the use of IRR may result in a number of complexities such as a project with multiple IRRs or no IRR. Moreover, IRR neglects the size of the project and assumes that cash flows are reinvested at a constant rate.

In IRR calculations, positive cash flows are assumed to be 'paid' instantly to the investor who can use them immediately to reinvest on a new project. But in reality, the positive cash flows are not paid instantly to the investors, but rather kept by the 'project management entity' (ie: venture capital firm, department owning the project...) until the end of the project.

5.1.6 Net Present Value (NPV)

The final method of investment selection is to determine the Net Present Value (NPV) of an investment. Net Present value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows. NPV is used in capital budgeting to analyze the profitability of an investment or project. NPV analysis is sensitive to the reliability of future cash inflows that an investment or project will yield. The Formula is:

$$NPV = \sum_{t=1}^{T} \frac{C_t}{(1 + r)^t} - C_0 \quad \text{--- (5.5)}$$

NPV compares the value of a dollar today to the value of that same dollar in the future, taking inflation and returns into account. If the NPV of a prospective project is positive, it should be accepted. However, if NPV is negative, the project should probably be rejected because cash flows will also be negative.

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5.2 Criteria Fixation

Before detailed feasibility analysis it is important to estimate cost of the project and select the perfect type of building suitable for the project.

5.2.1: Building Type & Cost selection

Initially cost estimate was prepared for 6 types of building: 6 storied, 10 storied, 15 storied, 20 storied, 25 storied and 30-storied building. Then for each type of building project cost, no. of apartment unit, cost per sft, consequent population and population density was estimated. The results are presented in Table 5.1 & Figure 5.1.

Table 5.1 Project cost and other parameters

Storey	Project Cost	No. of Apt. Unit	Cost / sft	Family	Person/ family	Population	Area (acre)	Density
6	3059.58	17140	1,905.33	17140	4.72	80,901	252.26	320.70
10	6564.30	30852	2,271.04	30852	4.72	145,621	252.26	577.27
15	9556.37	47992	2,125.41	47992	4.72	226,522	252.26	897.97
20	12668.57	65132	2,076.12	65132	4.72	307,423	252.26	1218.68
25	15899.95	82272	2,062.83	82272	4.72	388,324	252.26	1539.38
30	19307.40	99412	2,073.02	99412	4.72	469,225	252.26	1860.08
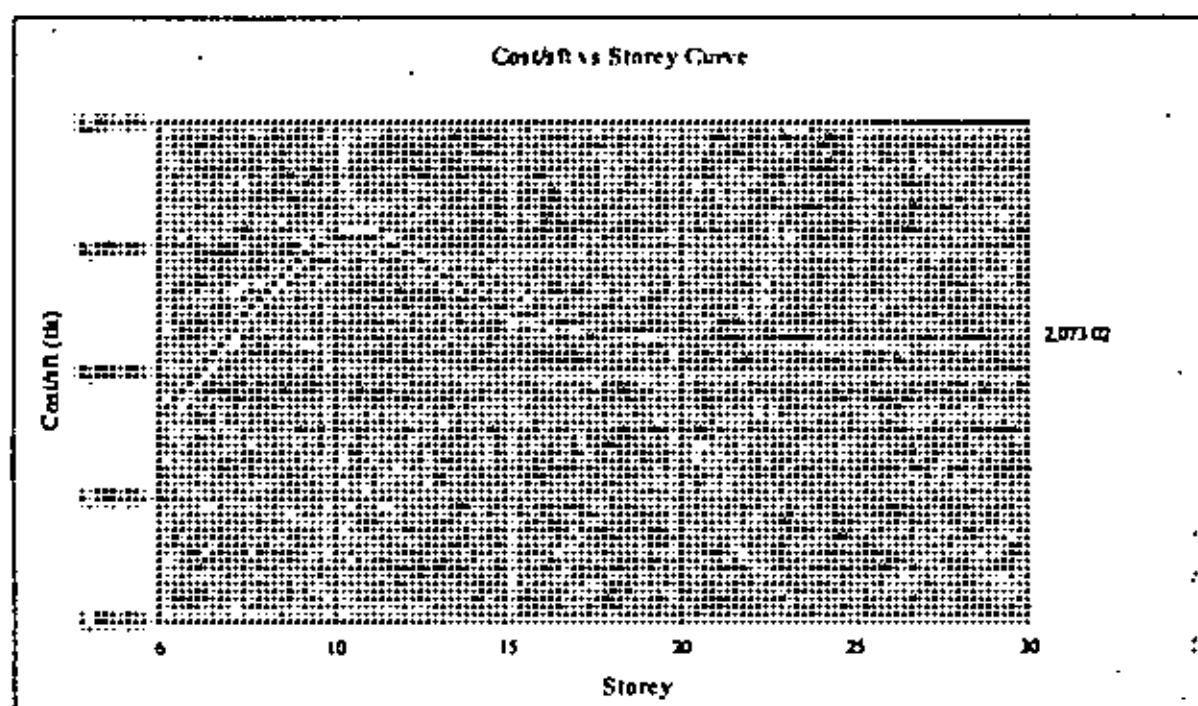
Figure 5.1 Cost/sft vs Storey curve

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From figure: 5.1 it is found that cost/sft is lowest for 6-storied buildings and it increases with the storey and above 20-storey it becomes almost flat without showing significant changes. But population density and project cost increases linearly with the increase in storey. 20-storied building provides 65,132 no. units of apartments for which sufficient space is allocated in the "Purbachal" city. Considering all these criteria 20-storied building is selected for this project. Another important reason is if more than 20-storied building is selected then it will increase the estimated population density of the "Purbachal" city which may cause environmental pollution and excess pressure on the utility services system of the whole city.

5.2.2 Selection of Payment Method

5.2.2.1 Selection of Maximum Monthly Installment

As it was discussed in previous chapter of literature review a salary structure of govt. official was presented at Table2.2: Salary and Allotable floor space for govt. official. Another table was presented showing the average monthly income of the urban population of the country. Considering all these it is wise to keep the monthly installment below Tk. 10,000.

Formula Used for the calculation of monthly installment is:

$$A = P \; [\frac{(1 + R/m)^{(mn)} - 1}{(R/m)(1 + R/m)^{mn}}] \; (1 + R/m) \text{---} (5.6)$$

Where,

A= Monthly Installment

P= Total amount of to be paid after down payment

R= Interest Rate

n= Payment Period (in Years)

m= No. of Months in 'n' period

5.2.2.2 Selection of Down payment

Fore the similar reason stated in above section down payment should not exceed the amount that a government official can gather or accumulate at welfare or GP fund due his service benefit.

5.2.2.3 Selection of Payment Period

If payment period is longer monthly installment will be lower. But if it is expected that a govt. official may pay his monthly installment from his salary as "hire and purchase" basis, the payment period must not exceed 25 years. In this way a government officer can pay his monthly installment from the house rent portion of his salary.

5.2.2.4 Selection of Interest Rate

If interest rate is higher monthly installment would be higher and vice versa. As the government himself without any bank financing would initiate the proposed project so initially interest rate might be considered 1% only.

5.2.2.5 Selection of Mode of Payment

Selection of mode of payment is very important for this project. The main philosophy of selection of mode of payment is that the payment would be made as "hire and purchase" basis. Several trials were performed to get the result.

5.3 Financial Appraisal

For financial appraisal of this project several types of payment method have been considered. As this is project is proposed for Govt. agency to execute, so it was taken into account that the project would be **"no profit no loss"** project. The discount factor was considered 12% that is accepted planning commission. As cash inflow depends on payment period and mode of payment so several trials were performed. 28 no.s of them are presented in Appendix-5, 2 no.s of sample are presented in tabular format (Table 5.2 & Table 5.3).

The important abbreviations used in the different tables are listed below:

NPV	:	Net Present Value
IRR	:	Internal Rate of Return
PI	:	Profitability Index
DP	:	Down Payment
DPA	:	Down Payment for Type-A (1100 sft) Apartment
DPB	:	Down Payment for Type-B (800 sft) Apartment
MI	:	Monthly Installment
MIA	:	Monthly Installment for Type-A (1100 sft) Apartment
MIB	:	Monthly Installment for Type-B (800 sft) Apartment
PD	:	Project Duration
PP	:	Payment Period
Int	:	Interest Rate
F	:	Feasible
NF	:	Not Feasible
GoB	:	Government of Bangladesh

Values in parenthesis denotes negative value.

Table 5.2 Sample of Trial-6

Sensitivity Analysis			
Trial6: DP-5,PP-20,Int-10,PD-28			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	0.00	179.05	-179.05
Y-1	0.00	530.58	-530.58
Y-2	0.00	969.99	-969.99
Y-3	0.00	1312.75	-1312.75
Y-4	0.00	1752.16	-1752.16
Y-5	403.12	2393.33	-1990.21
Y-6	679.56	2041.80	-1362.24
Y-7	956.00	1602.39	-646.39
Y-8	1232.43	1162.97	69.46
Y-9	1508.87	723.56	785.31
Y-10	625.03	0.00	625.03
Y-11	1382.18	0.00	1382.18
Y-12	1382.18	0.00	1382.18
Y-13	1382.18	0.00	1382.18
Y-14	1382.18	0.00	1382.18
Y-15	1382.18	0.00	1382.18
Y-16	1382.18	0.00	1382.18
Y-17	1382.18	0.00	1382.18
Y-18	1382.18	0.00	1382.18
Y-19	1382.18	0.00	1382.18
Y-20	1382.18	0.00	1382.18
Y-21	1382.18	0.00	1382.18
Y-22	1382.18	0.00	1382.18
Y-23	1382.18	0.00	1382.18
Y-24	1382.18	0.00	1382.18
Y-25	1105.75	0.00	1105.75
Y-26	829.31	0.00	829.31
Y-27	552.87	0.00	552.87
Y-28	276.44	0.00	276.44
Total	27519.93	12668.57	14851.36
PV	27247.46	12543.14	
Average Inflow	948.96		
Net Present Value		NPV	(1,765.64)
Internal Rate of Return		IRR	8%
Profitability Index		PI	2.17
Payback Period			13.3

Table 5.3 Sample of Trial-7

Sensitivity Analysis			
Trial7: DP-5,PP-20,Int-10,PD-23			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	403.12	179.05	224.08
Y-1	679.56	530.58	148.98
Y-2	956.00	969.99	-14.00
Y-3	1232.43	1312.75	-80.32
Y-4	1508.87	1752.16	-243.29
Y-5	625.03	2393.33	-1768.30
Y-6	1382.18	2041.80	-659.62
Y-7	1382.18	1602.39	-220.20
Y-8	1382.18	1162.97	219.21
Y-9	1382.18	723.56	658.62
Y-10	1382.18	0.00	1382.18
Y-11	1382.18	0.00	1382.18
Y-12	1382.18	0.00	1382.18
Y-13	1382.18	0.00	1382.18
Y-14	1382.18	0.00	1382.18
Y-15	1382.18	0.00	1382.18
Y-16	1382.18	0.00	1382.18
Y-17	1382.18	0.00	1382.18
Y-18	1382.18	0.00	1382.18
Y-19	1382.18	0.00	1382.18
Y-20	1105.75	0.00	1105.75
Y-21	829.31	0.00	829.31
Y-22	552.87	0.00	552.87
Y-23	276.44	0.00	276.44
Total	27519.93	12668.57	14851.36
PV	27247.46	12543.14	
Average Inflow	1146.66		
Net Present Value		NPV	· 1,872.08
Internal Rate of Return		IRR	0%
Profitability Index		PI	2.17
Payback Period			11.0

Results of remarkable 28 no s of trials are presented in Table 5.4.

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Table 5.4 Trial Results

Trial	PD (Yr.)	PP (Yr.)	DP (%)	Int (%)	NPV	IRR (%)	Profitability Index	Payback Period	Remark
1	33	25	0	1	(4696.81)	--	1.01	33.6	NF
2	28	25	0	1	(2924.39)	--	1.13	25.6	NF
3	33	25	0	10	(2058.98)	8	2.68	12.7	NF
4	28	20	0	1	(4167.83)	--	1.10	26.4	NF
5	28	20	5	1	(4018.20)	--	1.09	26.5	NF
6	28	20	5	10	(1765.64)	8	2.17	13.3	NF
7	23	20	5	10	1872.08	0	2.17	11.0	F
8	23	20	5	6.17	1.13	12	1.66	14.4	F
9	23	20	10	6	81.11	13	1.61	14.9	F
10	23	20	20	5	21.82	12	1.45	16.6	F
11	19	15	30	1	(209.78)	19	1.05	18	NF
12	19	15	30	2	50.31	--	1.11	17.1	NF
13	19	15	33	2	163.18	--	1.10	17.2	NF
14	19	15	60	1	616.99	--	1.04	18.3	NF
15	14	10	50	1	1064.84	-4	1.03	143.7	NF
16	14	10	50	10	2574.34	--	1.29	10.9	NF
17	14	10	75	1	1830.45	-1	1.01	13.8	NF
18	14	10	80	1	1983.57	0	1.01	13.9	F
19	19	10	80	1	(1614.51)	0	1.01	18.8	NF
20	19	10	80	35	0.36	12	1 50	12.6	F
21	10	5	80	1	2118.95	0	1.00	10.0	F
22	10	5	75	1	1999.67	0	1.01	9.9	F
23	10	5	70	1	1880.39	0	1.01	9.9	F
24	10	5	65	1	1761.12	0	1.01	9.9	F
25	10	5	90/2	1	617.19	0	1.00	10.0	F
26	10	5	100/2	1	620.61	0	1.00	10.0	F
27	33	25	30	5	16.29	12	1.50	19.3	F
28	33	28	42.6	5	3.35	11	1.19	24.4	F

Table 5.5 Summary

Trial	PD (Yr.)	PP (Yr.)	DP (%)	Int (%)	DP-A	DP-B	MI-A	MJ-B	Remark	Service Done (Yr.)	Option
1	33	25	0	1	0	0	7694.37	5595.91	NF	0	
2	28	25	0	1	0	0	7694.37	5595.91	NF	0	
3	33	25	0	10	0	0	20,580.79	14,967.85	NF	0	
4	28	20	0	1	0	0	10,494.01	7,632.01	NF	5	
5	28	20	5	1	114186.6457	83044.8332	9,969.31	7,250.41	NF	5	
6	28	20	5	10	114186.6457	83044.8332	20,763.56	15,100.77	NF	5	
7	23	20	5	10	114186.6457	83044.8332	20,763.56	15,100.77	F	5	Option-1
8	23	20	5	6.17	114186.6457	83044.8332	15,676.23	11,400.89	F	5	Option-2
9	23	20	10	6	228,373.29	166,089.67	14,651.97	10,655.98	F	5	Option-3
10	23	20	20	5	456,746.58	332,179.33	12,007.27	8,732.56	F	5	Option-4
11	19	15	30	1	685,119.87	498,269.00	9,559.64	6,952.47	NF	10	
12	19.	15	30	2	685,119.87	498,269.00	10,270.10	7,469.16	NF	10	
13	19	15	33	2	753,631.86	548,095.90	9,829.95	7,149.05	NF	10	
14	19	15	50	1	1,141,866.46	830,448.33	6,828.32	4,966.05	NF	10	
15	14	10	50	1	1,141,866.46	830,448.33	9,994.89	7,269.01	NF	15	
16	14	10	50	10	1,141,866.46	830,448.33	14,965.14	10,883.74	NF	15	
17	14	10	75	1	1,712,799.68	1,245,672.50	4,997.45	3,634.51	NF	15	
18	14	10	80	1	1,826,986.33	1,328,717.33	3,997.96	2,907.60	F	15	Option-5
19	19	10	80	1	1,826,986.33	1,328,717.33	3,997.96	2,907.60	NF	15	
20	19	10	80	35	1,826,986.33	1,328,717.33	3,997.96	2,907.60	F	15	Option-6
21	10	5	80	1	1,826,986.33	1,328,717.33	7,801.01	5,673.46	F	20	Option-7
22	10	5	75	1	1,712,799.68	1,245,672.50	9,751.26	7,091.83	F	20	Option-8
23	10	5	70	1	1,598,613.04	1,162,627.66	11,701.51	8,510.19	F	20	Option-9
24	10	5	65	1	1,484,426.39	1,079,582.83	13,651.77	9,928.56	F	20	Option-10
25	10	5	90/2	1	2,055,359.62	1,494,807.00	3,900.50	2,836.73	F	20	Option-11
26	10	5	100/2	1	2,283,732.91	1,660,896.66	0.00	0.00	F	20	Option-12
27	33	25	30	5	685,119.87	498,269.00	9,306.56	6,768.40	F	0	Option-13
28	33	28	42.6	1	972,870.22	707,541.98	4,936.17	3,589.94	F	0	Option-14

Table 5.6 Selection of Alternatives

Option	PD (Yr.)	PP (Yr.)	DP (%)	DP-A	DP-B	MI-A	MI-B	Service Duration (Yr.)	Comments	Alternative
Option-1	23	20	5	114,186.65	83,044.83	20,763.56	15,100.77	5	MI high, Unacceptable	
Option-2	23	20	5	114,186.65	83,044.83	15.676.23	11,400.89	5	MI high, Unacceptable	
Option-3	23	20	10	228,373.29	166,089.67	14,651.97	10,655.98	5	MI high, Unacceptable	
Option-4	23	20	20	456,746.58	332,179.33	12,007.27	8,732.56	5	MI high, Unacceptable	
Option-5	14	10	80	1,826,986.33	1,328,717.33	3,997.96	2,907.60	15	DP high, Unacceptable	
Option-6	19	10	80	1,826,986.33	1,328,717.33	3,997.96	2,907.60	15	DP high but acceptable	Alternative-1
Option-7	10	5	80	1,826,986.33	1,328,717.33	7,801.01	5,673.46	20	DP high but acceptable	
Option-8	10	5	75	1,712,799.68	1,245,672.50	9,751.26	7,091.83	20	DP high but acceptable	Alternative-2
Option-9	10	5	70	1,598,613.04	1,162,627.66	11,701.51	8,510.19	20	MI & DP high, Unacceptable	
Option-10	10	5	65	1,484,426.39	1,079,582.83	13,651.77	9,928.56	20	MI & DP high, Unacceptable	
Option-11	10	5	90/2	2,055,359.62	1,494,807.00	3,900.50	2,836.73	20	MI very low, DP high but Acceptable	Alternative-3
Option-12	10	5	100/2	2,283,732.91	1,660,896.66	0.00	0.00	20	MI very low, DP high but Acceptable	Alternative-4
Option-13	33	25	30	685,119.87	498,269.00	9,306.56	6,768.40	0	Acceptable subject to condition	Alternative-5
Option-14	33	28	42.6	972,870.22	707,541.98	4,936.17	3,589.94	0	Acceptable subject to condition	Alternative-6

5.4 Findings

In this section all the alternatives will be analyzed elaborately and a final decision will be taken.

Alternative-1 In this proposal a person will be eligible to get an apartment (type-A) after 15 years length of service. He has to pay Tk. 18,26,986.33 as an initial down payment and then he will get the ready apartment handed over to him and then he will pay Tk. 3,997.96 only per month. Most week point of this alternative is to collect or gather Tk. 18,26,986.33 in welfare or GP fund or others within only 15 years of service in government agencies in our country. So this is not a very good solution.

Alternative-2 In this proposal a person will be eligible to get an apartment (type-A) after 20 years length of service. He has to pay Tk. 1,712,799.68 as an initial down payment and then he has to wait 5 years to get the apartment handed over to him and meanwhile he will pay Tk. 9,751.26 per month. After 5 years he will get the full ownership. Most week point of this alternative is to during the 5 years of construction period he has to pay the installment (house rent portion of his salary plus more) but he will have stay some where else where another house rent he will have to pay . So this is not a very practical solution.

Alternative-3 In this proposal a person will be eligible to get an apartment (type-A) after 20 years length of service. He has to pay Tk. 10,27,679.81 as half of initial down payment and then he has to wait 5 years to get the apartment handed over to him and during the period of construction he has to pay Tk. 3,900.50only per month. After 5 years he will get the full ownership paying rest of the down payment Tk10,27,679.81. Most week point of this alternative is to during the 5 years of construction period he has to pay the installment (house rent portion of his salary plus more) but he will have stay some where else where another house rent he will have to pay . So this is not a very practical solution

Alternative-4 In this proposal a person will be eligible to get an apartment (type-A) after 20 years length of service. He has to pay Tk. 11,41,866.45 as half of initial down payment and then he has to. wait 5 years to get the apartment handed over to him and during the period of construction he has to pay nothing. After 5 years he will get the full ownership paying rest of

the down payment Tk. 11,41,866.45. This alternative could be applicable to the government employees and officers who are able to or gather sufficient money in welfare or GP fund.

Alternative-5 In this proposal a person will be eligible to get an apartment (type-A) after 2 years length of service. He has to pay Tk. 6,85,119.87 as initial down payment and then he will get the ready apartment handed over to him and then he will pay Tk. 9,306.56 only per month. As it is impossible to collect Tk. 6,85,119.87 in welfare or GP fund within only 02 years of service in government agencies in our country so government itself has to pay the down payment at the beginning that will be adjusted by Tk. 2,579.88 per month from the salary of the person. After 25 years he will get the full ownership of the apartment. So ultimately he has to pay Tk. 11,886.44 which almost equal to the total salary of a class-I government officer. So this is not a very practical solution.

Alternative-6 In this proposal a person will be eligible to get an apartment (type-A) after 2 years length of service. He has to pay Tk. 9,72,870.22 as initial down payment and then he will get the ready apartment handed over to him and then he will pay Tk. 4,936.17only per month. As it is impossible to collect Tk. 9,72,870.22 in welfare or GP fund within only 02 years of service in government agencies in our country so government itself has to pay the down payment at the beginning that will be adjusted by Tk. 3,663.43 per month from the salary of the person. After 25 years he will get the full ownership of the apartment. So ultimately he has to pay Tk 8,599.60/month. This solution is more practical than others.

So from the above discussion it is found that amongst the six alternatives alternative-6 and alternative-4 can meet most of the requirements. Alternative-6 is applicable for new officers who have joined recently in the government service and alternative-4 is for the persons who have already past 20 years in the service. From now alternative-6 will be termed as Solution-1 and alternative-4 will be termed as Solution-2

5.5 Summary

The Findings of the analysis is presented in the table below:

Table 5.7 Solution

Solution	Apartment Type	Down Payment/ Monthly Payment	Payment Duration	Applicable For
Solution-1	Type-A (1100 sft)	No Down Payment but Monthly Tk. 8,599.60	25 years	Newly recruited
	Type-B (800 sft)	No Down Payment but Monthly Tk. 6254.25		
Solution-2	Type-A (1100 sft)	No monthly payment but Tk. 11,41,866.45 has to be paid once and after 5 years before handover Tk. 11,41,866.45 has to be paid.	Twice	Who has sufficient money in the Welfare or GP Fund
	Type-B (800 sft)	No monthly payment but Tk. 8,30,448.33 has to be paid once and after 5 years before handover Tk. 8,30,448.33 has to he paid.		

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CHAPTER 6

CONCLUSIONS & RECOMMENDATIONS

6.1 Conclusions

Shelter crisis is a burning question of the day and it is being acute day by day. As it is a constitutional right of the people to get a shelter state should come forward to solve the problem. Main objective of the project is to reduce the acute shelter crisis through government initiative. But due to lack of adequate financing Government of Bangladesh (GoB) should take careful decision about after detail techno economic analysis of such big project. Long-term planning and adequate allocation of fund is very much important to make the project successful. As primary initiative government can ensure permanent shelter for its employees. As government provides temporary residence facilities for its employees during the service length, many of the employees are worried about the housing after retirement. Implementing this type of project may solve this problem and may work as motivation also. Moreover, only government has the necessary manpower, pre-investment capability, land and other logistics to implement such big project.

The financial appraisal performed in the thesis is considering a project initiated by the government which is 'No profit, no loss' project. It is a little bit critical to analyze such type of project because if financial parameters reflect that the project is profitable than it is discouraged. On the other hand if the financial parameter reflects loss then the project should be abandoned. Moreover, for fixing up down payment and monthly installment it was in active consideration that the amount of down payment and monthly installment should be kept within the limit of the people. Another important issue was payment period which was limited to within the service length of average population. Considering all these financial analyses were performed and it was found that this type of project is financial viable and has minimum risk to return on investment. The study did not focus on financial appraisal of investment only but also purchasing capability of the people. For this reason monthly installment is fixed within the reach of the middle income people of the country, considering the government pay scale. Though the analyses were done on 20-storied building projects but analysis showed that 25-storied and 30-storied building project would be also financially viable if environmental factors do not interfere.

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After detail financial appraisal two solutions stand quite feasible to solve the housing problem of middle-income group, mostly for government officials. Solution-1 is for newly recruited government officer or similar level of people who can avail an apartment of 1100 sft by paying Tk. 8,599.60 per month or an apartment of 800 sft by paying Tk. 6254.25 per month, which is adjustable from his/her salary. After 25 years of service, full ownership of the apartment would be handed over to the person. Solution-2 is for those who have passed a long service period and may go to retirement after 5 years. In that case they will not have to pay any monthly installment, but they will have to pay Tk. 11,41,866.45 once and after 5 years before handover Tk. 11,41,866.45 has to be paid for 1100 sft apartment and Tk. 8,30,448.33 has to be paid once and after 5 years before handover Tk. 8,30,448.33 has to be paid for 800 sft apartment. The sum is adjustable from the welfare or GP fund of the person.

5.2 Recommendations

To implement the project more successfully and to fix the down payment and monthly installment accurately following recommendations are made:

- A financial appraisal should be done on actual cost and realistic project duration.
- Calculation of cash inflow and out flow on monthly basis.
- Thorough information regarding the pay-scale especially yearly increments, detail calculation of welfare or GP funds, payment method of GP fund etc.

REFERENCES

[1]   Uddin, AKM R, "Strengthening the Role of Private Sector Housing in Bangladesh Economy: The Policy Challenges", Report No.-64, Center for Policy Dialogue (CPD), Dhaka, Bangladesh, November, 2003.

[2]   Zhu, J "Commons and Anticommons: Role of the state in the Housing Market", Department of Real Estate, National University of Singapore, 2004.

[3]   Statistical Year Book of Bangladesh-2006, 26th Edition, Bangladesh Bureau of Statistics (BBS), 2006.

[4]   Uddin, AHM Z, "Apartment Blocks- an Alternative Approach to Urban Housing, Commodity versus Dwelling: An Experience from an Architect's Perspective", AUST, Dhaka, Bangladesh, 2001.

[5]   Rashid, M, "Housing at Uttara Model Town in Dhaka City, Analysis and exploring ways to take the housing problem of middle class", Department of Architecture, BUET, Dhaka, 2003.

[6]   National Housing Policy of Bangladesh, 1991.

[7]   National Urban Sector Policy of Bangladesh (Draft), September, 2006.

[8]   Household Income and Expenditure Survey of Bangladesh-2005, Bangladesh Bureau of Statistics (BBS), 2005.

[9]   Levey, H & Sarnat, M. "Capital Investment and Financial Decisions", 5th Edition, Prentice Hall, 1994.

[10]   Meredith, J R & Mantel Jr., S J "Project Management: A Managerial Approach", 5th Edition, John Wiley & Sons, 2004.

APPENDIX-A: COST ESTIMATE

APPENDIX-A: COST ESTIMATE

High-Rise Apartment (20-storied) Construction Project

1. Land Development:

Block	Location	Plot ID	Area (Katha)	Area (Acre)
Block 01	Sector-27	27-203-025	2501 06	41.34
Block 02	Sector-30	30-401-001	2579 13	42.63
Block 03	Sector-21	21-115-002	2006.82	33.17
Block 04	Sector-03	03-102-004	1506.44	24.9
		03-102-004a	1047.64	17.32
Block 05	Sector-02	02-102-002	1061.11	17 54
		02-102-002a	1483.44	24 52
Block 06	Sector-15	15-112-001	3075 62	50.84
		Total Area	15261.26	252.26

Cost of Land Development @ 2.00 Lac / Katha: Tk. in Cr.   305.23

2. Cost of Apartment Construction:

Location of Buildings	No. of Buildings	Cost / Building (Tk. in Cr.)	Cost (Tk. in Cr.)
4-Unit (1100 sft) 20 Storied Residential Building			
Block-03	102	14.84	1513 515558
Block-04	131	14.84	1943 828805
Block-06	158	14 84	2344.465276
Sub Total	391		5801.809638
8-Unit (800 sft) 20 Storied Residential Building			
Block-01	75	24.73	1854.627806
Block-02	79	24.73	1953.541289
Block-05	79	24.73	1953.541289
Sub Total	233		5761.710385
Apartment Construction Cost			11563.52002

Apartment Construction Cost   Tk. in Cr.   11563.52

3. Road Construction:

Total Covered Area		sq.m.	360800.14
Total Area:		sq m.	1021199.55
Rest of the Area:		sq m.	660399.41
Total internal road area	(assuming 35%)	sq.m	231139 79
Cost of per sqm Road Construction:		Tk.	915.00
Cost of Road Construction:		Tk. in Cr.	21.15
Sub Total		Tk. in Cr.	11889.90
Add 5% for Utility & Other Cost:		Tk. in Cr.	578.18
Add 7.5% for Contingency & Overhead:		Tk. in Cr.	867.26
Sub Total:		Tk. in Cr.	13335.34
Less 5%		Tk. in Cr.	666.77
Total		Tk. in Cr.	12668.57

4. Cost Break-up

Total No. of Apartment of 1100 sft @ 4 unit each floor = 29716
Total No. of Apartment of 800 sft @ 8 unit each floor = 35416

Location of Buildings	No. of Buildings	No. of Apartments	Sellable Floor Arae (sft)
4-Unit (1100 sft) 20 Storied Residential Building			
Block-03	102	7752	8527200
Block-04	131	9956	10951600
Block-06	158	12008	13208800
8-Unit (800 sft) 20 Storied Residential Building			
Block-01	75	11400	9120000
Block-02	79	12008	9606400
Block-05	79	12008	9606400
Total sellable floor area		65132	61020400

Total Sellable Floor Area :		Area in sft	61020400.00
Total Development Cost :		Tk. in Cr.	12668.57
Development Cost per sft Floor Area :		Tk.	2,076.12
:	Say	Tk.	2,076.12

Cost of a Type-1 Apartment (1100) sft: Tk. 2,283,732.91

Cost of a Type-2 Apartment (800) sft: Tk. 1,660,896.66

Analysis of Apartment Construction (High-Rise)

Construction of 20 Storied Residential Building
A. "Construction of 4-Unit (1100 sft) 20 Storied Residential Building" as Standard Type

Total Plinth Area of the structure: sqm 464.7

Item No.	Description	Unit	Quantity	Unit Cost (Tk.)	Cost (Tk.)
1	Soil Investigation	L S		50000.00	50,000.00
2	Foundation				
i)	Foundation upto Plinth	sq m.	464.7	24953 00	11,595,659.10
ii)	Add cost for 1:1.5:3 concrete with stone chips and wind load / earthquake analysis (10% of previous item)				1,159,565 91
3	Super Structure				
i)	Ground Floor	sq m.	464.7	6532.00	3,035,420.40
ii)	Total Floor Area for 20 Storied Building = 19x464.7 sq.m.	sq.m.	8829.3	10932 63	96,527,484 00
iii)	Add 1.5% Additional cost for 30 MPa concrete				1,447,912.26
iv)	Roof Top	sq.m	464 7	1284.00	596,674.80
4	Internal water supply & sanitation Considering 10% cost of superstructure cost				10,160,749.15
5	Internal Electrification Work Considering 8% cost of superstructure cost				8,128,599 32
6	Gas Connection				
i)	2.5% of G.F. Const. Cost				75,885.51
ii)	1% of other floor const. cost				965,274.64
7	External Water Supply				
i)	Underground Water Reservoir	gallon	20000	34.5	690,000.00
ii)	Roof Top Water Tank	gallon	20000	20.25	405,000.00
8	External Electrification (includes substation, Transformer, Pump Motor, HT/LT Line, PDB charge etc) Considering 1% of superstructure cost				979,753.96
9	Electro-Mechanical Component Lift	No	2	2500000.00	5,000,000 00
10	Fire Fighting	L.S.		500000.00	500,000.00
	Sub-Total				141,317,979.25
	Price Escalation considering 5%				7,065,898 96
	Grand Total				148,383,878.21

Tk. In Cr.   14.84

Analysis of Apartment Construction

Construction of 20 Storied Residential Building
B. "Construction of 8-Unit (800 sft) 20 Storied Residential Building" as Standard Type

Total Plinth Area of the structure: sqm   768.68

Item No.	Description	Unit	Quantity	Unit Cost (Tk.)	Cost (Tk.)
1	Soil Investigation	L.S		50000.00	50,000.00
2	Foundation				
i)	Foundation upto Plinth	sq.m	768.68	24953 00	19,180,872.04
ii)	Add cost for 1:1.5.3 concrete with stone chips and wind load / earthquake analysis (10% of previous item)				1,918,087.20
3	Super Structure				
i)	Ground Floor	sq m	768.68	6532.00	5,021,017 76
ii)	Total Floor Area for 20 Storied Building = 19x768.68 sq.m	sq m.	14604.92	10932.63	159,670,209.60
iii)	Add 1 5% Additional cost for 30 MPa concrete				2,395,053.14
iv)	Roof Top	sq.m	768.68	1284.00	986,985 12
4	Internal water supply & sanitation Considering 10% cost of superstructure cost				18,807,326.56
5	Internal Electrification Work Considering 8% cost of superstructure cost				13,445,861 25
6	Gas Connection				
i)	2.5% of G.F. Const. Cost				125,525.44
ii)	1% of other floor const cost				1,596,702 10
7	External Water Supply				
i)	Underground Water Reservoir	gallon	40000	34 5	1,380,000 00
ii)	Roof Top Water Tank	gallon	40000	20.25	810,000.00
8	External Electrification (includes substation, Transformer, Pump Motor, HT/LT Line, PDB charge etc) Considering 1% of superstructure cost				1,620,652.63
9	Electro-Mechanical Component Lift	No	4	2500000 00	10,000,000 00
10	Fire Fighting	L S		500000 00	500,000 00
	Sub-Total				235,508,292 85
	Price Escalation considering 5%				11,775,414.64
	Grand Total				247,283,707.49

Tk. In Cr.   24.73

APPENDIX-B: INVESTMENT SCHEDULE, ASSUMPTIONS & PROGGRAMME FOR CASH FLOW

APPENDIX-B: INVESTMENT SCHEDULE, ASSUMPTIONS & PROGGRAMME FOR CASH FLOW

Sl. No.	Cost Component	Estimated Cost (Tk. In Cr.)	Less@5%	Investment Cost (Tk. In Cr.)	% of the Total Cost
1	Land Purchase& Development Cost (LPDC)	305.23	15.26	289.97	2.29
2	Apartment Construction Cost (ACC)	11563.52	578.18	10985.34	86.71
3	Utility & Others Cost (UTC)	578.18	28.91	549.27	4.34
4	Road Construction Cost (RCC)	21.15	1.06	20.09	0.16
5	Contingency & Overhead Cost (COC)	867.26	43.36	823.90	6.50
	Total	13335.34		12668.57	100.00

Investment Schedule Considering 10 Year Project Duration

Year	Cost Component	Cost (Tk. In Cr.)	% of Total Cost
Y-0	LPDC-1+COC-1	179 05	1.41
Y-1	LPDC-2+ACC-1+COC-2	530.58	4.19
Y-2	LPDC-3+ACC-2+COC-3	969.99	7.66
Y-3	ACC-3+COC-4	1312.75	10.36
Y-4	ACC-4+COC-5	1752.16	13.83
Y-5	ACC-5+RCC-1+UTC-1+COC-6	2393.33	18.89
Y-6	ACC-6+RCC-2+UTC-2+COC-7	2041.80	16.12
Y-7	ACC-7+RCC-3+UTC-3+COC-8	1602.39	12.65
Y-8	ACC-8+RCC-4+UCC-4+COC-9	1162.97	9.18
Y-9	ACC-9+RCC-5+UTC-5+COC-10	723.56	5.71
	Total	12668.57	100.00

Considerations   Cash Outflow

1	Land Purchase and development	3	Years	From	Year-0	To	Year-2
2	Apartment Construction	9	Years	From	Year-1	To	Year-9
3	Road Construction	5	Years	From	Year-5	To	Year-9
4	Utility & Others	5	Years	From	Year-5	To	Year-9
5	Contingency&Overhead	10	Years	From	Year-0	To	Year-9

Assumtions:

1 Total land will be purchased in three years

2 Apartment Construction will be finished within 5 years from starting

3 No Apartment construction will be start after year-5

4 20% of total apartment construction will begin at year-1 that will be completed by year-5

5 20% of total apartment construction will begin at year-2 that will be completed by year-6

6 20% of total apartment construction will begin at year-3 that will be completed by year-7

7 20% of total apartment construction will begin at year-4 that will be completed by year-8

8 20% of total apartment construction will begin at year-5 that will be completed by year-9

10 20% of the total road construction will be carried out each year starting from year-5

11 20% of the total utility works will be carried out each year starting from year-5

LPDC	=	Land Purchase & Development Cost
ACC	=	Apartment Construction Cost
RCC	=	Road Construction Cost
UTC	=	Utility & others Cost
COC	=	Contingency & Overhead

Land Purchase & Development Cost (LPDC)

Land Purchase and Development will begin at Y-0 and will be end by Y-2

Total Estimated Cost for LPDC=   289.97 Cr. Tk

Cost Component LPDC Year		Cost (Tk. In Cr.)	
Y-0	1/3 of total LPDC	96.66	LPDC-1
Y-1	1/3 of total LPDC	96.66	LPDC-2
Y-2	1/3 of total LPDC	96.66	LPDC-3
		289.97	

Road Construction Cost (RCC)

Road Construction will begin at Y-5 and will be end by Y-9

Total Estimated Cost for RCC=   20.09 Cr Tk.

Cost Component RCC Year		Cost (Tk. In Cr.)	
Y-5	20% of total RCC	4.02	RCC-1
Y-6	20% of total RCC	4.02	RCC-2
Y-7	20% of total RCC	4.02	RCC-3
Y-8	20% of total RCC	4.02	RCC-4
Y-9	20% of total RCC	4.02	RCC-5
		20.09	

Uutilty & Other Cost (UTC)

Utility & other services cost will begin at Y-5 and will be end by Y-9

Total Estimated Cost for UTC=   549 27 Cr. Tk.

Cost Component UTC Year		Cost (Tk. In Cr.)	
Y-5	20% of total UTC	109.85	UTC-1
Y-6	20% of total UTC	109.85	UTC-2
Y-7	20% of total UTC	109.85	UTC-3
Y-8	20% of total UTC	109.85	UTC-4
Y-9	20% of total UTC	109.85	UTC-5
		549.27	

Contingency & Overhead Cost (COC)

Total Estimated Cost for COC=   823.90 Cr. Tk.

Cost Component Year	COC	Cost (Tk. in Cr)
Y-0	10% of total COC	82.39 COC-1
Y-1	10% of total COC	82.39 COC-2
Y-2	10% of total COC	82.39 COC-3
Y-3	10% of total COC	82.39 COC-4
Y-4	10% of total COC	82.39 COC-5
Y-5	10% of total COC	82 39 COC-6
Y-6	10% of total COC	82.39 COC-7
Y-7	10% of total COC	82.39 COC-8
Y-8	10% of total COC	82.39 COC-9
Y-9	10% of total COC	82 39 COC-10
		823.90

Year wise break up of apartment construction cost

1st year	Foundation+superstructure cost	16% F+S C
2nd year	Superstructure cost	20% S C-1
3rd year	Superstructure cost	20% S C-2
4th year	Superstructure cost	20% S C-3
5th year	Utility and other cost	24% U&O C

Year	Description	Package	Cost of Package (Tk. In cr)
Y-1	20% of total no.s of Apartment Construction will begin	Package-1	2197.07
Y-2	20% of total no.s of Apartment Construction will begin	Package-2	2197.07
Y-3	20% of total no s of Apartment Construction will begin	Package-3	2197.07
Y-4	20% of total no s of Apartment Construction will begin	Package-4	2197.07
Y-5	20% of total no.s of Apartment Construction will begin	Package-5	2197.07
			10985.34

Cost Component Year	F+S C	S C-1	S C-2	S C-3	U&O C	Total (Tk. In Cr.)
Y-1	16% of P-1	-	·	-	-	351.53 ACC-1
Y-2	16% of P-2	20% of P-1				790.94 ACC-2
Y-3	16% of P-3	20% of P-2	20% of P-1			1230.36 ACC-3
Y-4	16% of P-4	20% of P-3	20% of P-2	20% of P-1		1669.77 ACC-4
Y-5	16% of P-5	20% of P-4	20% of P-3	20% of P-2	24% of P-1	2197.07 ACC-5
Y-6	-	20% of P-5	20% of P-4	20% of P-3	24% of P-2	1845.54 ACC-6
Y-7	-		20% of P-5	20% of P-4	24% of P-3	1406.12 ACC-7
Y-8	-			20% of P-5	24% of P-4	966.71 ACC-8
Y-9	-				24% of P-5	527.30 ACC-9
Total						10985.34

APPENDIX-C:
SAMPLE CALCULATION OF
DOWNPAYMENT & MONTHLY
INSTALLMENT

APPENDIX-C
SAMPLE CALCULATION OF DOWNPAYMENT & MONTHLY INSTALLMENT

Considering 5% Downpayment 1% Interest rate   20 years payment period
Installment   at the beginning of the month

Type-1   1100 sft

Cost of Construction			Tk.	2,283,732.91	
Down Payment	@	5%.	Tk.	114,186.65	
Rest of the Amount		:	Tk.	2,169,546.27	(P)
Total Payment Period		:	20	Year	(n)
Month in a Year		:	12	Months	(m)
Interest Rate		:	1%		(R)

Factor   : $[\{(1+R/m)^{\wedge}(mn)-1\}/\{(R/m)^*(1+R/m)^{\wedge}(m^*n)\}]^*(1+R/m)$

R/m	:	0.00
1+R/m	:	1.00
mn	:	240 00
$(1+R/m)^{\wedge}(mn)$	·	1 22
$(1+R/m)^{\wedge}(mn)-1$		0 22
$\{(R/m)^*(1+R/m)^{\wedge}(m^*n)\}$		0 00
Factor	·	217 62
Installment	:	9,969.31 Tk/Month

Type-2   800 sft

Cost of Construction		:	Tk.	1,660,896.66	
Down Payment	@	5%:	Tk.	83,044.83	
Rest of the Amount		:	Tk.	1,577,851.83	(P)
Total Payment Period		·	20	Year	(n)
Month in a Year		.	12	Months	(m)
Interest Rate		:	1%		(R)

Factor   . $[\{(1+R/m)^{\wedge}(mn)-1\}/\{(R/m)^*(1+R/m)^{\wedge}(m^*n)\}]^*(1+R/m)$

R/m	:	0.00
1+R/m	:	1.00
mn	:	240.00
$(1+R/m)^{\wedge}(mn)$	:	1.22
$(1+R/m)^{\wedge}(mn)-1$	:	0.22
$\{(R/m)^*(1+R/m)^{\wedge}(m^*n)\}$		0.00
Factor	:	217.62
Installment	:	7,250.41 Tk/Month

APPENDIX-D: SAMPLE CALCULATION OF RECOVERY SCHEDULE

APPENDIX-D: SAMPLE CALCULATION OF RECOVERY SCHEDULE

		Building	Apartment / Building	No.s of Apartment
Total No s of Apartment Type-A (1100 sft) =		391	76	29716
Total No s of Apartment Type-B (800 sft) =		233	152	35416
				65132

Earnest Money for Type-A (EMA)	=	114,186.65 Tk.
Monthly Installment for Type-A (I-A)	=	9,969.31 Tk

Earnest Money for Type-B (EMB)	=	83,044 83 Tk
Monthly Installment for Type-B (I-B)	=	7,250.41 Tk.

Payment will be made from Year-5

Expected Sell of Type-A at Year-6	20%	5943	Payment will start from Year-6	and End at	Year-25
Expected Sell of Type-A at Year-7	20%	5943	Payment will start from Year-7	and End at	Year-26
Expected Sell of Type-A at Year-8	20%	5943	Payment will start from Year-8	and End at	Year-27
Expected Sell of Type-A at Year-9	20%	5943	Payment will start from Year-9	and End at	Year-28
Expected Sell of Type-A at Year-10	20%	5943	Payment will start from Year-10	and End at	Year-29
	100%	29716			

Expected Sell of Type-A at Year-6	20%	7083	Payment will start from Year-6	and End at	Year-25
Expected Sell of Type-A at Year-7	20%	7083	Payment will start from Year-7	and End at	Year-26
Expected Sell of Type-A at Year-8	20%	7083	Payment will start from Year-8	and End at	Year-27
Expected Sell of Type-A at Year-9	20%	7083	Payment will start from Year-9	and End at	Year-28
Expected Sell of Type-A at Year-10	20%	7083	Payment will start from Year-10	and End at	Year-29
	100%	35416			

					Tk. In Cr.
EMA-Y-0	0.00 I-A-Y-0	0.00 EMB-Y-0	0.00 I-B-Y-0	0 00	0.00 Rovenue-Y-0
EMA-Y-1	0 00 I-A-Y-1	0.00 EMB-Y-1	0.00 I-B-Y-1	0.00	0.00 Revenue-Y-1
EMA-Y-2	0 00 I-A-Y-2	0 00 EMB-Y-2	0.00 I-B-Y-2	0.00	0.00 Revenue-Y-2
EMA-Y-3	0.00 I-A-Y-3	0 00 EMB-Y-3	0.00 I-B-Y-3	0.00	0.00 Revenue-Y-3
EMA-Y-4	0.00 I-A-Y-4	0.00 EMB-Y-4	0.00 I-B-Y-4	0.00	0.00 Revenue-Y-4
EMA-Y-5	0.00 I-A-Y-5	0.00 EMB-Y-5	0.00 I-B-Y-5	0.00	0.00 Revenue-Y-5
EMA-Y-6	678,634,072 49 I-A-Y-6	710,995,381.74 EMB-Y-6	588,223,162 58 I-B-Y-6	616,273,141.86	259.41 Revenue-Y-6
EMA-Y-7	678,634,072 49 I-A-Y-7	1,421,990,763.49 EMB-Y-7	588,223,162.58 I-B-Y-7	1,232,546,283.72	392.14 Revenue-Y-7
EMA-Y-8	678,634,072 49 I-A-Y-8	2,132,986,145 23 EMB-Y-8	588,223,162.58 I-B-Y-8	1,848,819,425.58	524.87 Revenue-Y-8
EMA-Y-9	678,634,072 49 I-A-Y-9	2,843,981,526 98 EMB-Y-9	588,223,162.58 I-B-Y-9	2,465,092,567.44	657.59 Revenue-Y-9
EMA-Y-10	678,634,072.49 I-A-Y-10	3,554,976,908.72 EMB-Y-10	588,223,162.58 I-B-Y-10	3,081,365,709.30	790.32 Revenue-Y-10
EMA-Y-11	0.00 I-A-Y-11	3,554,976,908.72 EMB-Y-11	0.00 I-B-Y-11	3,081,365,709.30	663.63 Revenue-Y-11
EMA-Y-12	0.00 I-A-Y-12	3,554,976,908.72 EMB-Y-12	0 00 I-B-Y-12	3,081,365,709 30	663.63 Revenue-Y-12
EMA-Y-13	0 00 I-A-Y-13	3,554,976,908 72 EMB-Y-13	0.00 I-B-Y-13	3,081,365,709.30 -	663.63 Revenue-Y-13
EMA-Y-14	0.00 I-A-Y-14	3,554,976,908.72 EMB-Y-14	0.00 I-B-Y-14	3,081,365,709.30	663.63 Revenue-Y-14
EMA-Y-15	0.00 I-A-Y-15	3,554,976,908.72 EMB-Y-15	0.00 I-B-Y-15	3,081,365,709.30	663.63 Revenue-Y-15
EMA-Y-16	0.00 I-A-Y-16	3,554,976,908.72 EMB-Y-16	0.00 I-B-Y-16	3,081,365,709 30	663.63 Revenue-Y-16
EMA-Y-17	0.00 I-A-Y-17	3,554,976,908.72 EMB-Y-17	0.00 I-B-Y-17	3,081,365,709.30	663.63 Revenue-Y-17
EMA-Y-18	0.00 I-A-Y-18	3,554,976,908.72 EMB-Y-18	0 00 I-B-Y-18	3,081,365,709.30	663.63 Revenue-Y-18
EMA-Y-19	0.00 I-A-Y-19	3,554,976,908 72 EMB-Y-19	0.00 I-B-Y-19	3,081,365,709 30	663.63 Revenue-Y-19
EMA-Y-20	0.00 I-A-Y-20	3,554,976,908.72 EMB-Y-20	0.00 I-B-Y-20	3,081,365,709.30	663.63 Revenue-Y-20
EMA-Y-21	0.00 I-A-Y-21	3,554,976,908.72 EMB-Y-21	0.00 I-B-Y-21	3,081,365,709.30	663.63 Revenue-Y-21
EMA-Y-22	0.00 I-A-Y-22	3,554,976,908.72 EMB-Y-22	0.00 I-B-Y-22	3,081,365,709.30	663.63 Revenue-Y-22
EMA-Y-23	0.00 I-A-Y-23	3,554,976,908.72 EMB-Y-23	0 00 I-B-Y-23	3,081,365,709.30	663.63 Revenue-Y-23
EMA-Y-24	0 00 I-A-Y-24	3,554,976,908 72 EMB-Y-24	0 00 I-B-Y-24	3,081,365,709.30	663.63 Revenue-Y-24
EMA-Y-25	0 00 I-A-Y-25	3,554,976,908 72 EMB-Y-25	0 00 I-B-Y-25	3,081,365,709.30	663.63 Revenue-Y-25
EMA-Y-26	0.00 I-A-Y-26	2,843,981,526 98 EMB-Y-26	0 00 I-B-Y-26	2,465,092,567.44	530.91 Revenue-Y-26

EMA-Y-27
EMA-Y-28
EMA-Y-29

0.001-A-Y-27   2,132,986,145.23 EMB-Y-27
0.001-A-Y-28   1,421,990,763.49 EMB-Y-28
0.001-A-Y-29   710,995,381.74 EMB-Y-29

0.001-B-Y-27   1,848,819,425.58   398.18 Revenue-Y-27
0.001-B-Y-28   1,232,546,283.72   265.45 Revenue-Y-28
0.001-B-Y-29   616,273,141.86   132.73 Revenue-Y-29

13906.11

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APPENDIX-E: RESULTS OF TRIALS PRESENTED IN TABULAR FORMAT

APPENDIX-E
RESULTS OF TRIALS PRESENTED IN TABULAR FORMAT

The important abbreviations used in the tables are listed below:

NPV	:	Net Present Value
IRR	:	Internal Rate of Return
PI	:	Profitability Index
DP	:	Down Payment
DPA	:	Down Payment for Type-A (1100 sft) Apartment
DPB	:	Down Payment for Type-B (800 sft) Apartment
MI	:	Monthly Installment
MIA	:	Monthly Installment for Type-A (1100 sft) Apartment
MIB	:	Monthly Installment for Type-B (800 sft) Apartment
PD	:	Project Duration
PP	:	Payment Period
Int	:	Interest Rate
F	:	Feasible
NF	:	Not Feasible
GoB	:	Government of Bangladesh

Table 5.3.1 Trial-1

Sensitivity Analysis			
Trial1: DP-0,PP-25,Int-1,PD-33			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	0.00	179.05	-179.05
Y-1	0.00	530.58	-530.58
Y-2	0.00	969.99	-969.99
Y-3	0.00	1312.75	-1312.75
Y-4	0.00	1752.16	-1752.16
Y-5	102.44	2393.33	-2290.89
Y-6	204.88	2041.80	-1836.92
Y-7	307.32	1602.39	-1295.07
Y-8	409.76	1162.97	-753.21
Y-9	512.20	723.56	-211.36
Y-10	512.20	0.00	512.20
Y-11	512.20	0.00	512.20
Y-12	512.20	0.00	512.20
Y-13	512.20	0.00	512.20
Y-14	512.20	0.00	512.20
Y-15	512.20	0.00	512.20
Y-16	512.20	0.00	512.20
Y-17	512.20	0.00	512.20
Y-18	512.20	0.00	512.20
Y-19	512.20	0.00	512.20
Y-20	512.20	0.00	512.20
Y-21	512.20	0.00	512.20
Y-22	512.20	0.00	512.20
Y-23	512.20	0.00	512.20
Y-24	512.20	0.00	512.20
Y-25	512.20	0.00	512.20
Y-26	512.20	0.00	512.20
Y-27	512.20	0.00	512.20
Y-28	512.20	0.00	512.20
Y-29	512.20	0.00	512.20
Y-30	409.76	0.00	409.76
Y-31	307.32	0.00	307.32
Y-32	204.88	0.00	204.88
Y-33	102.44	0.00	102.44
Total	12804.92	12668.57	136.35
PV	12678.14	12543.14	
Average Inflow	376.62		
Net Present Value		NPV	(4,696.81)
Internal Rate of Return		IRR	
Profitability Index		PI	1.01
Payback Period			33.6

Table 5.3.2 Trial-2

Sensitivity Analysis			
Trial2: DP-0,PP-25,Int-1,PD-28			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	115.11	179.05	-63.93
Y-1	230.23	530.58	-300.35
Y-2	345.34	969.99	-624.65
Y-3	460.46	1312.75	-852.29
Y-4	575.57	1752.16	-1176.59
Y-5	512.20	2393.33	-1881.13
Y-6	575.57	2041.80	-1466.23
Y-7	575.57	1602.39	-1026.82
Y-8	575.57	1162.97	-587.40
Y-9	575.57	723.56	-147.99
Y-10	575.57	0.00	575.57
Y-11	575.57	0.00	575.57
Y-12	575.57	0.00	575.57
Y-13	575.57	0.00	575.57
Y-14	575.57	0.00	575.57
Y-15	575.57	0.00	575.57
Y-16	575.57	0.00	575.57
Y-17	575.57	0.00	575.57
Y-18	575.57	0.00	575.57
Y-19	575.57	0.00	575.57
Y-20	575.57	0.00	575.57
Y-21	575.57	0.00	575.57
Y-22	575.57	0.00	575.57
Y-23	575.57	0.00	575.57
Y-24	575.57	0.00	575.57
Y-25	460.46	0.00	460.46
Y-26	345.34	0.00	345.34
Y-27	230.23	0.00	230.23
Y-28	115.11	0.00	115.11
Total	14325.86	12668.57	1657.29
PV	14184.02	12543.14	
Average Inflow	494.00		
Net Present Value		NPV	(2,924.39)
Internal Rate of Return		IRR	
Profitability Index		PI	1.13
Payback Period			25.6

Table 5.3.3 Trial-3

Trial-3, Sensitivity Analysis			
Trial2: DP-0,PP-25,Int-10,PD-33			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	0.00	179.05	-179.05
Y-1	0.00	354.81	-354.81
Y-2	0.00	750.28	-750.28
Y-3	0.00	1268.81	-1268.81
Y-4	0.00	1927.93	-1927.93
Y-5	0.00	2393.33	-2393.33
Y-6	274.00	2261.51	-1987.50
Y-7	548.01	1866.03	-1318.03
Y-8	822.01	1206.91	-384.90
Y-9	1096.01	459.91	636.10
Y-10	1370.02	0.00	1370.02
Y-11	1370.02	0.00	1370.02
Y-12	1370.02	0.00	1370.02
Y-13	1370.02	0.00	1370.02
Y-14	1370.02	0.00	1370.02
Y-15	1370.02	0.00	1370.02
Y-16	1370.02	0.00	1370.02
Y-17	1370.02	0.00	1370.02
Y-18	1370.02	0.00	1370.02
Y-19	1370.02	0.00	1370.02
Y-20	1370.02	0.00	1370.02
Y-21	1370.02	0.00	1370.02
Y-22	1370.02	0.00	1370.02
Y-23	1370.02	0.00	1370.02
Y-24	1370.02	0.00	1370.02
Y-25	1370.02	0.00	1370.02
Y-26	1370.02	0.00	1370.02
Y-27	1370.02	0.00	1370.02
Y-28	1370.02	0.00	1370.02
Y-29	1370.02	0.00	1370 02
Y-30	1370.02	0.00	1370.02
Y-31	1096.01	0.00	1096.01
Y-32	822.01	0.00	822.01
Y-33	548.01	0.00	548.01
Total	33976.40	12668.57	21307.83
PV	33640.00	12543.14	
Average Inflow	999.31		
Net Present Value		NPV	(2,058.98)
Internal Rate of Return		IRR	8%
Profitability Index		PI	2.68
Payback Period			12.7

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Table 5.3.4 Trial-4

Sensitivity Analysis			
Trial4: DP-0,PP-20,Int-1,PD-28			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	0.00	179.05	-179.05
Y-1	0.00	530.58	-530.58
Y-2	0.00	969.99	-969.99
Y-3	0.00	1312.75	-1312.75
Y-4	0.00	1752.16	-1752.16
Y-5	139.71	2393.33	-2253.62
Y-6	279.42	2041.80	-1762.37
Y-7	419.14	1602.39	-1183.25
Y-8	558.85	1162.97	-604.12
Y-9	698.56	723.56	-25.00
Y-10	625.03	0.00	625.03
Y-11	698.56	0.00	698.56
Y-12	698.56	0.00	698.56
Y-13	698.56	0.00	698.56
Y-14	698.56	0.00	698.56
Y-15	698.56	0.00	698.56
Y-16	698.56	0.00	698.56
Y-17	698.56	0.00	698.56
Y-18	698.56	0.00	698.56
Y-19	698.56	0.00	698.56
Y-20	698.56	0.00	698.56
Y-21	698.56	0.00	698.56
Y-22	698.56	0.00	698.56
Y-23	698.56	0.00	698.56
Y-24	698.56	0.00	698.56
Y-25	558.85	0.00	558.85
Y-26	419.14	0.00	419.14
Y-27	279.42	0.00	279 42
Y-28	139.71	0.00	139.71
Total	13897.71	12668.57	1229.14
PV	13760.11	12543.14	
Average Inflow	479.23		
Net Present Value		NPV	(4,167.83)
Internal Rate of Return		IRR	
Profitability Index		PI	1.10
Payback Period			26.4

Table 5.3.5 Trial-5

Sensitivity Analysis			
Trial5: DP-5,PP-20,Int-1,PD-28			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	0.00	179.05	-179.05
Y-1	0.00	530.58	-530.58
Y-2	0.00	969.99	-969.99
Y-3	0.00	1312.75	-1312.75
Y-4	0.00	1752.16	-1752.16
Y-5	259.41	2393.33	-2133.92
Y-6	392.14	2041.80	-1649.66
Y-7	524.87	1602.39	-1077.52
Y-8	657.59	1162.97	-505.38
Y-9	790.32	723.56	66.76
Y-10	625.03	0.00	625.03
Y-11	663.63	0.00	663.63
Y-12	663.63	0.00	663.63
Y-13	663.63	0.00	663.63
Y-14	663.63	0.00	663.63
Y-15	663.63	0.00	663.63
Y-16	663.63	0.00	663.63
Y-17	663.63	0.00	663.63
Y-18	663.63	0.00	663.63
Y-19	663.63	0.00	663.63
Y-20	663.63	0.00	663 63
Y-21	663.63	0.00	663.63
Y-22	663.63	0.00	663.63
Y-23	663.63	0.00	663.63
Y-24	663.63	0.00	663.63
Y-25	530.91	0.00	530.91
Y-26	398.18	0.00	398.18
Y-27	265.45	0.00	265.45
Y-28	132.73	0.00	132.73
Total	13867.51	12668.57	1198.94
PV	13730.21	12543.14	
Average Inflow	478.19		
Net Present Value		NPV	(4,018 20)
Internal Rate of Return		IRR	
Profitability Index		PI	1.09
Payback Period			26.5

Table 5.3.6 Trial-6

Sensitivity Analysis			
Trial6: DP-5,PP-20,Int-10,PD-28			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	0.00	179.05	-179.05
Y-1	0.00	530.58	-530.58
Y-2	0.00	969.99	-969.99
Y-3	0.00	1312.75	-1312.75
Y-4	0.00	1752.16	-1752.16
Y-5	403.12	2393.33	-1990.21
Y-6	679.56	2041.80	-1362.24
Y-7	956.00	1602.39	-646.39
Y-8	1232.43	1162.97	69.46
Y-9	1508.87	723.56	785.31
Y-10	625.03	0.00	625.03
Y-11	1382.18	0.00	1382.18
Y-12	1382.18	0.00	1382.18
Y-13	1382.18	0.00	1382.18
Y-14	1382.18	0.00	1382.18
Y-15	1382.18	0.00	1382.18
Y-16	1382.18	0.00	1382.18
Y-17	1382.18	0.00	1382.18
Y-18	1382.18	0.00	1382.18
Y-19	1382.18	0.00	1382.18
Y-20	1382.18	0.00	1382.18
Y-21	1382.18	0.00	1382.18
Y-22	1382.18	0.00	1382.18
Y-23	1382.18	0.00	1382.18
Y-24	1382.18	0.00	1382.18
Y-25	1105.75	0.00	1105.75
Y-26	829.31	0.00	829.31
Y-27	552.87	0.00	552.87
Y-28	276.44	0.00	276.44
Total	27519.93	12668.57	14851.36
PV	27247.46	12543.14	
Average Inflow	948.96		
Net Present Value		NPV	(1,765 64)
Internal Rate of Return		IRR	8%
Profitability Index		PI	2.17
Payback Period			13.3

Table 5.3.7 Trial-7

Sensitivity Analysis			
Trial7: DP-5,PP-20,Int-10,PD-23			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	403.12	179.05	224.08
Y-1	679.56	530.58	148.98
Y-2	956.00	969.99	-14.00
Y-3	1232.43	1312.75	-80.32
Y-4	1508.87	1752.16	-243.29
Y-5	625.03	2393.33	-1768.30
Y-6	1382.18	2041.80	-659.62
Y-7	1382.18	1602.39	-220.20
Y-8	1382.18	1162.97	219.21
Y-9	1382.18	723.56	658.62
Y-10	1382.18	0.00	1382.18
Y-11	1382.18	0.00	1382.18
Y-12	1382.18	0.00	1382.18
Y-13	1382.18	0.00	1382.18
Y-14	1382.18	0.00	1382.18
Y-15	1382.18	0.00	1382.18
Y-16	1382.18	0.00	1382.18
Y-17	1382.18	0.00	1382.18
Y-18	1382.18	0.00	1382.18
Y-19	1382.18	0.00	1382.18
Y-20	1105.75	0.00	1105.75
Y-21	829.31	0.00	829.31
Y-22	552.87	0.00	552.87
Y-23	276.44	0.00	276.44
Total	27519.93	12668.57	14851.36
PV	27247.46	12543.14	
Average Inflow	1146.66		
Net Present Value		NPV	1,872.08
Internal Rate of Return		IRR	0%
Profitability Index		PI	2.17
Payback Period			11.0

Table 5.3.8 Trial-8

Sensitivity Analysis			
Trial8: DP-5,PP-20,Int-6.17,PD-23			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	335.39	179.05	156.35
Y-1	544.10	530.58	13.52
Y-2	752.80	969.99	-217.19
Y-3	961.51	1312.75	-351.24
Y-4	1170.22	1752.16	-581.95
Y-5	625.03	2393.33	-1768.30
Y-6	1043.53	2041.80	-998.27
Y-7	1043.53	1602.39	-558.86
Y-8	1043.53	1162.97	-119.44
Y-9	1043.53	723.56	319.97
Y-10	1043.53	0.00	1043.53
Y-11	1043.53	0.00	1043.53
Y-12	1043.53	0.00	1043.53
Y-13	1043.53	0.00	1043.53
Y-14	1043.53	0.00	1043.53
Y-15	1043.53	0.00	1043.53
Y-16	1043.53	0.00	1043.53
Y-17	1043.53	0.00	1043.53
Y-18	1043.53	0.00	1043.53
Y-19	1043.53	0.00	1043.53
Y-20	834.82	0.00	834.82
Y-21	626.12	0.00	626.12
Y-22	417.41	0.00	417.41
Y-23	208.71	0.00	208.71
Total	21085.54	12668.57	8416.96
PV	20876.77	12543.14	
Average Inflow	878.56		
Net Present Value		NPV	1.13
Internal Rate of Return		IRR	12%
Profitability Index		PI	1.66
Payback Period			14.4

Table 5.3.9 Trial-9

Sensitivity Analysis			
Trial9: DP-10,PP-20,Int-6,PD23			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	448.44	179.05	269.39
Y-1	643.51	530.58	112.93
Y-2	838.58	969.99	-131.41
Y-3	1033.65	1312.75	-279.10
Y-4	1228.72	1752.16	-523.44
Y-5	625.03	2393.33	-1768.30
Y-6	975.35	2041.80	-1066.45
Y-7	975.35	1602.39	-627.04
Y-8	975.35	1162.97	-187.62
Y-9	975.35	723.56	251.79
Y-10	975.35	0.00	975.35
Y-11	975.35	0.00	975.35
Y-12	975.35	0.00	975.35
Y-13	975.35	0.00	975.35
Y-14	975.35	0.00	975.35
Y-15	975.35	0.00	975.35
Y-16	975.35	0.00	975.35
Y-17	975.35	0.00	975.35
Y-18	975.35	0.00	975.35
Y-19	975.35	0.00	975.35
Y-20	780.28	0.00	780.28
Y-21	585.21	0.00	585.21
Y-22	390.14	0.00	390.14
Y-23	195.07	0.00	195.07
Total	20423.51	12668.57	7754.93
PV	20221.29	12543.14	
Average Inflow	850.98		
Net Present Value		NPV	81.11
Internal Rate of Return		IRR	13%
Profitability Index		PI	1.61
Payback Period			14.9

Table 5.3.10 Trial-10

Sensitivity Analysis			
Trial-10: DP-20,PP-20,Int-5,PD23			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	666.60	179.05	487.56
Y-1	826.46	530.58	295.88
Y-2	986.32	969.99	16.33
Y-3	1146.18	1312.75	-166.57
Y-4	1306.04	1752.16	-446.12
Y-5	625.03	2393.33	-1768.30
Y-6	799.30	2041.80	-1242.50
Y-7	799.30	1602.39	-803.09
Y-8	799.30	1162.97	-363.68
Y-9	799.30	723.56	75.74
Y-10	799.30	0.00	799.30
Y-11	799.30	0.00	799.30
Y-12	799.30	0.00	799.30
Y-13	799.30	0.00	799.30
Y-14	799.30	0.00	799.30
Y-15	799.30	0.00	799.30
Y-16	799.30	0.00	799.30
Y-17	799.30	0.00	799.30
Y-18	799.30	0.00	799.30
Y-19	799.30	0.00	799.30
Y-20	639.44	0.00	639.44
Y-21	479.58	0.00	479.58
Y-22	319.72	0.00	319.72
Y-23	159 86	0.00	159.86
Total	18345.38	12668.57	5676.81
PV	18163.74	12543.14	
Average Inflow	764.39		
Net Present Value		NPV	21.82
Internal Rate of Return		IRR	12%
Profitability Index		PI	1.45
Payback Period			16.6

Table 5.3.11 Trial-11

Sensitivity Analysis			
Trial-11: DP-30,PP-15,Int-1,PD19			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	887.39	179.05	708.34
Y-1	1014.66	354.81	659.85
Y-2	1141.93	750.28	391.65
Y-3	1269.21	1268.81	0.40
Y-4	1396.48	1927.93	-531.45
Y-5	636 36	2393.33	-1756.97
Y-6	636.36	2261.51	-1625.14
Y-7	636.36	1866.03	-1229.67
Y-8	636.36	1206.91	-570.55
Y-9	636.36	459.91	176.45
Y-10	636.36	0.00	636.36
Y-11	636.36	0.00	636.36
Y-12	636.36	0.00	636.36
Y-13	636.36	0.00	636.36
Y-14	636.36	0.00	636.36
Y-15	509.09	0.00	509.09
Y-16	381.82	0.00	381.82
Y-17	254.55	0.00	254.55
Y-18	127.27	0.00	127.27
Total	13346.03	12668.57	677.45
PV	13213.89	12543.14	
Average Inflow	702.42		
Net Present Value		NPV	(209.78)
Internal Rate of Return		IRR	19%
Profitability Index		PI	1.05
Payback Period			18.0

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Table 5.3.12 Trial-12

Sensitivity Analysis			
Trial-12: DP-30,PP-15,Int-2,PD19			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	896.85	179.05	717.80
Y-1	1033.58	354.81	678.77
Y-2	1170.31	750.28	420.02
Y-3	1307.04	1268.81	38.23
Y-4	1443.77	1927.93	-484.16
Y-5	683.66	2393.33	-1709.67
Y-6	683.66	2261.51	-1577.85
Y-7	683.66	1866.03	-1182.38
Y-8	683.66	1206.91	-523.26
Y-9	683.66	459.91	223.75
Y-10	683.66	0.00	683.66
Y-11	683.66	0.00	683.66
Y-12	683.66	0.00	683.66
Y-13	683.66	0.00	683.66
Y-14	683.66	0.00	683.66
Y-15	546.93	0.00	546.93
Y-16	410.19	0.00	410.19
Y-17	273.46	0.00	273.46
Y-18	136.73	0.00	136.73
Total	14055.42	12668.57	1386.85
PV	13916.26	12543.14	
Average Inflow	739.76		
Net Present Value		NPV	50.31
Internal Rate of Return		IRR	
Profitability Index		PI	1.11
Payback Period			17.1

Table 5.3.13 Trial-13

Sensitivity Analysis			
Trial-13: DP-33,PP-15,Int-2,PD19			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	967.00	179.05	787.95
Y-1	1097.87	354.81	743.06
Y-2	1228.74	750.28	478.46
Y-3	1359.61	1268.81	90.80
Y-4	1490.48	1927.93	-437.44
Y-5	654.36	2393.33	-1738.97
Y-6	654.36	2261.51	-1607.15
Y-7	654.36	1866.03	-1211.68
Y-8	654.36	1206.91	-552.56
Y-9	654.36	459.91	194.45
Y-10	654.36	0.00	654.36
Y-11	654.36	0.00	654.36
Y-12	654.36	0.00	654.36
Y-13	654.36	0.00	654.36
Y-14	654.36	0.00	654.36
Y-15	523.49	0.00	523.49
Y-16	392.61	0.00	392.61
Y-17	261.74	0.00	261.74
Y-18	130.87	0.00	130.87
Total	13995.99	12668.57	1327.42
PV	13857.41	12543.14	
Average Inflow	736.63		
Net Present Value		NPV	163.18
Internal Rate of Return		IRR	
Profitability Index		PI	1.10
Payback Period			17.2

Table 5.3.14 Trial-14

Sensitivity Analysis			
Trial-14: DP-60,PP-15,Int-1,PD19			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	1357.77	179.05	1178.72
Y-1	1448.68	354.81	1093.86
Y-2	1539.58	750.28	789.30
Y-3	1630.49	1268.81	361.69
Y-4	1721.40	1927.93	-206.53
Y-5	454.55	2393.33	-1938.79
Y-6	454.55	2261.51	-1806.96
Y-7	454.55	1866.03	-1411.49
Y-8	454.55	1206.91	-752.37
Y-9	454.55	459.91	-5.36
Y-10	454.55	0.00	454.55
Y-11	454.55	0.00	454.55
Y-12	454.55	0.00	454.55
Y-13	454.55	0.00	454.55
Y-14	454.55	0.00	454.55
Y-15	363.64	0.00	363 64
Y-16	272.73	0.00	272.73
Y-17	181.82	0.00	181.82
Y-18	90.91	0.00	90.91
Total	13152.47	12668.57	483.90
PV	13022.25	12543.14	
Average Inflow	692.24		
Net Present Value		NPV	616.99
Internal Rate of Return		IRR	
Profitability Index		PI	1.04
Payback Period			18.3

Table 5.3.15 Trial-15

Sensitivity Analysis			
Trial-15: DP-50,PP-10,Int-1,PD14			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	1399.92	179.05	1220.88
Y-1	1532.99	530.58	1002.41
Y-2	1666.06	969.99	696.07
Y-3	1799.13	1312.75	486.38
Y-4	1932.19	1752.16	180.03
Y-5	665.34	2393.33	-1727.99
Y-6	665.34	2041.80	-1376.46
Y-7	665.34	1602.39	-937.05
Y-8	665.34	1162.97	-497.64
Y-9	665.34	723.56	-58.22
Y-10	532.27	0.00	532.27
Y-11	399.20	0.00	399.20
Y-12	266.13	0.00	266.13
Y-13	133.07	0.00	133.07
Total	12987.66	12668.57	319.08
PV	12859.07	12543.14	
Average Inflow	927.69		
Net Present Value		NPV	1,064.84
Internal Rate of Return		IRR	-4%
Profitability Index		PI	1.03
Payback Period			13.7

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Table 5.3.16 Trial-16

Sensitivity Analysis			
Trial-16: DP-50,PP-10,Int-10,PD14			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	1466.10	179.05	1287.05
Y-1	1665.34	530.58	1134.76
Y-2	1864.57	969.99	894.58
Y-3	2063.81	1312.75	751.06
Y-4	2263.05	1752.16	510.89
Y-5	996.20	2393.33	-1397.14
Y-6	996.20	2041.80	-1045.60
Y-7	996.20	1602.39	-606.19
Y-8	996.20	1162.97	-166.78
Y-9	996.20	723.56	272.64
Y-10	796.96	0.00	796.96
Y-11	597.72	0.00	597.72
Y-12	398.48	0.00	398.48
Y-13	199.24	0.00	199.24
Total	16296.24	12668.57	3627.66
PV	16134.89	12543.14	
Average Inflow	1164.02		
Net Present Value		NPV	2,574.34
Internal Rate of Return		IRR	#DIV/0!
Profitability Index		PI	1.29
Payback Period			10.9

Table 5.3.17 Trial-17

Sensitivity Analysis			
Trial-17: DP-75,PP-10,Int-1,PD14			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	1966.82	179.05	1787.77
Y-1	2033.35	530.58	1502.78
Y-2	2099.89	969.99	1129.90
Y-3	2166.42	1312.75	853.67
Y-4	2232.95	1752.16	480.79
Y-5	332.67	2393.33	-2060.66
Y-6	332.67	2041.80	-1709.13
Y-7	332.67	1602.39	-1269.72
Y-8	332.67	1162.97	-830.30
Y-9	332.67	723.56	-390.89
Y-10	266.13	0.00	266.13
Y-11	199.60	0.00	199.60
Y-12	133.07	0.00	133.07
Y-13	66.53	0.00	66.53
Total	12828.11	12668.57	159.54
PV	12701.10	12543.14	
Average Inflow	916.29		
Net Present Value		NPV	1,830.45
Internal Rate of Return		IRR	-1%
Profitability Index		PI	1.01
Payback Period			13.8

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Table 5.3.18 Trial-18

Sensitivity Analysis			
Trial-18: DP-80,PP-10,Int-1,PD14			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	2080.20	179.05	1901.15
Y-1	2133.43	530.58	1602.85
Y-2	2186.65	969.99	1216.66
Y-3	2239.88	1312.75	927.13
Y-4	2293.11	1752.16	540.94
Y-5	266.13	2393.33	-2127.20
Y-6	266.13	2041.80	-1775.66
Y-7	266.13	1602.39	-1336.25
Y-8	266.13	1162.97	-896.84
Y-9	266.13	723.56	-457.42
Y-10	212.91	0.00	212.91
Y-11	159.68	0.00	159.68
Y-12	106.45	0.00	106.45
Y-13	53.23	0.00	53.23
Total	12796.21	12668.57	127.63
PV	12669.51	12543.14	
Average Inflow	914.01		
Net Present Value		NPV	1,983.57
Internal Rate of Return		IRR	0%
Profitability Index		PI	1.01
Payback Period			13.9

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Table 5.3.19 Trial-19

Sensitivity Analysis			
Trial-19: DP-80,PP-10,Int-1,PD19			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	0.00	179.05	-179.05
Y-1	0.00	354.81	-354.81
Y-2	0.00	750.28	-750.28
Y-3	0.00	1268.81	-1268.81
Y-4	0.00	1927.93	-1927.93
Y-5	2080.20	2393.33	-313.13
Y-6	2133.43	2261.51	-128.08
Y-7	2186.65	1866.03	320.62
Y-8	2239.88	1206.91	1032.97
Y-9	2293.11	459.91	1833.20
Y-10	266.13	0.00	266.13
Y-11	266.13	0.00	266.13
Y-12	266.13	0.00	266.13
Y-13	266.13	0.00	266.13
Y-14	266.13	0.00	266.13
Y-15	212.91	0.00	212.91
Y-16	159.68	0.00	159.68
Y-17	106.45	0.00	106.45
Y-18	53.23	0.00	53.23
Total	12796.21	12668.57	127.63
PV	12669.51	12543.14	
Average Inflow	673.48		
Net Present Value		NPV	(1,614.51)
Internal Rate of Return		IRR	0%
Profitability Index		PI	1.01
Payback Period			18.8

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Table 5.3.20 Trial-20

Sensitivity Analysis			
Trial-20: DP-80,PP-10,Int-35,PD19			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	0.00	179.05	-179.05
Y-1	0.00	354.81	-354.81
Y-2	0.00	750.28	-750.28
Y-3	0.00	1268.81	-1268.81
Y-4	0.00	1927.93	-1927.93
Y-5	2204.96	2393.33	-188.37
Y-6	2382.94	2261.51	121.43
Y-7	2560.92	1866.03	694.89
Y-8	2738.91	1206.91	1531.99
Y-9	2916.89	459.91	2456.98
Y-10	889.92	0.00	889.92
Y-11	889.92	0.00	889.92
Y-12	889.92	0.00	889.92
Y-13	889.92	0.00	889.92
Y-14	889.92	0.00	889.92
Y-15	711.94	0.00	711.94
Y-16	533.95	0.00	533.95
Y-17	355.97	0.00	355.97
Y-18	177.98	0.00	177.98
Total	19034.07	12668.57	6365.50
PV	18845.61	12543.14	
Average Inflow	1001.79		
Net Present Value		NPV	0.36
Internal Rate of Return		IRR	12%
Profitability Index		PI	1.50
Payback Period			12.6

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Table 5.3.21 Trial-21

Sensitivity Analysis			
Trial-21: DP-80,PP-5,Int-1,PD10			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	2026.97	179.05	1847.93
Y-1	2130.83	530.58	1600.25
Y-2	2234.69	969.99	1264.70
Y-3	2338.55	1312.75	1025.80
Y-4	2442.41	1752.16	690.25
Y-5	519.30	2393.33	-1874.04
Y-6	415.44	2041.80	-1626.36
Y-7	311.58	1602.39	-1290.81
Y-8	207.72	1162.97	-955.25
Y-9	103.86	723.56	-619.70
Total	12731.33	12668.57	62.76
PV	12605.28	12543.14	
Average Inflow	1273.13		
Net Present Value		NPV	2,118.95
Internal Rate of Return		IRR	0%
Profitability Index		PI	1.00
Payback Period			10.0

Table 5.3.22 Trial-22

Sensitivity Analysis			
Trial-22: DP-75,PP-5,Int-1,PD10			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	1900.29	179.05	1721.24
Y-1	2030.11	530.58	1499.53
Y-2	2159.93	969.99	1189.94
Y-3	2289.76	1312.75	977.01
Y-4	2419.58	1752.16	667.42
Y-5	649.12	2393.33	-1744.21
Y-6	519.30	2041.80	-1522.50
Y-7	389.47	1602.39	-1212.91
Y-8	259.65	1162.97	-903.32
Y-9	129.82	723.56	-593.73
Total	12747.03	12668.57	78.45
PV	12620.82	12543.14	
Average Inflow	1274.70		
Net Present Value		NPV	1,999.67
Internal Rate of Return		IRR	0%
Profitability Index		PI	1.01
		·	
Payback Period			9.9

Table 5.3.23 Trial-23

Sensitivity Analysis			
Trial-23: DP-70,PP-5,Int-1,PD10			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	1773.60	179.05	1594.55
Y-1	1929.39	530.58	1398.81
Y-2	2085.18	969.99	1115.19
Y-3	2240.97	1312.75	928.22
Y-4	2396.75	1752.16	644.59
Y-5	778.94	2393.33	-1614.39
Y-6	623.15	2041.80	-1418.65
Y-7	467.37	1602.39	-1135.02
Y-8	311.58	1162.97	-851.39
Y-9	155.79	723.56	-567.77
Total	12762.72	12668.57	94.14
PV	12636.35	12543.14	
Average Inflow	1276.27		
Net Present Value		NPV	1,880.39
Internal Rate of Return		IRR	0%
Profitability Index		PI	1.01
Payback Period			9.9

Table 5.3.24 Trial-24

Sensitivity Analysis			
Trial-24: DP-65,PP-5,Int-1,PD10			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	1646.91	179.05	1467.87
Y-1	1828.67	530.58	1298.09
Y-2	2010.42	969.99	1040.43
Y-3	2192.17	1312.75	879.43
Y-4	2373.93	1752.16	621.77
Y-5	908.77	2393.33	-1484.56
Y-6	727.01	2041.80	-1314.79
Y-7	545.26	1602.39	-1057.13
Y-8	363.51	1162.97	-799.47
Y-9	181.75	723.56	-541.81
Total	12778.41	12668.57	109.83
PV	12651.89	12543.14	
Average Inflow	1277.84		
Net Present Value		NPV	1,761.12
Internal Rate of Return		IRR	0%
Profitability Index		PI	1.01
Payback Period			9.9

Table 5.3.25 Trial-25

Sensitivity Analysis			
Trial-25: DP-90/2,PP-5,Int-1,PD10			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	1164.28	179.05	985.24
Y-1	1216.21	530.58	685.64
Y-2	1268.14	969.99	298.15
Y-3	1320.07	1312.75	7.32
Y-4	1372.00	1752.16	-380.16
Y-5	1375.71	2393.33	-1017.62
Y-6	1323.78	2041.80	-718.02
Y-7	1271.85	1602.39	-330.54
Y-8	1219.92	1162.97	56.95
Y-9	1167.99	723.56	444.43
Total	12699.95	12668.57	31.38
PV	12574.21	12543.14	
Average Inflow	1270.00		
Net Present Value		NPV	617.19
Internal Rate of Return		IRR	0%
Profitability Index		PI	1.00
Payback Period			10.0

Table 5.3.26 Trial-26

Sensitivity Analysis			
Trial-26: DP-100/2,PP-5,Int-1,PD10			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	1266.86	179.05	1087.81
Y-1	1266.86	530.58	736.28
Y-2	1266.86	969.99	296.87
Y-3	1266.86	1312.75	-45.89
Y-4	1266.86	1752.16	-485.31
Y-5	1266.86	2393.33	-1126.47
Y-6	1266.86	2041.80	-774.94
Y-7	1266.86	1602.39	-335.53
Y-8	1266.86	1162.97	103.89
Y-9	1266.86	723.56	543.30
Total	12668.57	12668.57	0.00
PV	12543.14	12543.14	
Average Inflow	1266.86		
Net Present Value		NPV	620.61
Internal Rate of Return		IRR	0%
Profitability Index		PI	1.00
Payback Period			10.0

Table 5.3.27 Trial-27

Sensitivity Analysis			
Trial 27: DP-30,PP-25,Int-5,GOB/30			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	884.02	179.05	704.97
Y-1	1007.92	530.58	477.34
Y-2	1131.82	969.99	161.83
Y-3	1255.73	1312.75	-57.02
Y-4	1379.63	1752.16	-372.53
Y-5	572.46	2393.33	-1820.88
Y-6	572.46	2041.80	-1469.34
Y-7	572.46	1602.39	-1029.93
Y-8	572.46	1162.97	-590.52
Y-9	572.46	723.56	-151.10
Y-10	572.46	0.00	572.46
Y-11	619.52	0.00	619.52
Y-12	619.52	0.00	619.52
Y-13	619.52	0.00	619.52
Y-14	619.52	0.00	619.52
Y-15	619.52	0.00	619.52
Y-16	619.52	0.00	619.52
Y-17	619.52	0.00	619.52
Y-18	619.52	0.00	619.52
Y-19	619.52	0.00	619.52
Y-20	619.52	0.00	619.52
Y-21	619.52	0.00	619.52
Y-22	619.52	0.00	619.52
Y-23	619.52	0.00	619.52
Y-24	619.52	0.00	619.52
Y-25	495.61	0.00	495.61
Y-26	371.71	0.00	371.71
Y-27	247.81	0.00	247.81
Y-28	123.90	0.00	123.90
Total	19006.11	12668.57	6337.54
PV	18817.93	12543.14	
Average Inflow	655.38		
Net Present Value		NPV	16.29
Internal Rate of Return		IRR	12%
Profitability Index		PI	1.50
Payback Period			19.3

Table 5.3.28 Trial-28

Sensitivity Analysis			
Trial 28: DP-30,PP-25,Int-5,GOB/42.6			
Year	Cash Inflow	Cash Outflow	Net Cash flow (NCF)
Y-0	1145.08	179.05	966.03
Y-1	1210.80	530.58	680.22
Y-2	1276.52	969.99	306.52
Y-3	1342.23	1312.75	29.49
Y-4	1407.95	1752.16	-344.21
Y-5	572.46	2393.33	-1820.88
Y-6	572.46	2041.80	-1469.34
Y-7	572.46	1602.39	-1029.93
Y-8	572.46	1162.97	-590.52
Y-9	572.46	723.56	-151.10
Y-10	572.46	0.00	572.46
Y-11	328.59	0.00	328.59
Y-12	328.59	0.00	328.59
Y-13	328.59	0.00	328.59
Y-14	328.59	0.00	328.59
Y-15	328.59	0.00	328.59
Y-16	328.59	0.00	328.59
Y-17	328.59	0.00	328.59
Y-18	328.59	0.00	328.59
Y-19	328.59	0.00	328.59
Y-20	328.59	0.00	328.59
Y-21	328.59	0.00	328.59
Y-22	328.59	0.00	328.59
Y-23	328.59	0.00	328.59
Y-24	328.59	0.00	328.59
Y-25	262.87	0.00	262.87
Y-26	197.15	0.00	197.15
Y-27	131.44	0.00	131.44
Y-28	65.72	0.00	65.72
Total	15074.74	12668.57	2406.17
PV	14925.49	12543.14	
Average Inflow	519.82		
Net Present Value		NPV	3.35
Internal Rate of Return		IRR	11%
Profitability Index		PI	1.19
Payback Period			24.4

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APPENDIX-F: DRAWINGS

PURBACHAL NEW TOWN MASTERPLAN
(NOT N SCALE)
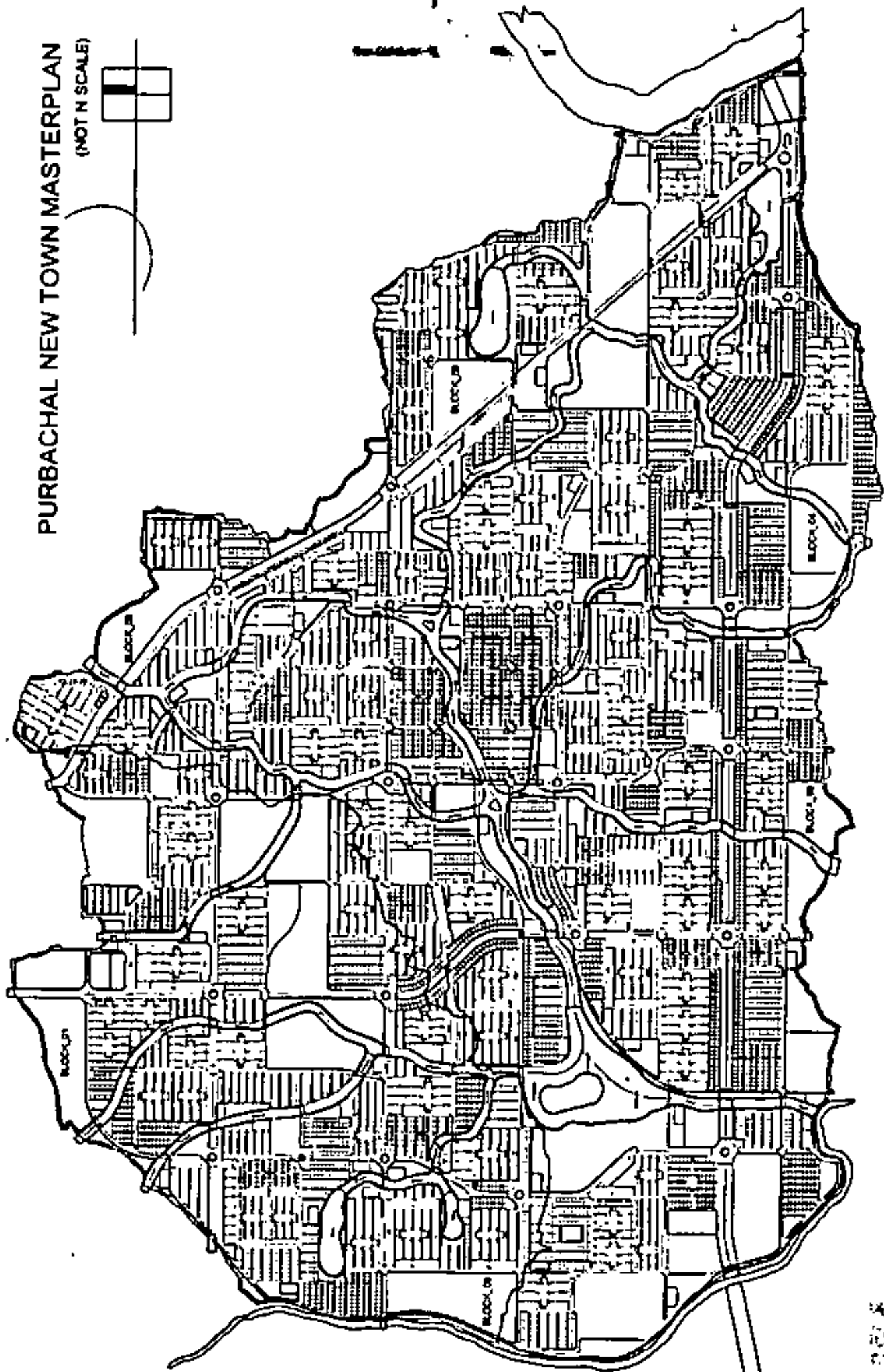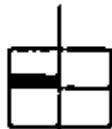
highrise block_01
building type_02

Puspakati

highrise block_ 03
building type_01
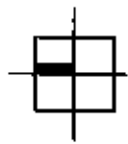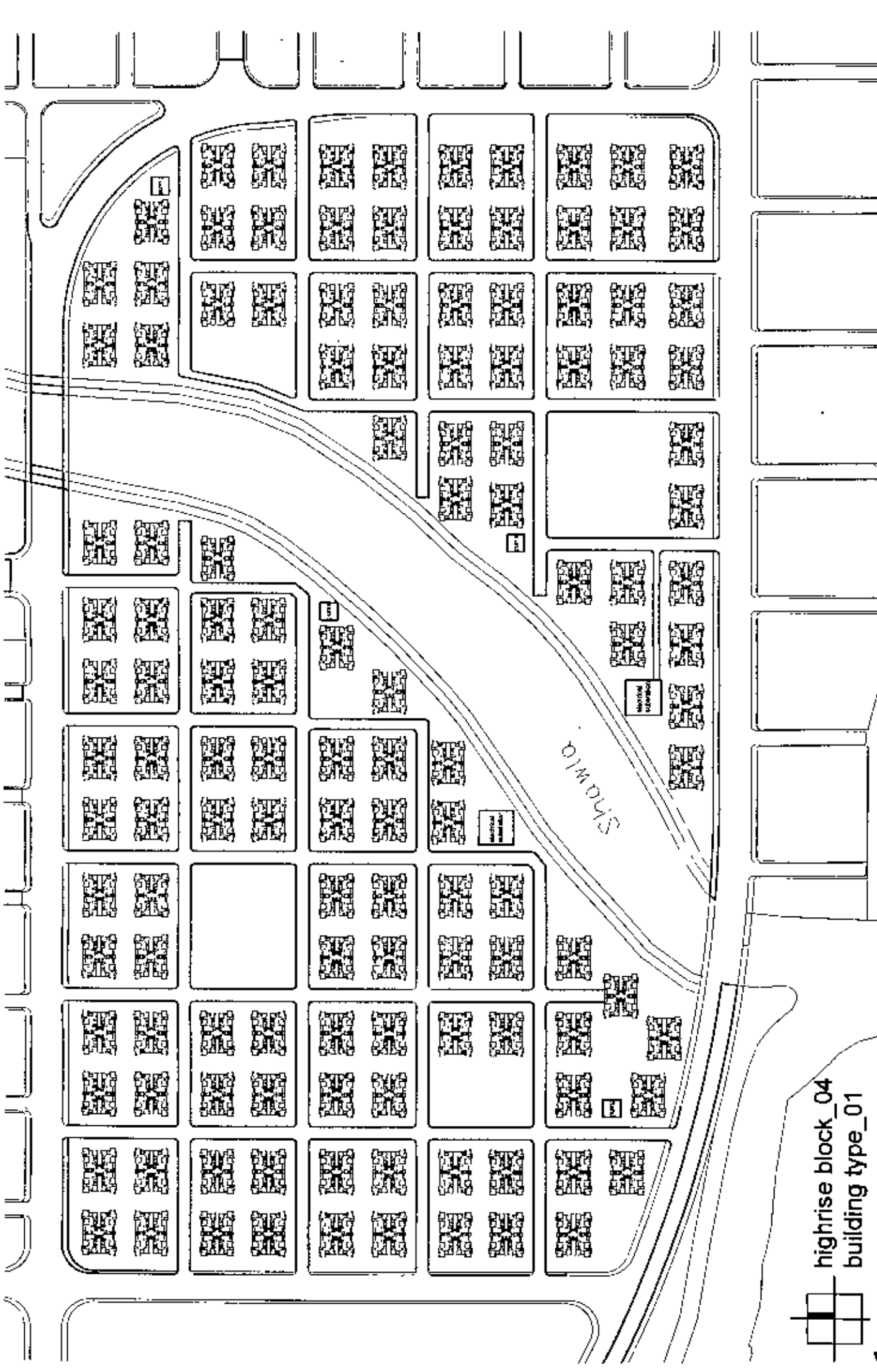
highrise block_04
building type_01

Słonia
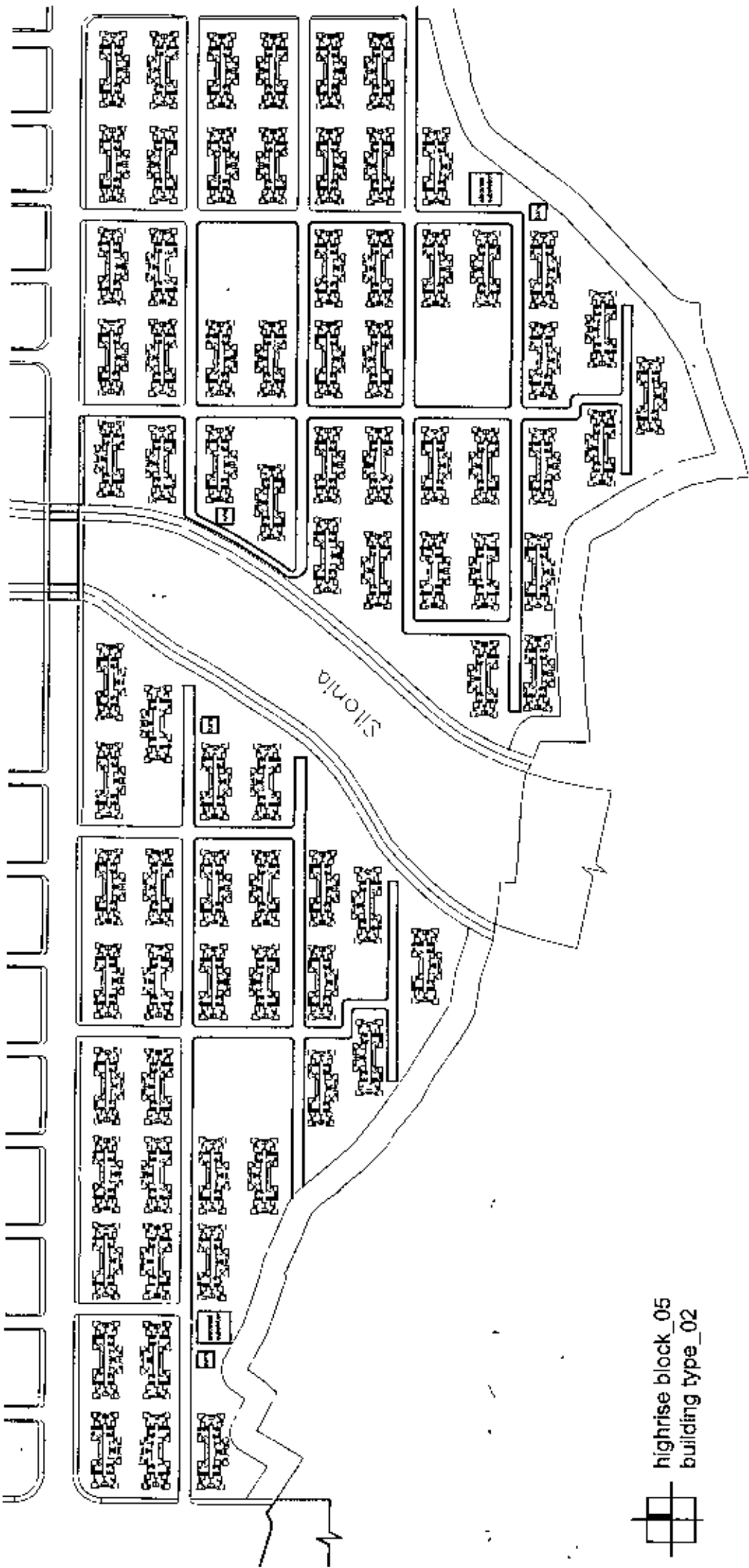
highrise block_05
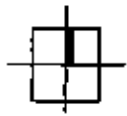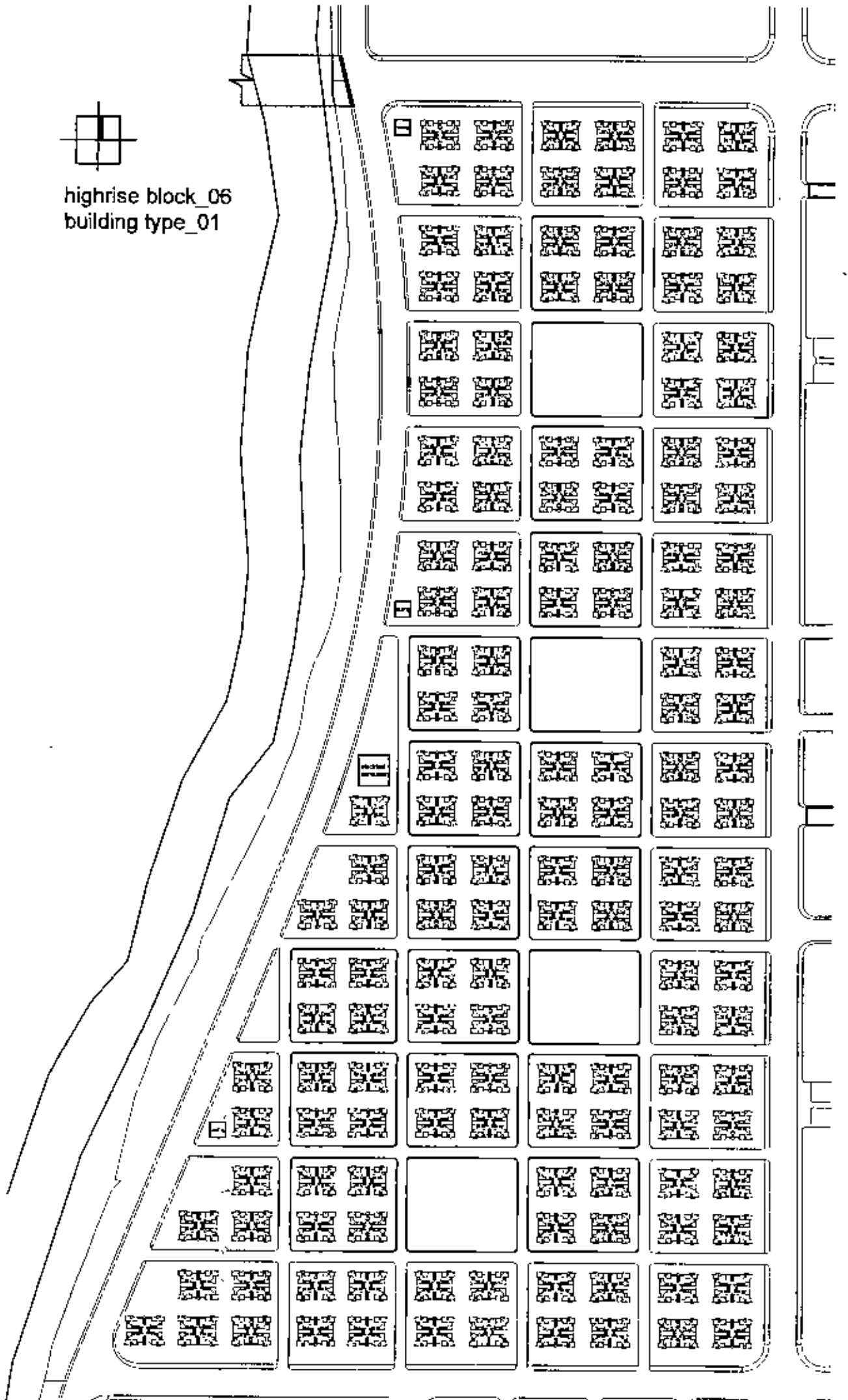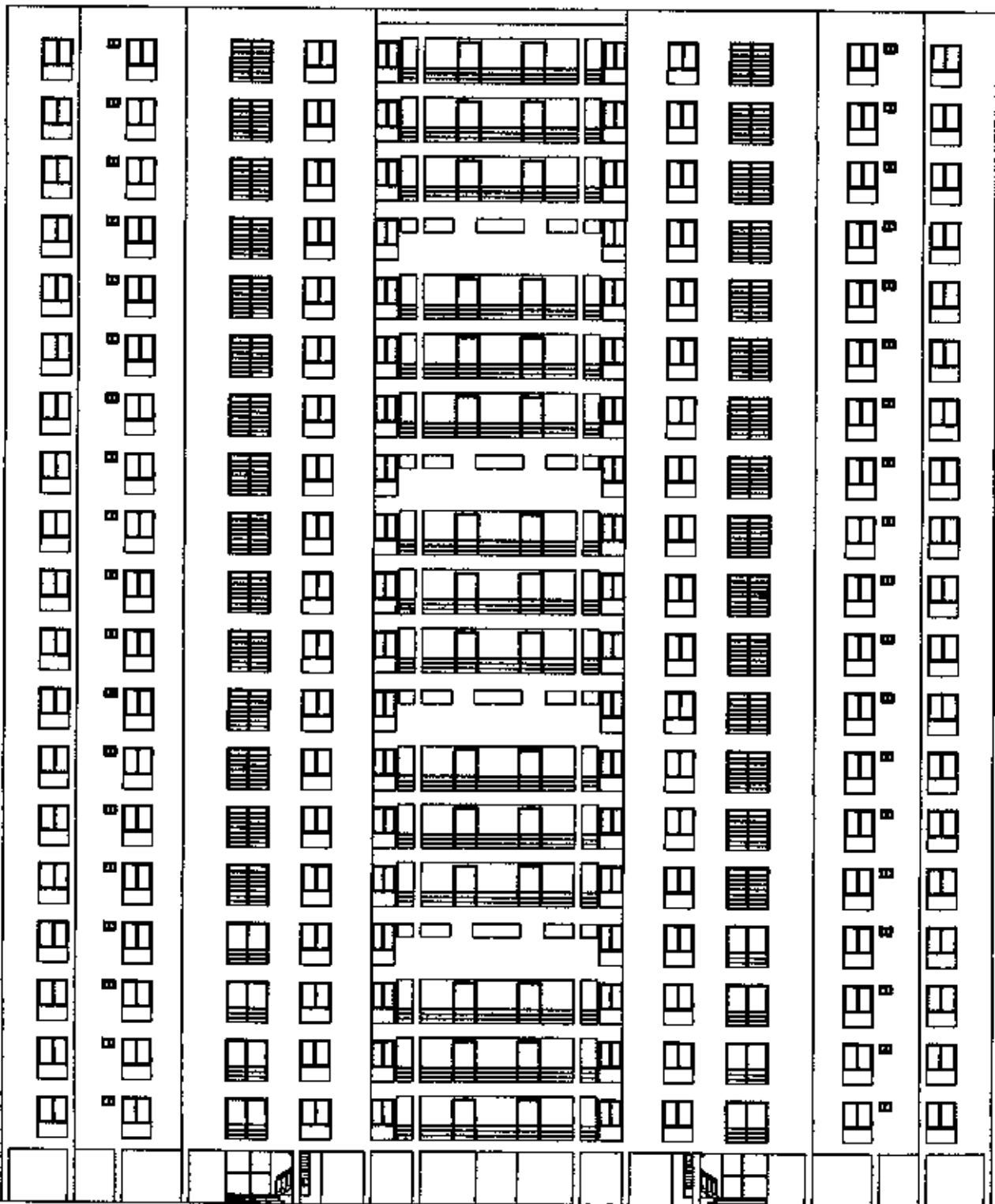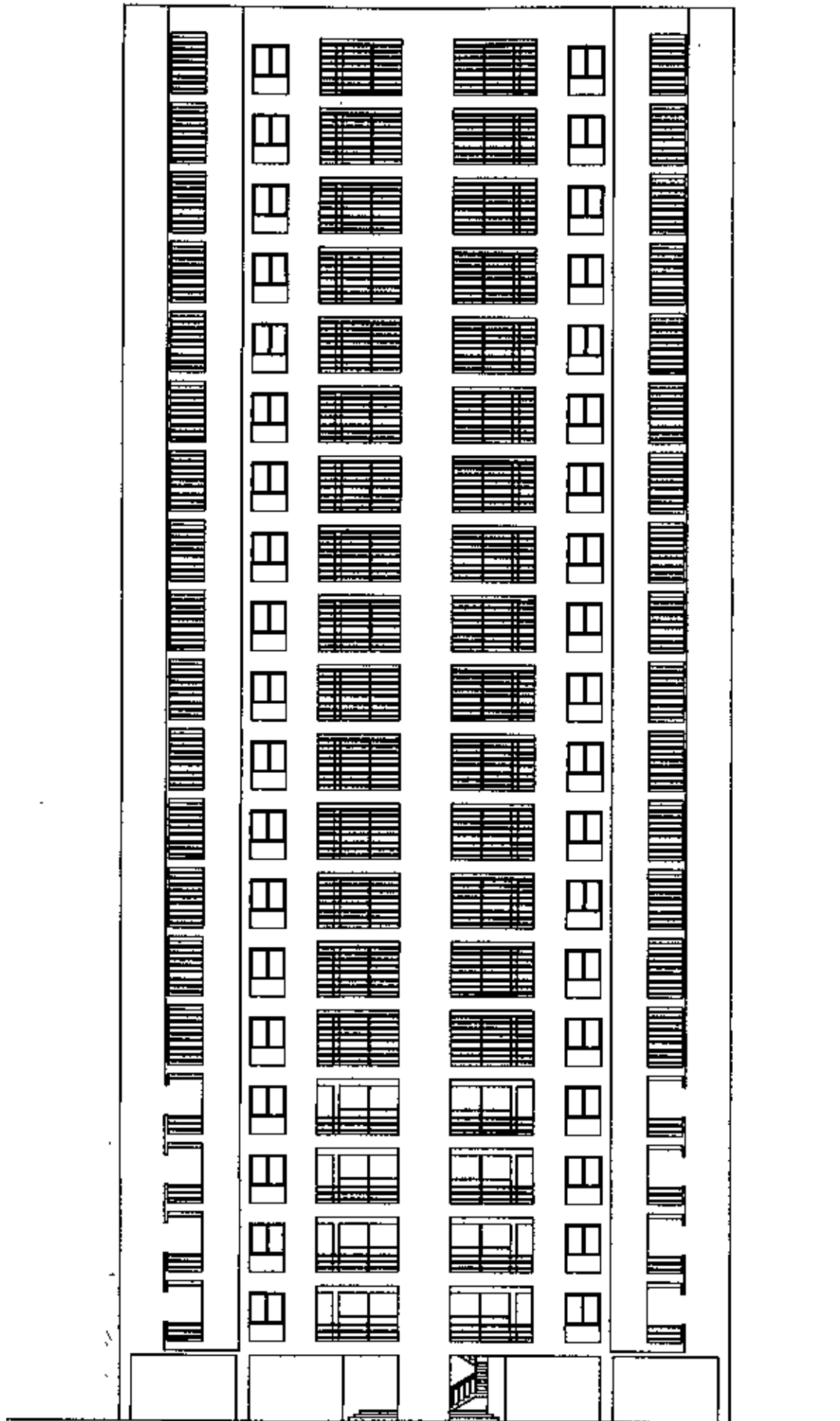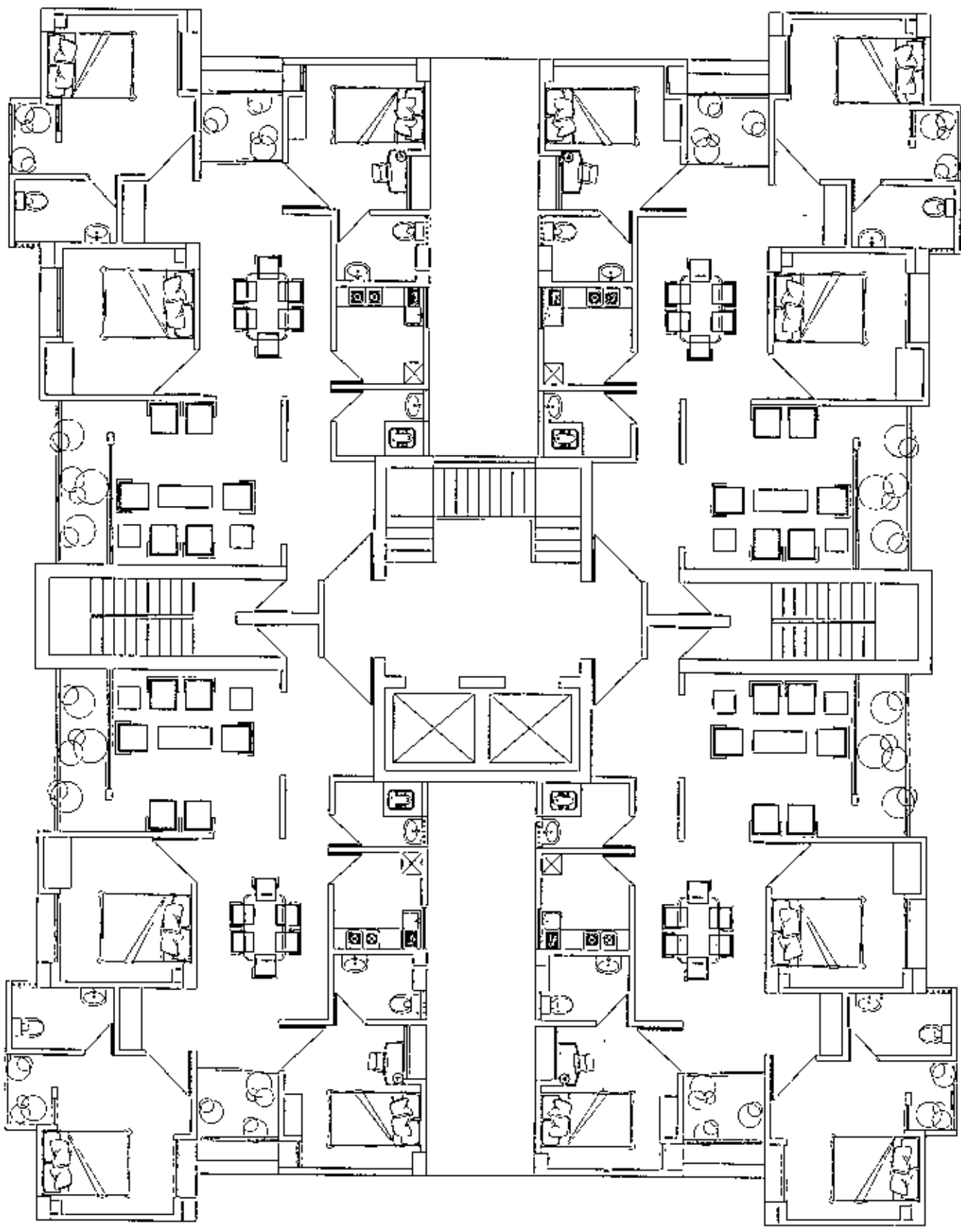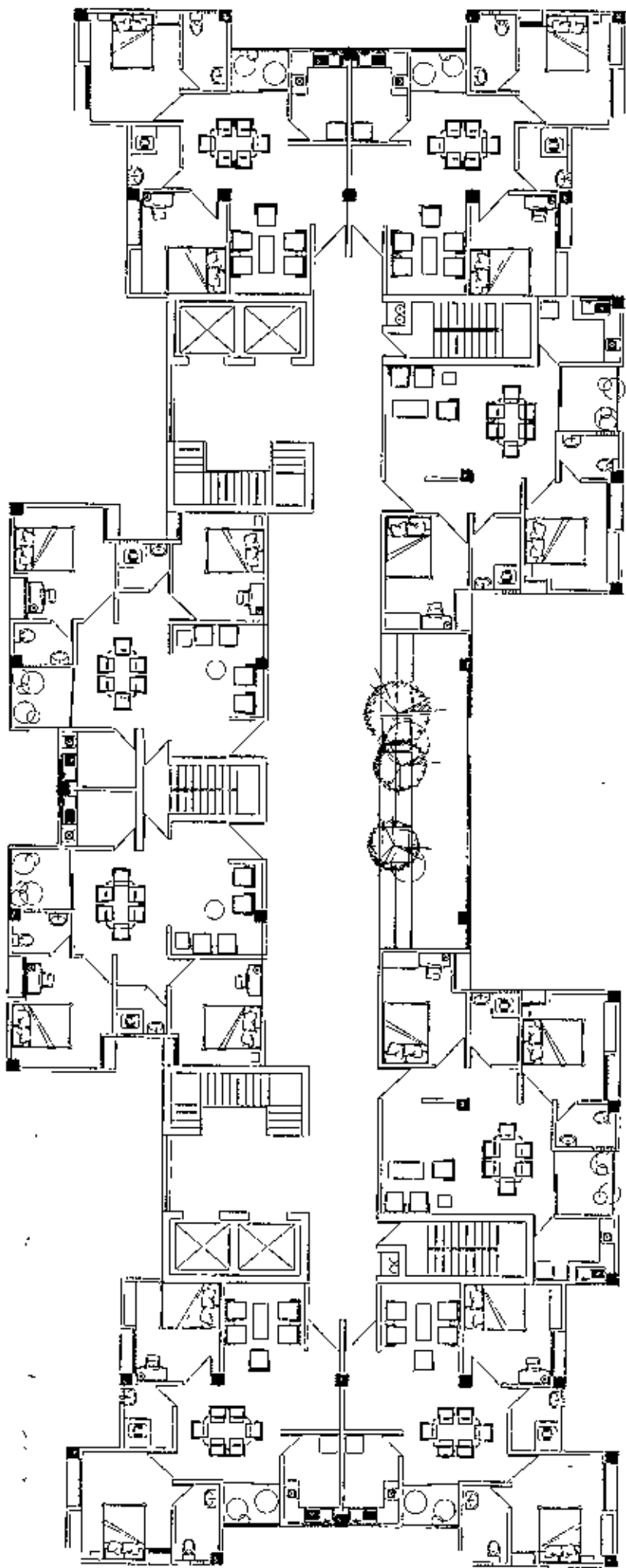building type_02

highrise block_06
building type_01

front side elevation
building type_02
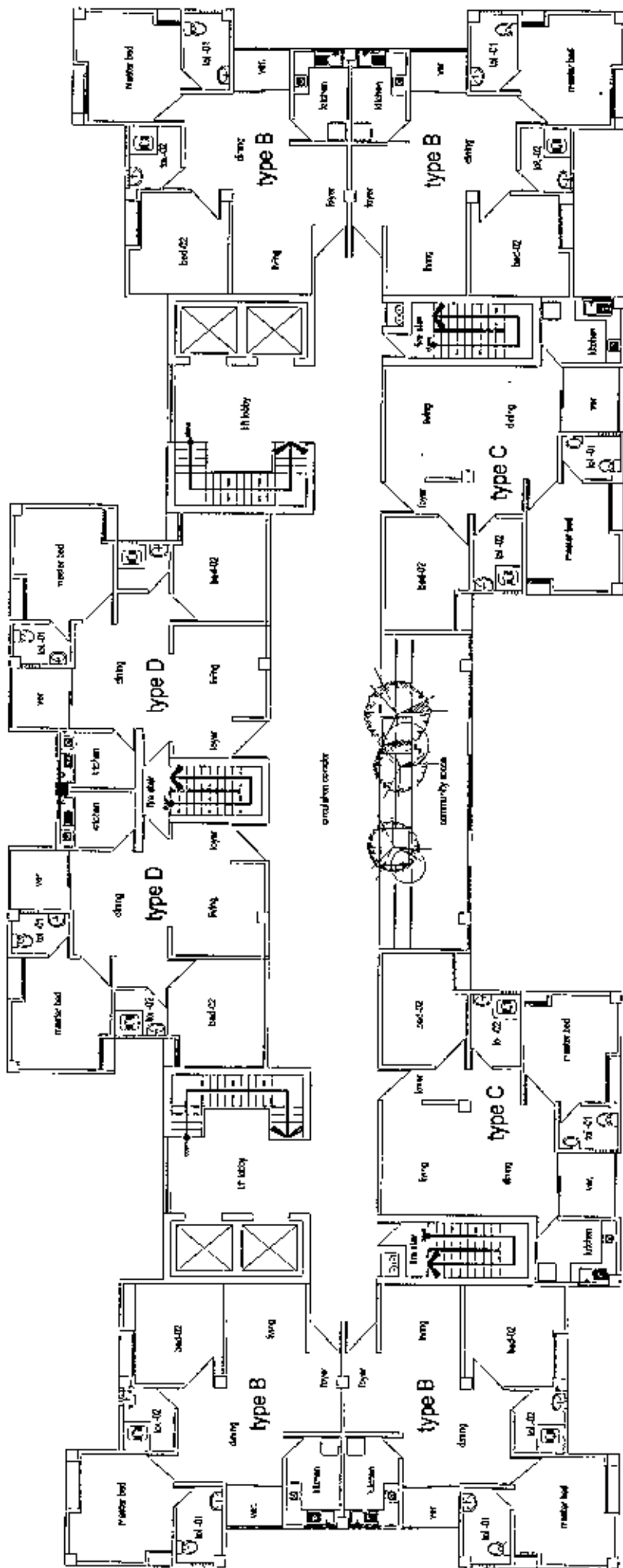
front side elevation
building type_01

unit type A
area 1100 sft.

unit type B, C & D
area 650 s.f.

type B

type B

type B

type B

type C

type C

type D

type D

master bed

master bed

master bed

master bed

master bed

master bed

master bed

dining

dining

dining

dining

dining

dining

dining

dining

living

living

living

living

living

living

living

living

kitchen

kitchen

kitchen

kitchen

bed-02

bed-02

bed-02

bed-02

bed-02

bed-02

foyer

foyer

foyer

foyer

foyer

foyer

lift lobby

lift lobby

fire stair

fire stair

fire stair

circulation corridor

community space

ver.

ver.

ver.

ver.

ver.

ver.

ver.

ver.

toi-01

toi-01

toi-01

toi-01

toi-01

toi-02

toi-02

toi-02

toi-02

toi-02

unit type B, C & D
area 500 sft.

ver.

guest bed

toi 01

ver.

master bed

fire stair

living

dining

ver.
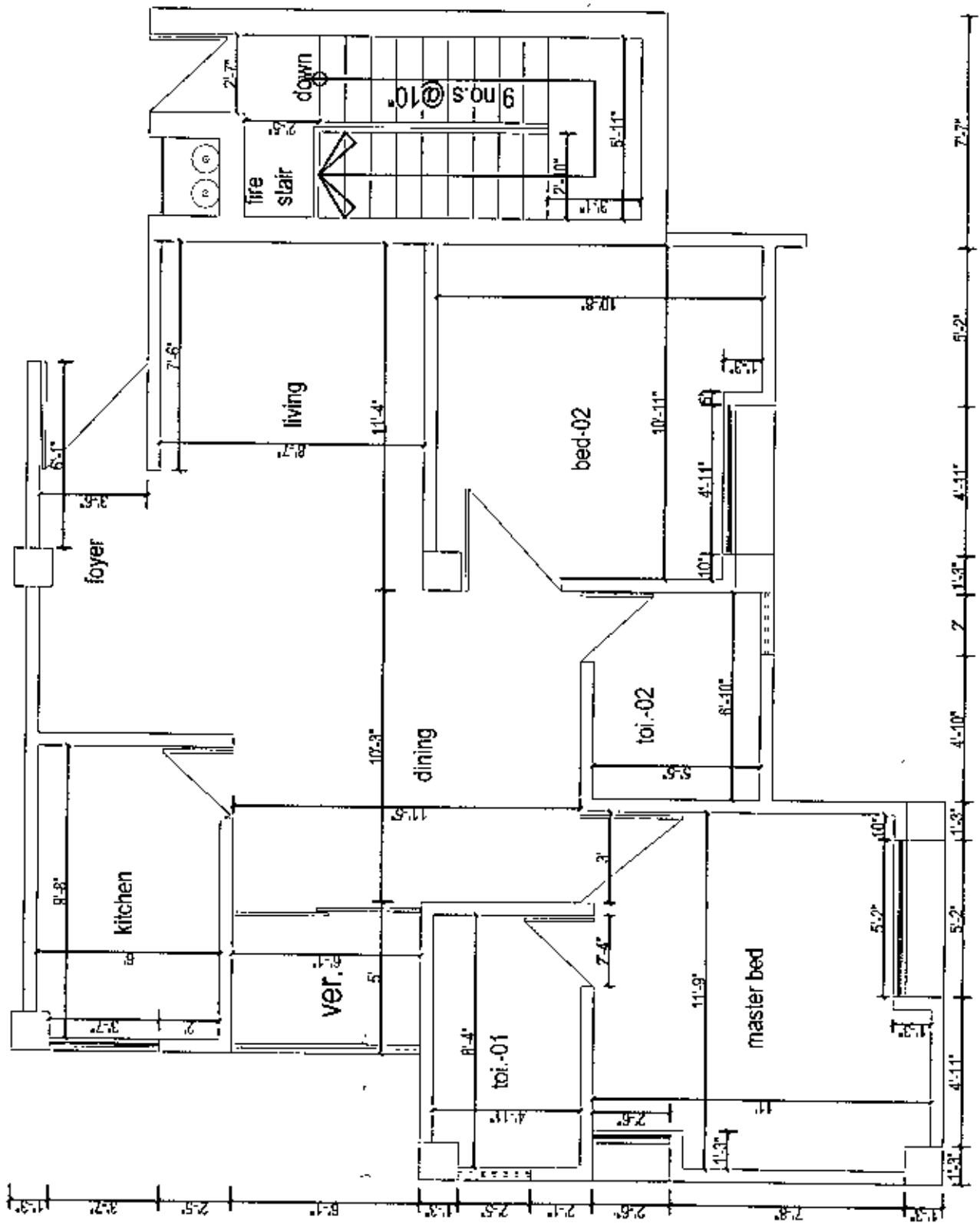
child bed

toi 02

kitchen

foyer

toi 03

lift lobby

to other units

unit type A
area 1100 sft.

unit type A
area 1100 sft.

ver

living

fire stair

foyer

lift lobby

to other units

fire stair

down
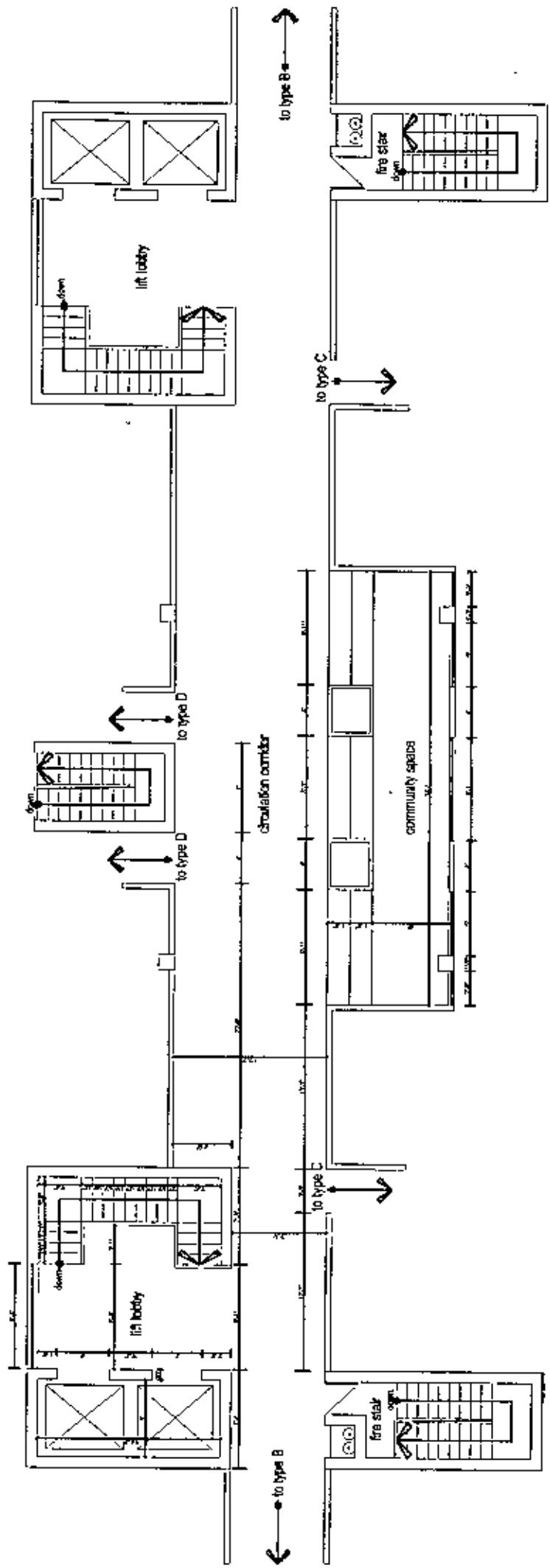
9 nos. @ 10"

living

bed-02

foyer

kitchen

dining

ver.

toi.-01

toi.-02

master bed

unit type C
area 800 sft.

bed-02

foyer

toi.-02

master bed

living

dining

toi.-01

ver.

kitchen

fire stair

down

unit type D

area 800 sft.

Rooms labeled: fire stair, kitchen, ver., dining, living, foyer, toi.-01, master bed, toi.-02, bed-02

lift lobby

down

to type B

to type C

to type D

to type D

circulation corridor

community space

fire stair
down

to type C

to type B

lift lobby

down

fire stair
down

common area

MASTER PLAN

BUILDING TYPE 01(1100 SFT EACH APARTMENT)

BLOCK	NO. OF BUILDING UNT	NO. OF APARTMENTS
BLOCK_03	102	7752
BLOCK_04	131	9956
BLOCK_06	158	12008
TOTAL		29716

BUILDING TYPE 02 (800 SFT EACHAPARTMENT)

BLOCK	NO. OF BUILDING UNT	NO. OF APARTMENTS
BLOCK_01	75	11400
BLOCK_02	79	12008
BLOCK_05	79	12008
TOTAL		35416

UNIT DETIAL

BUILDING TYPE 01   1100 SFT EACH APARTMENT
BUILDING TYPE 02   800 SFT EACH APARTMENT

ver

living

fire stair

lift lobby

foyer

toi 03

kitchen

guest bed

dining

toi 02

toi 01

ver.

ver.

master bed

child bed

to other units

unit type A
area 1100 sft.

unit type A
area 1100 sft.

ver.

living

foyer

fire stair

lift lobby

to other units

unit type A
area 1100 sf.

ver.

living

fire stair

foyer

lift lobby

to other units