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ENVIRONMENTAL EFFECT OF HIGH-RISE
RESIDENTIAL BUILDINGS

THESIS

SUMBITTED TO THE DEPARTMENT OF URBAN AND REGIONAL PLANNING
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IN PARTIAL FULFILMENT OF THE REQUIREMENTS
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DEPARTMENT OF URBAN AND REGIONAL PLANNING
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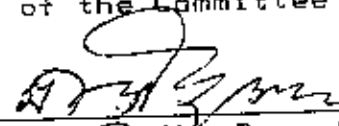
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ABSTRACT

High-rise residential buildings are a recent phenomenon in Dhaka City. High-rise residential buildings are coming up both in inner city areas as well as in outer city areas, specially along the main thoroughfares of the city and this type of housing market is flourishing day by day. Limited supply of buildable land and high land price have made it almost impossible even for the upper middle income group to own a piece of land for house construction. In this situation the upper middle income group of people have become inclined to the purchase of flats in their efforts to find an abode of their own in the capital city. Being encouraged by this market situation, a considerable number of housing companies have become engaged in building high-rise flat housing in the city. But these high-rise buildings are coming up sporadically and are being allowed amidst low-rise buildings without considering their environmental effects such as shading, disruption of air flow, loss of privacy, interference on T.V. reception on the surrounding area and impact on existing infrastructural, utility and service facilities. Also the internal environment consisting of vertical transportation arrangement, uninterrupted power supply, safety provisions, other amenities and various socio-cultural and psychological requirements of inhabitants of different age groups are not being given due importance in these high-rise buildings.

In this study attempts were made to evaluate above mentioned aspects of environment, both internal and external to these buildings, and to establish a relationship between lateral clearance, height, building coverage as represented by the Floor Area Ratio (F.A.R.) which is a measure of intensity of landuse and various other environmental qualities. Also, government policies on high-rise buildings were reviewed. The study identified the problems of residents of high-rise buildings and its neighbours, also the problems of public agencies giving services to high-rise buildings. It was found that the problems faced by the neighbours of high-rise buildings were positively correlated with the F.A.R. of adjacent high-rise buildings and calls for imposing F.A.R. restrictions at appropriate levels considering existing infrastructure, utility and service facilities. At the end, some guidelines for zoning restrictions considering F.A.R. were formulated.

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CHAPTER 1

**INTRODUCTION, OBJECTIVES,
METHODOLOGY AND SCOPE.**



1.1. INTRODUCTION

Urban housing situation in Bangladesh especially the housing situation in Dhaka City had long been unsatisfactory, both qualitatively and quantitatively, inspite of various measures taken by the government at various times. The back log of housing in Dhaka City went on increasing with the increase of city population.

Misuse, under utilization, speculation and scarcity of land and high price of construction materials are the main reasons of the accumulating of housing back log.

Accumulation of a sizeable amount of money (but not as much as to buy a parcel of land) in the hands of wage earners working abroad, some business men and high income group of the country, and the prestige and social security attached to the ownership of a house or flat, led to the generation of demand of residential flats in the city and under this situation real estate developers came forward to meet the demand and paved the way for large scale growth of residential flats or apartments including high-rise apartment housing.

The growth of high-rise buildings, particularly high-rise residential apartments, is a relatively new phenomenon in this city. The pros and cons of high-rise living is still unknown to the general buyers of the apartments. These are also commonly believed to be the solution of housing problem in the wake of scarcity and high price of land.

The absence of multi-owner building construction rules and building codes containing specification for construction, safety provisions, amenity, socio-psychological and environmental requirements has created the admixture of high and low rise buildings with subsequent problems both internal and external to the building and threatened to cause deterioration of the over all housing environment (Enam, 1984).

Hence it is high time for studying the housing environment both inside and outside high-rise residential buildings and to make suggestions regarding high-rise residential buildings.

1.2. OBJECTIVES OF THE STUDY

The objectives of the study are

- (a) To determine the effects of high-rise residential buildings on sun shine, day light and ventilation received by the surrounding structures and other problems felt by the neighbours due to adjacent high-rise buildings.

- b) To determine a relationship between lateral clearance, height, building coverage as represented by floor area ratio (F.A.R) and the housing environment containing sun shine, ventilation, privacy, amenity and other socio-psychological requirements of the residents.
- c) To review government policy on high-rise residential buildings.
- d) To develop some guide lines for zoning restrictions considering F.A.R.

1.3. METHODOLOGY.

The objectives were operationalized in measuring quality of housing environment with the problems felt by the residents and neighbours of high-rise buildings as indicators by an arbitrary scale (Modified net index value of problems) developed by the author and correlating this modified net index value of problems associated with the buildings with the floor area ratios. The modified net index values of problems were treated as dependent variables and floor area ratios as independent variable.

In calculating the floor area ratios of the buildings, floor area including the wall area was taken as floor area of each storey.

In selecting samples, random sampling of residents and neighbours were adopted.

The study was carried out in three Phases

1.3.1. LITERATURE SURVEY:

Relevant literature published at the national and international levels was surveyed to have a basis of understanding and to collect information from published and unpublished sources.

1.3.2. COLLECTION OF DATA:

Data has been collected in the following way

a) Questionnaire survey: Questionnaire survey was carried out to collect information about the problems faced by the neighbours and residents. Two sets of questionnaires, one for the residents and the other for neighbours, were used.

b) Interviews: Interviews were conducted with knowledgeable persons of the Planning Commission of Bangladesh, urban service agencies such as WASA, Titas Gas Transmission and Distribution Company, Dhaka Electric Supply, Dhaka City Corporation, Rajdhan Unnayan Kartipakkha (RAJUK) Directorate of Fire Service and the Traffic Division of Dhaka Metropolitan Police, Meteorological Department, real estate developers, elites of

the city and professionals including architects, planners and engineers.

1.3.3. ANALYSIS OF DATA

Data collected in the above way was analysed and information was generated, from which inferences were made.

1.4. SCOPE OF THE STUDY.

RAJUK's definition of tall buildings as buildings above six storeys was accepted for the study. Since residential apartments with 15 or more storeys are yet to be inhabited, other buildings, viz, Hotel Elysium (10 Storeyed), Aziz Co-operative Housing (9 Storeyed) and Property Enclave (8 storeyed) at different strategic locations - Hatkhola, Purana Paltan and Bangla-Motor were studied in respect of both the residents and neighbours.

CHAPTER 2

URBANIZATION PATTERN AND URBAN HOUSING SITUATION IN BANGLADESH.

In this chapter urbanization pattern in terms of population growth, economic condition and urban housing situation including definition and significance of housing, housing stock, effective demand and affordability of housing in Bangladesh in general and in urban areas in particular have been discussed. An over view of government efforts in tackling housing problems as revealed in the Five Year Plans have also been made.

2.1. URBANIZATION PATTERN

Bangladesh (Fig. 2.1), occupying a land area of 55,598 sq. miles, is one of the most densely populated countries in the world having a critical man-land ratio of 1700 : 1 . Population in census years 1951-81 is given in the following table.

Table 2.1 : POPULATION IN CENSUS YEAR: 1951-81.

Census year	1951	1961	1974	1981
Population	44165000	55222000	76398000	89912000

Source : Statistical Year Book of Bangladesh: 1987 (1988), p.35.

Inter-censal growth rates of population between 1951 and 1981 are given in the table below.

Table 2.2 : INTER-CENSAL GROWTH RATE OF POPULATION: 1951-81

Census year	1951	1961	1974	1981
Growth in %	5.16	25.04	38.35	17.69
Expn.Growth rate	0.50	2.26	2.48	2.32

Source: Statistical Year Book of Bangladesh: 1987 (1988), p. 35.

The growth of urban population had always been more than the total national population growth. The annual rates of urban population growth between 1951 and 1980 are shown in the following table.

Table 2.3 : ANNUAL RATES OF URBAN GROWTH: 1951-1980.

Period	Rate of urban population growth (Percent per annum)	Rate of National population growth (percent per annum)
1951-61	3.72	1.92
1961-74	6.70	2.65
1974-1980	6.70	2.60

Source: World Bank (1981), p.1

The growth of urban population was more concentrated in the larger six cities. The combined rate of growth in these cities was 9 percent between 1961 and 1974. Population size distribution of cities in Bangladesh is shown in the following table.

Ward wise population distribution for the year 1981 and estimated population distribution for the year 1990 of Dhaka Metropolis are shown in Fig. 2.2-2.3.

Table 2.4 : SIZE DISTRIBUTION OF CITIES IN BANGLADESH.

City/ urban area	Population 1974, (million)	Annual growth rate 1961-74 (% P.a)	Population 1980 (estimated)	% of total urban population	Annual growth rate 1974-80 (assumed)
Dhaka	1.95	9.4	3.35	28.60	9.70
Chitta- gang	0.95	7.1	1.43	12.00	7.10
Khulna	0.40	9.9	0.70	6.00	9.90
Mymer- shingh	0.12	2.8	0.14	1.00	3.20
Rajshahi	0.13	6.7	0.16	1.00	3.10
Barisal	0.098	2.6	0.12	1.00	3.10
Total U. Pop.	8.0	6.7	11.80	100	6.70

Source: World Bank (1981), p.1.

Migration is the main cause of rapid urban growth. Migrants to major cities from rural areas per year increased five fold between the census periods 1951-1961 and 1961-74 from an average of about 40,000 people per year during the first period to about 200,000 people per year during the later period. Only one out of every seven people in urban areas was a rural migrant in 1961. By 1974 two out of every five urban dwellers were rural migrants.

The following table shows the share of migrants in the population of the three major cities.

Table 2.5 : MIGRANTS TO MAJOR CITIES: 1961-74

City	Estimated No of migrants	Migrants as Proportion of total population (1974)	Estimated squatter population (1974)	Squatters as proportion of migrants (1974)
Dhaka	947,000	56%	173,000	18%
Chittagong	378,000	43%	28,000	7%
Khulna	257,000	59%	54,000	21%

Source: Choudhury et.al., (1976) quoted in World Bank (1981), p. 5.

2.2. URBAN GROWTH PROJECTIONS: 1980-2000

Different authorities have projected urban growth of Bangladesh with different assumptions as revealed in the following table.

Table 2.6 : SUMMARY OF URBAN POPULATION PROJECTIONS FOR BANGLADESH: 1980-2000

Agency	2000 Total Projected Population (in millions)	2000 urban population (in million)	Percent urban	Assumptions/Methodology
Government of Bangladesh Planning Commission/ Paper presented to UNFPA Conference	118	32.4	27.6	Assume $ARR=1$ by 1980. Continued urban growth at 6%
World Bank Second population Project appraisal assumption 1	130	39.0	30.0	$NRR=1$ by 2025 urban population 30% of total
World Bank Second population project appraisal assumption 2	147	44.0	30.0	$NRR=1$ by 2035 urban population 30% of total
DMAIUDP Population report (low)	135	36.5	27.0	Independent projections of national population. Urban population assumed to be 27%
DMAIUDP Population report (high)	161	43.5	27.0	Same as above

Source: World Bank (1981), p. 12.

The table indicates that the urban population of Bangladesh may reach 44 million in the year 2000, which is almost 3.5 times of present urban population.

Major cities of Bangladesh would experience more severe population growth as revealed in the following table.

Table 2.7 : POPULATION PROJECTION FOR MAJOR CITIES: 1980-2000.

City	1980 Population (millions)	Illustrative 2000 projects	
		Assumed annual Rate of Growth	Population (millions)
Dhaka	3.4	5.2	9.3
Chittagong	1.4	5.4	4.0
Xhulna	0.7	6.1	2.3
All urban population	11.80	6.15	39.01

Source: World Bank (1981), p. 13.

2.3.ECONOMIC CONDITION OF THE COUNTRY

- Bangladesh is one of the least developed countries of the world and the per capita income of the population is one of the lowest (\$ 120.00 per capita) in the world.

Till 1988-89 the agricultural sector played the major (not less than 47 percent) role in the sectoral contribution in GDP. The contribution of industry to the GDP is less than 10 percent. The following table shows the contribution of different sectors in the GDP of Bangladesh.

Table 2.8 : SECTORAL CONTRIBUTION IN GDP (IN 1984-85) PRICE (IN CRORES OF TAKA)

Sector	1986-87	1987-88	% growth from Previous year	1988-89 (estimated)	% growth from Previous year
Agriculture	17,808 (49.85)	17,928 (48.74)	0.65	17,847 (47.53)*	(-)0.43
Industry	3462 (9.78)	3,599 (9.79)	3.96	3,794 (10.10)*	(+)5.42
Electricity and Gas	301 (0.84)	346 (0.94)	14.95	396 (1.05)*	(+)14.45
Construction	880 (2.46)	967 (2.63)	9.89	1,077 (2.87)*	(+)11.38
Others	13,271 (37.15)	13,942 (37.91)	5.06	14,435 (38.45)*	(+)3.54
	35,722 (100)	36,772 (100)	2.95	37,547 (100)*	2.09

Source: Planning Commission, quoted in Bangladesh Arthonaitik Jarip 1988/89 (1989), p.17.

Figures in parenthesis indicates percentage distribution.

The per capita GNP of Bangladesh is one of the lowest in the world. The following table shows the comparison of per capita income of Bangladesh with that of other countries.

Table 2.9 : PER CAPITA GNP OF SOME COUNTRIES.

Country	Pop.(m) Aug.1990	GNP Per cap.	GDP growth	Foreign debt	Inflation CPI
Afghanistan	19.8	(\$150)	2.1%	\$ 1.5b.	56.8%
Australia	17.0	\$16,050	4.3%	\$93.3b.	7.8%
Bangladesh	110.4	\$179	2.4%	\$10.4b.	8.0%
Bhutan	1.4	\$160	5.3%	\$ 0.07b.	9.3%
Brazil	150.8	\$2,000	3.0%	\$110b.	1,287%
Brunei	0.2	\$17,000	4.5%	0t	2.3%
Burma	40.4	\$200	3.4%	\$4.5b.	70.0%
Cambodia	7.9	\$110	0%	\$0.6b.	10%
China	1,118.7	\$305	3.9%	\$41.3b.	4.1%
Hongkong	5.8	\$10,939	2.3%	0t	10.1%
India	830.7	\$320	4.5%	\$62.8b.	10%
Indonesia	182.8	\$520	5.5%	\$53.1b.	6.4%
Japan	124.2	\$22,879	4.4%	0t	2.1%
Malaysia	17.9	\$2,050	8.5%	\$16.4b.	2.8%
Nepal	19.0	\$170	1.5%	\$1.4b.	10.1%
Pakistan	112.8	\$365	5.2%	\$15.6b.	10.6%
Philippines	51.5	\$727	5.7%	\$27.0b.	10.8%
Singapore	2.7	\$10,521	8.4%	0t	3.5%
South Korea	43.0	\$4,968	6.1%	\$29.2b.	8.2%
Sri Lanka	17.0	\$416	2.5%	\$5.3b.	11.6%
Taiwan	20.2	\$7,509	7.2%	0t	4.7%
Thailand	56.6	\$1,194	11.0%	\$27.3b.	5.8%
U.S.	251.1	\$21,116	2.2%	\$664b.	4.8%

0t i.e. net creditor.

Source: Asia week (1990).

The economic weakness of the country is indicated by the negative growth in per capita income as is evident from the following table:

Table 2.10 : GDP & GROWTH IN PERCAPITA INCOME (AT 1984-85 PRICE)

Description	1984-85	1985-86	1986-87	1987-88
GDP in crore TK	38536	40110	41597	42529
Population (in lakh)	992.0	1017.0	1041.0	1066.0
Percapita income (Tk)	3885	3944	3996	3987
Growth rate in GDP(%)	-	4.1	3.7	2.2
Percapita growth of GDP in percentage		1.5	1.3	(-)0.2

Source: B.B.S. quoted in Bangladesh Arthonaitik Jarip 1988/89 (1989).

External assistance played the role of "Prince of Wales" in the annual development programme, the level of which went up to as high as 94 percent of the total annual development budget as shown from the following table.

Table 2.11 : EXTERNAL ASSISTANCE AS PERCENTAGE OF ADP (1984-89)

Year	Size of ADP (in crore of Taka)	External assistance (in crore of Tk)	External assistance as % of ADP.
1984-85	3508.42	2618.00	74.62
1985-86	4095.54	3391.81	82.82
1986-87	4513.38	3701.49	82.01
1987-88	4650.61	4371.61	94.00
1988-89	4595.34	4194.00	91.27
1989-90	*5803.02	*5050.00	*91.27

Source: Budget Summary Statements. (85-86, 86-87, 87-88, 88-89, 89-90), Ministry of Finance, GOB.
* Estimated budget.

2.4. INCOME GROUPS IN URBAN AREAS OF BANGLADESH.

The following table shows the distribution of household income groups in urban areas in Bangladesh. The medium low income group with a monthly income between Tk. 750-2499 comprises 58.63 percent of the total number of households.

Table 2.12 : INCOME GROUPING IN URBAN AREAS IN BANGLADESH: 1981-82.

Group	% of urban H/H	Monthly household Income Groups (in Tk.)	Average Monthly Income per H/H. (Tk.)	Average Monthly Expend. per H/H. (Tk.)	% of Urban Households
Lowest	24.88	<500	390.27	351.60	0.87
		500-749	637.79	625.17	4.34
		750-999	873.50	870.31	8.33
		1000-1249	1119.92	1071.71	11.34
Medium low	59.26	1250-1499	1358.82	1328.45	10.71
		1500-1999	1716.09	1676.88	15.84
		2000-2499	2221.81	2070.29	12.05
		2500-2999	2723.03	2542.41	8.80
		3000-3999	3396.82	3134.45	10.82
Medium	12.68	4000-4999	4396.11	4096.27	5.66
		5000-5999	5452.50	5196.22	3.94
		6000-6999	6471.56	5947.25	2.08
Medium high	1.27	7000-7999	7473.14	6421.95	1.27
High	1.91	8000 +	10922.85	8955.79	1.91
Total	100.00	All groups	2486.85	2315.51	100.00

Source: Bangladesh Household Expenditure Survey 1983-84, B.B.S., (1988) p.57.

There is wide spread poverty in urban areas specially in major cities. The following table expresses the various indicators of urban poverty in major urban areas.

Table 2.13 : DATA ON URBAN POVERTY IN THE MAJOR MUNICIPALITIES.

Municipality	Dhaka	Khulna	Chittagong	Rajshahi
Percentage of Population living in squatter settlements	9%	13.50%	3%	n.a
Percentage of Population in Poor Communities	37%	36%	16%	8%
Average Monthly house hold income in poor urban communities (1978)	675	375	475	529
Median rent Paid in Urban Poor Communities	44	12	23	27

Source: World Bank (1981), p. 16.

2.5. DHAKA'S SHARE OF THE NATIONAL ECONOMY AND INVESTMENT.

The capital city of Dhaka enjoys the major share of national economy and investment as expressed in the following table.

Table 2.14 : DHAKA'S SHARE OF NATIONAL ECONOMY AND INVESTMENT.

Criteria	Dhaka as percent of national total	Period
Manufacturing employment	47%	1976-77
Employment in jute and Textiles	75%	1976-77
Private industrial investment	55%	1976-79
Public sector investment	20%	1977-79
Physical Planning and housing sector allocation	57%	1978-80
No. of Government Housing units assigned in SFYP	68%	1980-85

Source: World Bank (1981), p. 7.

2.6. MEANING OF HOUSING

A house may be defined as the shelter for rest, safety and comfort, and for protection against enemies and vagaries of

climate. It includes space for rest, for sleeping, for cooking and bathing. But "housing" does not simply mean the physical structure only. It includes along with the physical structure used as shelter its environs and the services, facilities and equipments needed for the physical and mental health and social well-being of the family and the individual. It also includes residential environment and neighbourhood.

A proper residential environment plays a significant role in the development and well-being of a nation directly or indirectly. In the direct role housing serves as the area where the individual becomes capable of experiencing community and privacy; shelter and protection against hostile physical forces and disturbances. In its indirect role housing serves as the area where an abundant supply of social relationship and services such as places for social interaction, recreation, sports, social welfare and health protecting services, shopping and transportation are accessible.

"Housing" has been defined in 1961 by World health Organisation as:

"Residential environment, neighbourhood, microdistrict or the physical structure that mankind uses for shelter and the environs of that structure, including all necessary services, facilities, equipment and devices needed or devised for the physical and mental health and social well-being of the family and the individual".

Indeed, the primary objective of housing is health and the home or house is an instrument of health.

- Housing should include
- (1) Health and physical security aspects such as space utilization, lighting, ventilation toilet facilities, food processing and basic health services within the neighbourhood
 - (2) Privacy
 - (3) Provision for social interaction and co-ordination of shared activities
 - (4) Optimization of available social services
 - (5) Efficient integration with other land uses through communication facilities
 - (6) Improvement of urban form and community development through equity and efficiency.

Man-made physical environment has to play the role of fulfilment, wholly or partially, of human needs, - biological and socio-cultural, irrespective of formal recognition to these needs.

neighbourhood (c) The production environment, (Islam, 1981).

of three major components (a) individual and the family (b) The which as reflected in housing, is considered to be the function

All human activities are aimed at improving the quality of life.

"The house is not merely a place to take shelter from the rain or the cold, or the sun. It is, or should be, an enlargement of one's personality, and if human welfare is our objective, this is bound up with our house".

Nehru defined house as:

A housing environment should be an index of the social health, happiness, social justice and dignity of the inhabitants.

2.7. URBAN HOUSING SITUATION IN BANGLADESH

Urban housing situation in Bangladesh has never been satisfactory. Squeezing the sociological scale of "housing" to dwelling units only, the following table expresses the present extent and level of dwelling units in the country.

Table 2.15 : DWELLING UNITS BY TYPE (FIGURES IN LAKH)

Area	Total	%	*Pucca	%	*Semi Pucca	%	*Katcha	%
Urban	20.42	13.81	3.21	2.17	1.57	1.06	15.54	10.58
Rural	127.43	86.19	0.95	0.65	1.45	0.98	125.03	84.56
	147.85	100.00	4.16	2.82	3.02	2.04	140.57	95.14

Source: Statistical Pocket Book of Bangladesh 1986, Bangladesh Bureau of Statistics, 1987, p. 167.

* Pucca dwelling consist of cemented roof and brick masonry walls. Dwellings with tiles/C.I sheet/wood as roofing material, brick masonry walls are semi pucca and all other types of dwellings are included in katcha dwellings.

Out of 147.85 lakh dwelling units of the country only 13.81 percent ie. 20.42 lakh units are situated in urban areas and 3.21 lakh units are pucca, which is only 2.17 percent of the total dwelling units of the country.

Rapid urbanization and poor economy followed by inequitable distribution of resources have created serious housing problems such as high occupancy as shown in the following table.

Table 2.16 : AVERAGE OCCUPANCY PER UNIT IN MAJOR CITIES OF BANGLADESH.

Pourashava (Municipality)	Average occupancy (Persons per unit)	
	1960	1973
Dhaka	5.5	7.7
Narayanganj	4.9	6.1
Chittagong	5.0	6.4
Khulna	5.5	6.7

Source: World Bank (1981), p. 31.

2.8. AFFORDABILITY OF SHELTER

The affordability of shelter by the urban households is extremely low. Only twenty percent of households in Dhaka City can afford more than Tk. 17,500 as initial investment for housing, as indicated in the following table.

Table 2.17 : AFFORDABILITY OF SHELTER BY URBAN HOUSE HOLD 1979/80

Approx. House hold income percentile (all urban areas)	Maximum monthly h/h income (Tk)	Max.h/h expenditure for house:		Affordable Initial investment at 13% over 20 year 10% down payment (Tk)
		(%)	(Tk)	
20	680	9	61	5,860
40	750	10	75	7,000
60	850	12	102	9,500
80	1,170	16	187	17,500

Source: DMAIUDP (1981), cited in World Bank (1981), p. 32.

2.9. ESTIMATED DEMAND FOR NEW SHELTER: 1980-2000

Requirement for new shelter in the period 1980-2000 had been estimated by World Bank mission and published in the urban sector memorandum.

Table 2.18 : ESTIMATED NEW SHELTER REQUIREMENT IN MAJOR CITIES IN BANGLADESH: 1980-2000

	1980		2000		1980-2000 New housing units required('000)
	Population (million)	h/h('000)	Population (million)	h/h('000)	
Dhaka	3.35	515	9.3	1,691	1,176
Chittagong	1.43	220	4.0	727	507
Khulna	0.70	108	2.3	418	310
Total	11.80	1,820	39.10	7,197	5,287

Source: World Bank (1981), p. 32.

2.10. PUBLIC POLICIES AND STRATEGIES IN HOUSING DURING DIFFERENT PLAN PERIODS.

Housing situation had long been unsatisfactory, both qualitatively and quantitatively. After the separation of India in 1947, urban housing situation deteriorated mainly due to migration of refugees from across the border and also by rural to urban migration within the city.

After the emergence of sovereign Bangladesh in 1971, urban housing situation took a serious turn. The government tried to face the problem through different policies and measures in different plan periods. These are summarised below.

In the First Five Year Plan the government tried to formulate long term programmes based on rational analysis and study of demand for housing and to off set the back log of housing for government staff through short term programmes such as construction of multi-storved apartments in urban areas, provision of minimum shelter in planned environments, organisation and financing of co-operative housing societies, framing adequate controlling and regulating measures including housing code and building bye-laws to check unplanned and haphazard urban development. Along with this, to maintain a decent urban environment infrastructural and urban service facilities were also given importance. (Planning Commission, 1973).

In the two year plan, role of physical Planning in the country, especially for the urban area was given more importance to maintain appropriate environment and also to control pollution. Provision of housing for government staff including the low income group at district head quarter level was also sought. Some policy guide line was put forward in the plan book, such as better enforcement of existing laws and formulation of necessary legal provisions to control haphazard urban growth, establishment of a "National Housing Authority" to take care of large scale housing for low income groups, smaller plots to be offered by DIT, CDA, KDA for serving a larger number of people in the wake of scarcity of land, better co-ordination and restructuring of

various agencies for harmonious and efficient development in the urban area and promotion of public awareness for maintaining decent housing environment. (Planning Commission, 1978).

In the Second Five Year Plan the government out-look towards providing large scale housing for its staff changed, on the assessment of being able to provide only 2-3 percent of total demand of government housing. The policy of providing large scale housing for its staff was limited to providing housing in selective cases in specific places to achieve various socio economic-political causes. This was done to establish better equity and social justice among government staff. Policies of providing high cost multi-storied housing were reviewed and measures to minimize unit cost of housing were taken. Instead of this, provision of site and services and measures for utilizing house rent and private savings of government staff in developing housing was taken. For the over all growth of housing easy term financing and construction of multi-storied flats for hire purchase was introduced. Physical environment being of concern, measures were taken and fund was allocated in this Plan period. (Planning Commission, 1980).

In the Third Five Year Plan, the prescription for private sector participation on a large scale was given on acute shortage of public resource. Public investment was kept limited to squatter resettlement programmes, core housing programmes for relatively

disadvantaged groups and provision and extension of infrastructure and service facilities only.

For the growth of housing stock at district towns, strategy of "Seed fund" was taken.

For the over all growth of housing stock fiscal and financial incentives such as availability of loans, special interest rate, tax exemption on income, were given. Legislative measures for better control of housing co-operatives and restricting one family from having more than one plot of specified size through any source within the declared city limits for house construction.

Unplanned haphazard urban growth remained as a headache and an endeavour to check it, preparation of master plans for urban areas and greater co-ordination among various organisations and strengthening of their regulatory functions were given more importance (Planning Commission. 1985).

The country has launched its Fourth Five Year Plan, preliminary thoughts about the Fourth Five Year Plan, which is a part of a 20 year perspective plan, has been published in Bangladesh aid Memorandum 89-90, indicating poverty alleviation, promotion of self reliance, creation of employment through rural development and linking agricultural and industrial developments, at the

expense of social overhead costs, keeping decentralization of administration for the betterment of people in mind, (Planning Commission and External Resource Division, 1989).

In this back ground the government would prefer to pursue the guiding and regulatory role in the housing sector, especially for urban area, by creating a new private sector housing finance institution and restructuring of House Building Finance Corporation.

Implementation of large scale salvation schemes for urban infrastructure and service agencies would not be possible for resource constraints- in the aim of equitable distribution of resource, balanced growth between regions in the light of decentralisation of administration. Hence formation and better enforcement of law and bye-laws are the only tools in the hands of the government to maintain livable housing environment in the country, and in urban areas in particular.

CHAPTER 3

HIGH-RISE BUILDINGS IN DIFFERENT PARTS OF THE WORLD.

Living in high-rise apartments is not new in the developed and developing countries. Different countries have different experiences in high-rise living. In this chapter we would discuss some of the experiences with regard to the growth and development of high-rise residential buildings in different parts of the world.

3.1. EXPERIENCES IN HIGH-RISE BUILDINGS IN U.S.A.

In the end of the 19th century and at the beginning of the 20th century high-rise building began to spring up at different places specially in New York and Chicago without considering the existing infrastructural facilities such as transportation system, water, gas and electric supply, telephone network, and all of those facilities had to be improved substantially at a very huge investment. America, the wealthiest part of the world managed to afford that; The general public along with the owners of the high-rise building, had to bear the cost of those redevelopments added to that was the cost of degraded physical environment. As a result, regulations limiting the building height were introduced in the different cities of U.S.A.

"New York city and Washington, D. C. are familiar examples of regulations limiting building height, but in different ways. In New York the approach has been to

limit the total volume of the building relative to the site, primarily to provide light and air to the street. Earlier zoning codes emphasized building setbacks, whereas more recent thinkings has favoured ground level open space. Both rules limit congestion, but many observers believe that neither does it sufficiently. New York represents the extreme example of congestion induced by tall buildings, but there is no clear indication that it would be more prosperous if an absolute limitation were used to force horizontal dispersion. One admittedly subjective view is that New York demonstrates the present superiority of vertical transport for relatively short trips. The continued construction of tall buildings in the midtown area seems to be evident that there are still net positive returns to tall buildings". (CTB, 1981, p.318).

"Indeed, for poor families that have migrated from rural areas, life in a high-rise elevator building can prove to be a disaster. Epitomizing this was the pruitt-igoe housing project in St. Louis. By the 20th anniversary of its opening (in 1974), the United States government saw no other alternative but to completely raze all 30 of 11-story structures. Consequently, public housing agencies in American cities have been reconsidering their policies on high-rise housing. Similarly, the British government will no longer support high-rise

public housing A new zoning amendment passed in New York city would serve to discourage high rise apartment buildings", (CTB, 1981, pp.257-258).

3.1.1. AMERICAN CRITICISMS IN ECONOMIC VIEW POINT:

From the economic point of view the tall buildings in American cities have resulted the following experiences for the city authorities:

- "(1) Instead of "subsidizing" the municipal budget, as claimed by real estate interests, downtown high rise districts usually return fewer dollars than they cost in supporting services.
- (2) Instead of providing relief for home-owners through assessments on new high-rise buildings, property tax payments which accrue actually decline as a proportion of the city total.
- (3) Rapid growth in downtown high-rise land values tends to "ripple out" to surrounding neighborhoods, causing assessment increases and leading, in many instances, to the deterioration of a neighborhood's original character.
- (4) Changing patterns of land use which result from high-rise development tend to drive middle income residents to the suburbs and upset the demographic balances of cities.

- (5) Transportation facilities to service skyscrapers cost taxpayers staggering sums of money.
- (6) Law enforcement for protecting the downtown high-rise district costs considerably more per capita than what is required for protecting the rest of the city.
- (7) High-rise buildings cause substantial amount of air and water pollution which cost the cities large sums of money to clean up, "(CTB, 1981, p. 264-265).

However, the proponents of the high-rise buildings counter such criticism by claiming that:

- "(1) High-rise buildings are necessary for new kinds of office employment in finance, information processing, and service trades.
- (2) Limiting the height of tall buildings would redirect business to more congenial sites outside the city.
- (3) High-rise revenues exceed the costs of servicing them.
- (4) Greater downtown density made possible by high-rise buildings encourages greater use of public transit, thereby decreasing the use of automobiles and diminishing traffic congestion and air pollution.
- (5) High-rise development allow more open space both within and proximate to the city which can be enjoyed by all citizens (San Francisco Planning and Urban Renewal Association, 1975), (CTB, 1981, p. 265).

3.2. EXPERIENCE IN HIGH-RISE BUILDINGS IN EUROPE

European experience with tall buildings differs from the American experience to the extent that the public sector has played a greater role through planning.

Public sector control in European cities had been strong in development control through various planning measures, such as limiting city size for certain period, restricting construction of high-rise buildings in certain areas, allowing few high rise buildings then again imposing restrictions on high rise developments, and even limiting maximum height of buildings. In France, for example, during the presidency of President Valery Giscard d'Estaing legislative measures were taken curtailing the ownership right up to a maximum height, above which the land owner would not have any right, just the owner of land does not have any right on the subsoil.

In the context of high-rise construction, the Greater London Council has proposed that urban land be classified in three categories as follows:

- "(1) Areas in which high buildings are appropriate- within or without a visual relationship to famous areas of special character; within or with a visual relationship to other areas of high environmental quality or unified design ; situations in which high buildings would spoil traditional or famous views; major high points and ridges.

(2) Areas which are particularly sensitive to the impact of high buildings--areas of visual significance such as other high points areas of rural character; certain Thames-side areas; areas of architectural or historic interest; other areas of metropolitan importance.

(3) Areas in which a more flexible or positive approach is possible--this pertains to areas not covered by the other categories", (CTB, 1981, p.269).

In addition to the aforementioned esthetic effects functional aspects are also given due importance by the Greater London Council, by restricting high-rise building at locations such as :

"(1) In the vicinity of aerodromes of all types.

(2) Within telecommunications beam channels.

(3) In the vicinity of high chimneys.

(4) On promontories on the lower Thames where they may form navigational hazards.

(5) Where deep foundations might affect existing underground (subway) tunnels and proposed routes for new lines", (CTB, 1981, p.269).

3.2.1. PRACTICAL EXAMPLE (U.K.)

In the 60s -- the years of optimism and confidence in future of U.K. a 'new town' Killingworth near New Castle was developed amidst ambitions and expectations.

At Killingworth a cluster of 27 multistory residential buildings ranging between 6 to 10 storeys to accommodate 71,000 people were constructed. But it had to be demolished mainly because of socio-economic problems and also because of functional problems arising out of basic design problems (Kellest, 1987).

3.3. EXPERIENCE IN HIGH-RISE BUILDINGS IN THE DEVELOPING NATIONS

High-rise development is relatively a new phenomenon among the developing nations of the world. Balanced high-rise development responsive to societal needs requires effective planning, which is, in general, inadequate in developing countries because of organizational and administrative reasons ; as a result high rise buildings-- where they are being constructed, are not well integrated to the total urban context containing existing poor infrastructural and inadequate service facilities. In Singapore and Hong Kong which are economically much more solvent and do not have any scope for horizontal expansion, and where almost all of the territory is publicly owned and hence physical planning could be very effectively exercised, high-rise buildings were developed extensively. Key aspects of tall building development in the developing nations are :

- "(1) High-rise development has not kept pace with the needs of housing and commerce generated by rapid urbanization and rising land values.
- (2) The disordered nature of urban planning and generally inadequate supporting services are significant constraints on high-rise construction.

(3) As compared to the private sector, heavier responsibility is placed on the public sector for the provision of urban development and particularly large scale housing. The private sector generally lacks both the resources and the necessary incentives to play a role in high-rise development comparable to American and European cities", (CTB, 1981, p.272).

3.4. HIGH-RISE BUILDINGS IN CALCUTTA

Calcutta- one of the most populous cities, not only in Asia, but also in the world, with a population growth rate of less than 3 percent annually (Rosser, 1990) has physical constraint to horizontal growth and the urban land market is subject to free economy and speculative forces; already experienced high-rise buildings including few residential apartment buildings, throughout the city, as declared by the world famous architect Charles Correa, is not suitable for construction of any more high-rise building because of soil condition, scarcity of potable water and high intensity of land use. (See "Shananda" a weekly magazine of West Bengal, India; Vol. 9, 30th Nov. 1989, p. 113).

The same issue of the magazine also published interviews of different people of various professions and positions, such as architects, artists, mayor of Calcutta Corporation, ex-chief engineer, public works department, writer, historian and also a house wife. Their views regarding high-rise buildings are summarized below.

SHUBIMAL GHOSE-ARCHITECT:

It is possible to construct multi-storied buildings in Calcutta from soil condition and earth quake point of view, but sewerage, waste disposal and storm drainage system have to be improved.

D.C. PAUL- ARCHITECT:

Not only in Calcutta, but high-rise buildings should not be constructed any where in the world. High-rise buildings create hinderance to the mental and physical growth, personality build up of children and creates a feeling of confinement leading even to committing suicide. Horizontal expansion with rapid transportation system along with development of urban facilities may replace growth of high rise buildings. If money is no problem, buildings as high as one hundred storeys or one hundred and fifty storeys can be built, but it has to be kept in mind that high-rise buildings are cages.

PORITOSH SEN- ARTIST:

Provision of adequate children's play area, fresh air, parking facility, and control of noise pollution must preclude construction of high-rise buildings.

KOMAL BOSE- MAYOR OF CALCUTTA:

Unplanned development of high-rise buildings creates in fact slums. Infrastructural and service facilities should be considered before constructing high rise-buildings. He personally

believes that for residential purposes buildings should not be more than 6 or 8 storeys high and for office purpose they should not be more than 10 or 12 storeys high.

RABIN DUTTA- EX-CHIEF ENGINEER, P.W.D(INDIA)

High-rise buildings concentrates peoples in a small place and hence adequate urban facilities and amenities such as water supply, drainage infrastructures like roads, telephone and sunshine has to be ensured before construction of high rise buildings.

NISHITH RANJAN ROY- HISTORIAN:

High rise buildings destroy the historical character of the city.

NIRMAL MUKHERJEE - MEMBER, MAYOR-IN-COUNCIL(CALCUTTA):

High rise buildings should not be constructed here and there without proper planning, infrastructural and service facilities have to be considered also.

MAYA RANI GANGULEE - HOUSE WIFE:

Residential apartment in a high rise building is a hell. Residents of a mohalla experiences first what a high rise building is and with what they have to live with. Competitive attitude (in the financial sense) among the neighbours is created in a high-rise building.

3.5. HIGH-RISE RESIDENTIAL BUILDINGS IN DHAKA CITY.

Though high-rise (six storied or higher) constructions are recent addition in Dhaka City yet a very recent phenomenon is the development of high-rise residential buildings in and around it. Acceptability of these buildings as dwelling units was much less ten years back than today. Entrepreneurship of the developers along with difficulty of constructing dwelling on a purchased land due to high land price and high cost of construction are mainly responsible for that.

In the public sector the construction of high-rise residential buildings are very few. In early eighties the Public Works Department framed a scheme for constructing multi-storied housing for the government servants. This project included construction of 15- storied buildings with lifts at Dhaka and Chittagong. But due to resource constraint and in consideration of disadvantages of high-rise housing the 15-storied buildings at Dhaka and Chittagong were not taken up. In the public sector one 11-storied block has been constructed inside the Naval Headquarters at Banani to accommodate the Naval officers. The 6- storied gazetted officers hostel with lifts at Mymensingh road is now being used as family apartments (Alam, 1986).

In Dhaka City there are high demand for residential accommodation in certain areas having good accessibility and proximity to central areas or other activity areas or having good social environment. Encouraged by this trend the private property developers in Dhaka City are making investment in high-rise

residential buildings. As a result Dhaka City witnessed springing up of high-rise residential buildings in high demand areas from late eighties and the trend still continues (Choudhury, 1991).

Private developers or Real estate companies buy plots of land at potential locations, construct apartments or buildings with lower floors for commercial purposes (office etc.) and upper floors for residential apartments and then sell the whole to buyers. It is quite obvious that like all other private enterprises profit maximization is the prime objective of these developers/real estate companies, whatever colour they use to hide this reality.

At present there are about 40 Developers/real estate companies doing business in Dhaka City. A few companies are engaged in other cities of Bangladesh. The number of housing units in Dhaka supplied by them including those under construction is about 5000 (Seraj, 1989). The price of each flat, no matter how small it is, is affordable only by the very affluent class of the society. Location of apartment projects in Dhaka City are shown in fig. 3.1-3.2.

High-rise residential buildings are being introduced in the city in the background of high land price and scarcity of buildable land in Dhaka City.

The activities of some of the leading developers/real estate companies are described below.

a) PROPERTY DEVELOPERS:

One of the most prominent developers of the city has already completed six housing projects and with eleven on going projects at hand, the total dwelling units (flats) including those under construction supplied by them is more than 300. They have completed two high-rise residential apartments (Property Enclave, 8 storied) at Bangla Motor area. But they are not any more interested in high-rise residential apartment construction because of enhancement of price of flat due to costs involved in installation of lifts, stand by generators etc. rendering price per flat out of affordability of general flat buyers.

The firm is aware of various environmental, amenity and socio-cultural requirements including adequate children's play area, parking facility, community activity; tries to provide as much of these as possible under RAJUK'S rules and regulations and practical conditions, but faces acute shortage of potable water supplied by WASA. Concerned about the admixture of high and low rise buildings within the city it believes that there should have been well defined zones for high-rise buildings with adequate infrastructural and service facilities, elimination of ambiguity from RAJUK'S rules and regulations and introduction of a simpler system in approving building plans according to RAJUK'S rules and regulations.

The firm would participate in housing construction under government supervision, building specification and construction code if willingness of appropriate authorities is ensured to the firm. They also feel the need for national building codes covering construction specification, safety regulations including fire fighting, environmental and amenity requirements for planned housing environment and would welcome establishment of housing finance corporation and restructuring of house building finance corporation, low interest rate on loans for house construction. It feels that tagging of house rent or some part of salary of service holders in urban areas in housing construction would be a mile stone in solving housing problem in the country in general and big urban areas in particular.,

b) EASTERN HOUSING LTD:

This is a well organised, financially most solvent, operationally efficient firm established in 1964. It has undertaken sixteen projects including on going and completed ones. Number of flats in the housing complexes is about 1500. Housing projects include both high-rise and low-rise buildings. Responding to the demand it locates high-rise apartment complexes in the heart of the city.

-
1. Personal interview with Col. (rtd). Mahtabuddin managing director, Property developer, and Mr. F.R. Khan and Mr. Mustafizur Rahman of the same firm on 15/3/90.

The firm is aware of environmental, amenity and socio-culture requirements of apartment dwellers and tries to provide as much as possible under existing rules and regulations of RAJUK and practical financial limitations. It is concerned with the admixture of high and low rise buildings in Dhaka city and feels the necessity for appropriate physical planning measures in the form of zoning and provision of adequate infrastructural and service facilities for planned development of the city, creating a decent housing environment and efficient integration of high-rise buildings, especially residential buildings in the city system. Nonexistence of national building codes covering environmental aspects, amenity, socio-cultural aspects, safety including fire fighting requirements and construction specification, is also felt by the firm.

Apprehending inadequacy of potable water supplied by WASA, the firm explores the level of supplied water at a site before starting the projects and arranges adequate water supply, if required, in collaboration with WASA. The sewer facility is dealt with similarly. The firm does not face problem in RAJUK.

Regarding suggestions towards housing policy and housing development, personal interview of the Chairman of the firm Mr. Zahurul Islam in the Daily Ittefaque on August 27th 1989 may be recalled. In that interview he welcomed government decision of

2. Personal interview with Mr. Bakı, Manager Construction & Architect, Mr. Musa of Eastern housing Ltd, on 17/3/90.

expressed by them.
More or less same view as that of property developers were

(c) AZIZ CO-OPERATIVE HOUSING AND CITY DEVELOPERS

believes.
restricted from house construction on purchased land, he
house construction were suggested. Affluent people should not be
in legal paper formalities and reduced bank interest rate for
income group of people and both reduction of expenditure involved
pragmatic step towards solving housing problem of low and fixed
of Housing Bank in the private sector and called these hold
recognizing real estate business as an industry and establishment

REVIEW OF VARIOUS ASPECTS OF HIGH-RISE BUILDINGS.

Before introducing high-rise buildings in an existing urban area, with infrastructures and service facilities already laid various aspects of high-rise buildings have to be considered for better integration of these in the existing urban system. In this chapter various aspects of high-rise buildings are reviewed.

4.1. HIGH-RISE BUILDINGS AND URBAN LAND USE.

High-rise buildings are introduced in an urban area to bring about concentration of people or activity to form "node" or "growth centre" when such a concentration is required. It is also used when accumulation of people is not possible by horizontal expansion due to physical constraints.

In the first case adequate open space has to be provided to offset loss of private out door space. To ensure adequacy of open public spaces around high-rise buildings, the latter has to be introduced as a part of comprehensive plan, as has been done in Madrid, Rome, Manhattan, Singapore and Hong Kong.

Physical constraints to horizontal expansion is the cause of introducing high-rise buildings in those cities. Changed life-style of lesser out door space to greater indoor amenities is the result of vertical expansion. Strong economic condition, of course, favoured the trade-off.

Economics of land is a very complicated subject containing various socio-economic, climatic and physical parameters as variables. In general land value in an urban area depends largely

4.2. HIGH-RISE BUILDINGS, ECONOMICS OF LAND AND MUNICIPAL COST.

(Gokhale, 1974, quoted in Council on Tall Buildings

CTB, 1981, p.19).
 required is marginal above four to eight stories; standards for light, open space, and other amenities are maintained, the actual saving in overall land "Studies in India indicate that, assuming uniform

Building, 1981, p.22).

such as New York City or Chicago, "Council on Tall urban land, except in unusually large urban centres construction, would not tend to yield major savings in commercial densities alone, through high rise equivalent standards of open space. Increased low-rise (three-five storey) apartments. Given great saving in total urban land over that provided by above) it does not seem that there would be a very developed as high-rise buildings (six stories and "if a city's entire 15% of residential land were

buildings. In this connection it has been stated, urban land is not possible by introducing high-rise residential purposes, (London County Council, 1961), and hence much saving in In a city about 15 per cent of land is used for residential

on the proximity and accessibility from the important land use or the central business area.

Once the demand for additional space is met by allowing high-rise buildings to grow, land price of the adjacent area increases, which in turn necessitates high-rise buildings (Contini, 1973, Pellegrini, 1974, quoted in CTB, 1981, p. 25).

In societies that view land as a marketable commodity - the expected growth rate of urban area, zoning practices, tax policies, location and timing of public investment in urban infrastructure - all contribute to establish the market value of a particular parcel of land. Conversely, in societies that view land as a community asset, to be utilized with reason for the highest common good, theoretically there is no land value.

Private urban land speculation may make governments equate tall buildings with high density. In this connection it is stated,

"In some developing countries, such as Iran, where land has traditionally been the individual's safest investment, the pressures of private urban land speculation may lead governments to conclude that only tall buildings will cut the price of land to a reasonable sum per inhabitant. This conclusion is based on equating tall buildings with higher density", (Khalili, 1974, quoted CTB, 1981, p. 25).

The spiralling land prices that accompany tall buildings may drive away the low-income groups and add to the slum condition they are facing. In this connection it has been stated,

"In other developing countries such as India, where the urban poor are a particular difficult problem, the spiralling land prices that accompany tall buildings development are feared because they could make it impossible for the low income groups to find land for their housing. This will add to the acute slum conditions already prevailing in the cities". (Gokhal, 1975, quoted in CTB, 1981, p. 25).

Without long term strategic plans for a city, scattered growth of high-rise buildings may cause increased municipal cost in providing increased demand for various utility services.

4.3. HIGH-RISE BUILDINGS AND SOCIO-CULTURAL FACTORS.

Local culture has to be considered when introducing high-rise buildings; mere imitation of tall building construction in western developed countries may create serious consequence. Same view has been stated as,

"This cross cultural imitation of the high-rise building today is sometimes criticized as replacing "style" with "fashion" (Cowan, 1974). More importantly, superficial adoption and imitation of the Western developed tall building by some Third World and newly industrializing countries is a matter of serious

concern. It can be interpreted as the superimposition of a non-applicable form on a culture and an economy which may hope thereby to imitate the status (progress, technological development, modernity) of the tall building cultures through adoption of the built symbol. "(CTB, 1981, p. 6).

4.4. SYMBOLISM AND PRESTIGE

Symbolism and prestige had always been associated with high-rise buildings and played a vital role in the growth of these buildings. These buildings are the manifestation of power, prosperity and wealth. This has been expressed as,

"Height has traditionally symbolized power and prestige; tall buildings today bespeak of national technological progress as well as private economic status.

Some countries, projecting the image of a rapidly industrializing progressive nation, adopt the tall building as a symbol of growth and modernity, to be seen as such by both their own citizens and the outside world," (Khalili, 1974, quoted in CTB, 1981, p. 36).

"It is perhaps no coincidence that most legislative buildings or seats of government have a tall tower or dome which tends to convey the same impression," (CTB, 1981, p. 36).

"Today, high-rise buildings provide the image of progress, affluence, sophistication, and modernisation. This is particularly the case in the minds of our urban elite, be they politicians, bureaucrats or businessmen. News paper have also contributed and strengthened this image, "(Lim, 1974, quoted in CTB, 1981, p. 37).

4.5. HIGH-RISE BUILDINGS AND ENERGY CONSUMPTION.

High-rise buildings consume more energy in operation and maintenance including creation of artificial internal environment than low-rise buildings. In this regard it has been stated,

"So long as it was economical in developed nations to create an artificial internal environment with electrical and mechanical aids, it was economical to have tall buildings. When the oil for heating and the power for water pumps, cooling, lighting, and vertical transportation become expensive, tall buildings are no longer so profitable to operate as those smaller structures which can take advantage of natural light and ventilation. These issues are particularly pronounced with regard to tall commercial structures, which are more likely to have large enclosed internal spaces", (CTB, 1981, p. 44).

4.6. HIGH-RISE BUILDINGS AND SAFETY. » →

Safety, especially against fire and other accidents has to be given due importance in design, construction, operation and maintenance of high-rise buildings.

In connection to safety it has been stated,

"Local building codes must be stringent enough to demand construction that will forestall and contain fire, one of the most tragic disasters to which tall buildings are prone. Local fire-fighting equipment and departments must be available and competent to combat any blazes, should they occur. Improved fire fighting technology become increasingly important", (CTB, 1981, p. 47).

4.7. HIGH-RISE BUILDINGS VS. VANDALISM.

Vandalism is more pronounced in high-rise buildings. In this regard this has been stated,

"High-rise housing estates suffer disproportionately from vandalism, usually caused by children. The main targets are public or communal areas such as entrance lobbies, elevators, stairways, landscaped areas, lights and windows", (CTB, 1981, p. 48).

4.8. SHARING PROBLEMS OF MULTIOWNERSHIP FLATS.

There are sharing problems of multiownership flats in legal, social, economic, design and social aspects, (Enam, 1984).

4.9. INTERACTION BETWEEN HIGH-RISE BUILDING AND CLIMATE.

High-rise buildings create "Canyon" effect on both sides of narrow streets; by which air movements and diffusion of pollutants is retarded. Also, shadows casted by them is detrimental to adjacent buildings. In this regard it has been stated,

"The "Canyon" effect of tall buildings on both sides of narrow streets can retard air movement and the diffusion of pollutants; the juxtaposition of buildings coupled with prevailing winds and other climatic factors can transform once quiet localities into areas of severe wind turbulence; and the shadows cast by the buildings can be detrimental to neighboring buildings and open areas".

"Unfortunately, the pleasant plazas often provided around the base of tall city buildings are rarely occupied when shaded. Many city authorities are aware of this problem and require shadow analysis of buildings proposed around such areas. Many streets have suffered in the same way. Because city development is a gradual process; the exclusion of sunlight from streets often goes unnoticed until it is too late to take action", (CTB, 1981, p.428).

4.10. EFFECT OF HIGH-RISE BUILDINGS ON AIR TEMPERATURE

High-rise buildings have effects on air temperature in the city streets. It has been stated,

"A lot of heat energy is potentially a lot of pollution. Every use of energy transfer produces waste, frequently heat, which when concentrated at one location creates a high thermal stress in the otherwise natural environment.

It is said that the World Trade Center in New York uses as much electricity as a residential area for 350,000 people. All these energy especially for lighting and airconditioning is discharged to the atmosphere as waste, through cooling towers, enhancing environmental pollution.

By early afternoon the movement of warm air masses within the city is marked by the heating effects of large buildings. During this period lower points in the city still have lower temperatures but medium elevated locations tend to be warmer than those at high elevation, principally because high elevations tends to be better ventilated.

This ventilation effect was one of the major influences of wind velocity on air temperature through the city. The effect was amplified by the fact that many of the high ridges in the central business district are dominated by many of the city's tallest buildings, which tend to encourage a downward flow of air to pedestrian levels", (CTB, 1981, p. 437).

4.11. EFFECT ON HUMIDITY

Air discharged from air conditioning of high-rise buildings have effect on humidity levels in the surroundings. In this connection it has been stated,

"Humidity levels are affected in a similar way. While occupants of air-conditioned buildings enjoy controlled humidity in the uncomfortable summer months, pedestrians in public spaces suffer increased humidity as moisture is expelled by air conditioning systems. City authorities could control these effects by careful scrutiny of air conditioning plant size and location of air exhaust vents". (CTB, 1981, p. 439).

4.12. TRAFFIC HAZARDS DUE TO REFLECTION OF LIGHT FROM HIGH-RISE BUILDINGS

Reflection of sun light from glazed surfaces of high-rise buildings may cause traffic hazards. It has been stated,

"A new and quite serious problem has evolved from the combination of tall buildings and traffic. To overcome traffic problems most large cities have built large often elevated, roadways. Unlike the normal canyon like city roads, these multilane expressways allow sun penetration at low elevations. The intrusion of low elevation sunlight among tall buildings with highly reflective facades can create severe traffic hazards. Drivers can be temporarily be blinded by intense reflected sunlight at low elevation. The main problem occurs unfortunately in early morning and late

afternoon, and coincides with the peak traffic periods", (CTB, 1981, p.444).

4.13. TELEVISION INTERFERENCE FROM HIGH-RISE BUILDINGS.

High-rise buildings have interference in television communications. In this connection it has been stated,

"Television broadcasting is carried out in the VHF and UHF bands of the electromagnetic spectrum, which implies that reception quality depends upon the detection of a line of sight signal from the transmitter.

The imposition of large objects between the transmitter and receiver can produce a shadow of the object over the receiving position. The degree of shading is indicated by picture quality. Since shading weakens the signal at the receiver, the signal to noise ratio of the receiver be reduced to a level where noise is evident as "snow" degrading the picture quality. If the shading is severe, then the picture quality may be so degraded as to make viewing unacceptable", (Cohen, 1972. quoted in CTB, 1981, p. 459).

4.14. ENVIRONMENT AND POPULATION DENSITY.

For the well being of man, through the nourishment of mental and spritual faculties, a livable environment is a must, which in turn is dependent on the availability of amenities and urban

services of a locality. The amenities and services are estimated and provided on the basis of population and its density. Keeble (1969) states,

" The first, long pursued, is to control density on the assumption that human comfort and welfare in a residential area are in roughly inverse proportion to the density of the area; that, in terms of freedom from noise, privacy and absence of congestion on roads and footways, low density is good and high density is bad. There are two separate aspects of this objective; freedom from congestion around the home and freedom from congestion within the home.

The second objective is to control, within the not very close limits that are practicable, the total number of people living within a given area so that the provision of places of employment, schools, shops, open spaces, etc. may be of appropriate amount", (CTB, 1981, p. 143).

A gross estimation of intensity of space utilization and the quality of residential environment may be made from the number of house holds per acre and the average size of house holds.

CHAPTER 5

EFFECTS OF HIGH-RISE RESIDENTIAL BUILDINGS IN DHAKA CITY.

5.0. INTRODUCTION:

The environment of a community, city or a country depends to a large extent on the functional efficiency, organisational/institutional adequacy of urban planning and development, service agencies, and above all the awareness of the people.

In Dhaka City urban services are provided by Dhaka City Corporation (D.C.C.), Water and Sewerage Authority (WASA), Directorate of Public Health Engineering (DPHE), Dhaka Electric Supply, Titas Gas Transmission and Distribution Company, Directorate of Fire Service and Dhaka Metropolitan Police. The environment was evaluated both inside and outside high rise buildings on different locations (Fig. 5.1) and of different storey heights (Fig. 5.2-5.11) and also the views of personnel working in different organisation about the effects of high-rise residential buildings in Dhaka City was discussed.

5.1. ENVIRONMENT - INSIDE AND OUTSIDE OF HIGH-RISE RESIDENTIAL BUILDINGS.

The term environment has been used from livability point of view in a broader perspective, covering physical environment, consisting of sun shine, ventilation, wind, privacy, amenity, socio-psychological, and other aspects.

Problems in different aspects are taken to be the indicators of prevailing environment and an arbitrary scale has been constructed to measure the level and extent of the problems in terms of Reduced Net Index Value (RNIV) which in turn is correlated with floor area ratio of the buildings under study.

Residents and neighbours of the high-rise buildings at Hatkhola (Hotel Elysium), Purana Paltan (Aziz Co-operative Housing), and Bangla Motor (Property Enclave) were interviewed. Buildings are of 11, 9 and 8 storeys respectively (Fig. 5.1).

Table 5.1. Shows reduced Net index value of problems of selected high-rise buildings in Dhaka. The table reveals that environment associated with Hotel Elysium is the worst among the three buildings studied, with reduced net index value of

Table 5.1 : REDUCED NET INDEX VALUE OF PROBLEMS OF SELECTED HIGH-RISE BUILDINGS IN DHAKA.

Problems selected to	Reduced Net Index value of problems		
	Hotel Elysium at Hatkhola (Y 1)	Aziz Co-operative housing at Purana Paltan (Y 2)	Property Enclave at Bangla Motor (Y 3)
Neighbours	21.594	11.79	17.50
Residents	26.60	17.55	8.24
Total	48.194	29.34	25.74

Source: Field Survey, 1989.

Table 5.2 : FLOOR AREA RATIO OF SELECTED HIGH-RISE BUILDINGS OF DHAKA.

Building	Hotel Elysium at Hatkhula (X 1)	Aziz Co-operative Housing at Purana Paltan (X 2)	Property Enclave at Bangla Motor (X 3)
Floor area ratio (F.A.R)	6.41	4.94	5.42

Source: Field Survey, 1989.

problems 48.19. Next is the environment associated with Aziz Co-operative housing at Purana Paltan with net index value of problems of 29.34. Property enclave has the lowest value (25.75). indicating the best prevailing environment among these buildings.

To make the significance of the reduced net index value of problems clear and to make comparison of environment among buildings possible, a pen picture of the buildings is drawn.

HOTEL ELYSIUM: This is a ten storeyed building (Fig. 5.2-5.5). originally designed and constructed as a high class residential hotel in the last part of Pakistan period. It stands on the west of the Hatkhola road - one of the most busy and important throughfares of the city, at Tikatoli, the entry point of the city from southern and eastern parts of the country.

Entering into the compound from Hatkhola road, a grand stair leads from road level to ground floor at about 4 feet height from



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road level. The ground floor was designed for hotel reception and other entrance formalities, but is not finished properly till now. From ground floor two narrow stairs lead to 1st floor lobby. Two lifts facing each other on two sides of the lobby, facilitates vertical movement. One of the two lifts remains out of order almost throughout the year. The remaining one is also faulty and renders very poor service. Examples of accidents occurring in the lift, serves as sensational news items in the daily news papers and weekly journals. From 1st floor lobby, one narrow stair goes down to the ground level, initially kept for parking vehicles and service and maintenance activities, but a kindergarten has been arranged at this level reducing parking facility and children play area.

In the afternoon children play in ground floor, parking space and narrow corridors of the first floor and in the stairs. Relatively older children are found sitting on the entrance stair and compound wall looking at the crowd.

From the first floor a stair along with the lifts facilitates vertical movement. Dwelling units are situated on either side of the narrow corridor, very poorly illuminated by both natural and artificial lighting. About 85 families reside in eight dwelling floors. Almost all the flats are composed of two bed rooms and kitchen etc. covering 450 to 600 sft. which are very much inadequate than the required floor space. Flats are poorly

ventilated and illuminated. The total site area covers 10518 sft. and the building has a floor area ratio of 6.41.

Table 5.3: PROBLEMS FACED BY THE RESIDENTS.

Problems	Hotel Elysium		Aziz Co-operative Housing		Property Enclave			
	% response	NIV	Problem	% response	NIV	Problem	% response	NIV
1. Inadequate or faulty lift.	100	10000.00	Non availability of lift facility.	100	11600.00	Inconvenience with door and window during storm.	75.00	1650.00
2. Congested room	98.71	4189.06	Inadequate children's play area.	68.00	1704.00	Unavailable space for drying clothes	67.85	1528.40
3. Excessive noise in common space.	94.87	4174.88	Unsocial activity	48.00	760	Excessive noise	65.40	1115.00
4. Unavailable room arrangement	100.00	2400.00	Non-availability of community religious activity facilities	72.00	316.00	Unpleasant view.	64.28	877.57
5. Inadequate open space including children play area.	82.05	1148.70	Unsatisfactory solid waste disposal arrangement	60.00	480.00	Inadequate children's play area	60.71	728.08
6. Unavailable space for drying cloth	84.61	1015.32	Inconvenience with door and window during storm.	78.00	436.00	Inadequate open space including children play area.	58.57	785.70

Source: Field survey, 1987.

Table 5.4: PROBLEMS FACED BY THE NEIGHBOURS

Problems	Hotel Elysium		Aziz Co-operative Housing		Property Enclave			
	% response	NIV	Problem	% response	NIV	Problem	% response	NIV
1. Litter and thrown garbage.	85.28	9710.58	Litter and thrown garbage.	80	4480.00	Litter and thrown garbage.	90.46	7758.40
2. Garbage clearance	70.30	3940.00	Disruption of air flow	65	2080.00	Prevention of sunlight and shadow.	88.71	4456.71
3. Prevention of sunlight and shadow.	62.96	3325.00	a)Prevention of sunlight and shadow. b)Hesper of privacy.	60	1800.00	Hesper of privacy.	85.71	4114.08
4. Hesper of privacy	59.85	2480.50	Garbage clearance	70	700.00	Creation of air turbulence	57.14	685.58
5. Social problems	51.85	933.30	Creation of air turbulence	30	360.00	Disruption of air flow	61.90	619.00
6. Disruption of air flow	37.03	370.30	Creation of traffic congestion on the street	80	320.00	Garbage clearance	76.19	304.76

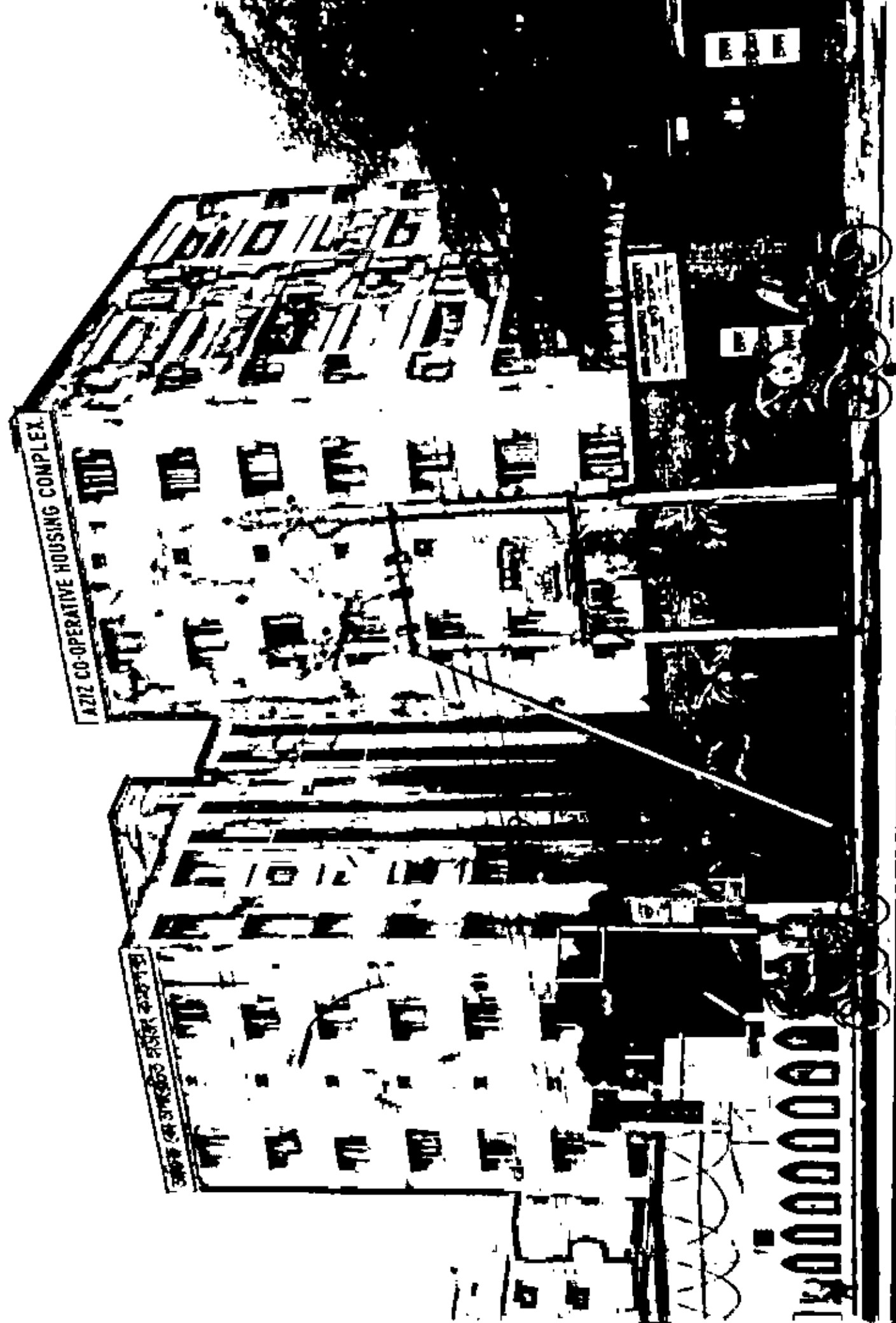
Source: Field survey, 1987.

From table 5.3, we see that cent percent respondent of Hotel Elysium (total No. of respondent is 39) identified amenity problem like inadequate or faulty lift as the most severe problem as indicated by the largest Net Index Value (NIV) of problem

10000.00. It's 48.71 percent respondents identified congested room as a problem and is the second according to the severity of problem indicated by NIV of 4189.06. Next is the excessive noise indicated by NIV of 4178.28 and is identified by 94.87 percent of resident respondents of Hotel Elysium. Other problems faced by them are unsuitable room arrangement, inadequate open space including children's play area and unavailability of space for drying clothes.

According to 85.18 percent of neighbour respondents (total No. of respondents is 30) of Hotel Elysium thrown litter and garbage is the most severe problem as indicated by NIV of 9710.52. Next severe problem indicated by NIV of 3940.00 is the garbage clearance problem which is identified by 70.30 percent neighbour respondents. According to them the third severe problem indicated by NIV of 3525.00 is prevention of sun light and shadow which is also identified by 62.96 percent of respondents. Other problems faced by the neighbours due to Hotel Elysium are hamper of privacy and disruption of air flow. (See table 5.4).

AZIZ CO-OPERATIVE HOUSING (Fig. 5.6-5.8): This is one of the oldest high-rise housing complexes of Dhaka. It stands near the intersection of north-south road and inner circular road. One lane of about 20 feet wide starting from inner circular road provides the access to the complex-comprising of twin buildings, separated from each other by a 45 feet wide open space between



AZIZ CO-OPERATIVE HOUSING COMPLEX.

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them, each building contains eight dwelling floors. Ground floor has been kept for parking and adds to the play area of the children. However space below building no. 1 is being used for maintenance and security staff's residential purposes. No lift has been installed in either of the buildings. The site area of the complex is about 11591 sft, and floor area ratio is 4.94. (See table 5.2).

Non availability of lift, Inadequate children's play area and unsocial activity in the common space are the main problems indicated by NIVs of 11600.00, 1904.00, and 960 identified by 100,68 and 48 percent of resident respondents of Aziz Co-operative housing. Other notable problems are non availability of community religious facility, unsatisfactory solid waste disposal arrangement. (See table 5.3).

Thrown litter and garbage, disruption of air flow, prevention of sunlight and shadow along with lack of privacy are the problem according to the severity indicated by NIV of 4480.00, 2080.00 and 1800.00 respectively and is identified by 80.65, and 60 percent of neighbour respondents of Aziz co-operative housing. (See table 5.4).

PROPERTY ENCLAVE (Fig. 5.9-5.11): This is a high-rise housing complex located near Bangla Motor. The main entrance to the complex is from New Eskaton road by a lane of about 10 feet



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width. The complex consists of two buildings each of 7 dwelling floors. The ground floor is kept for parking which also functions as children play area. Two stairs and two lifts near the stairs facilitates vertical movement.

The site area is 18475 sqft. and the floor area ratio of the complex is 5.42 (See Table 5.2).

As indicated by NIV of 1650.00, 1628.40, and 1114.08 the inconvenience with door and window during storms, unavailability of space for drying cloth and excessive noise are the main problems identified by 75.67.85 and 46.40 percent resident respondents respectively of Property Enclave. The other problems faced by its residents are unpleasant view, inadequate children play area. (See table 5.3).

Thrown litters and garbages, prevention of sunlight and shadow, lack of privacy are the problems indicated by NIV of 7238.40, 4456.92 and 4114.08 respectively, - identified by 90.48, 85.71 and 85.71 percent neighbour respondents of Property Enclave. The other problems faced by them are creation of air turbulence, disruption of air and garbage clearance problem. (See table 5.4).

SOCIO-ECONOMIC FINDINGS: Primary occupation of the residents of hotel Elysium (No of respondents 39) is service with monthly income up to Tk. 8,000, with 43.58 percent of respondents having monthly income upto Tk. 5,000.

Comparatively rich people among the three buildings studied live in Aziz Co-operative housing at Purana Paltan (no. of respondents 25) with 64 percent of respondents having monthly income above Tk. 10,000 and are mainly businessman and professional. The primary occupation of the residents (no. of respondent 28) of Property Enclave at Bangla Motor are business and professional activity (for 57.13 percent of respondents). 39.28 percent of respondents are primarily service-holders (Table A 5 and Table A 6 of Appendix A).

Table 5.5 : SCOPE AND SELECTING CRITERIA OF SPECIFIC FLAT OF HIGH-RISE BUILDING.

	Type	Building and location of Building					
		Hotel Elyelue at Hathkhola		Aziz Co-operative housing Purana Paltan.		Property Enclave at Bangla Motor.	
		Total No. of Respondents	% of total	Total No. of respondent	% of total	Total No. of respondent	% of total
Scope of Personal Selection	No.	27	69.2	14	64.0	19	50
Selecting Criteria							
	Earlier vertical movement	0	0	1	2.8	6	42.9
	Adequate sun shine	2	7.4	5	31.3	14	100
	Adequate wind	4	22.2	0	31.3	0	0
	Adequate Privacy	19	70.4	10	62.5	5	35.7

Source: Field Survey, 1989.

From table 5.3 It is revealed that excepting respondents of Property Enclave where 50 percent of respondents got the scope for personal selection of specific flat, majority of respondents of other two buildings got the chance to personally select their

flat. Among the selecting criteria, adequate privacy is most important and then comes adequate wind, adequate sun shine and ease of vertical movement.

Table 5.6 : ADVANTAGES AND DISADVANTAGES OF PRESENT AND EARLIER DWELLINGS

	Residents of the Building						
	Hotel Elysium at Methkhole		Amit Co-operative Housing Puram, Patlan,		Property Enclave at Banglamotor.		
	Total No. of Respondent-37	Total No. of respondent-25	Total No. of respondent-25	Total No. of respondent-25	Total No. of respondent-25	Total No. of respondent-25	
	No. of respondent	% of total	No. of respondent	% of total	No. of respondent	% of total	
Disadvantage of Earlier Dwelling	Too small in size	0	0.0	8	32.0	13	45.4
	Too distant from Place of work	14	41.0	12	48.0	7	28.0
	Too distant from school of Children	2	5.1	2	8.0	2	7.1
	Poor environment	3	7.7	12	48.0	12	48.0
	High rent	20	71.8	4	16.0	1	3.5
	Other	8	20.5	3	12.0	5	17.7
Advantage of present dwelling	Close to place of work	20	71.8	17	68.0	23	92.1
	Good transport facility	5	12.8	5	20.0	2	7.1
	Proximity to market shopping center	1	2.6	2	8.0	2	7.1
	Proximity to Children's School/College	2	5.1	10	76.0	13	45.4
	Good neighbour hood	4	10.4	2	8.0	2	7.1
	Others	3	7.7	1	4.0	2	7.1

Source : Field Survey, 1989.

From Table 5.4 it is revealed that comparatively low income (as low as 5,000 taka per month) of the resident respondents of Hotel Elysium has compelled them to consider house rent as the main disadvantage of earlier dwelling; quality of housing measured in terms of size of the dwelling is of less importance to them and the primary deciding factor for accepting poor housing environment is indicated by reduced net index value of problems of 48.19. For high income people of Property Enclave and

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Aziz Co-operative Housing, quality of housing measured in terms of size of the dwelling was the disadvantage of earlier dwelling. Financial solvency is the cause of treating poor environment of the earlier dwelling as disadvantage, by the respondents of Property Enclave and Aziz Co-operative Housing. Distance from place of work is the disadvantage of the respondents of Hotel Elysium and Aziz Co-operative Housing (according to 41.0 percent and 48.0 percent respondents). But only 25 percent respondents of Property Enclave treat distance of work place as the disadvantage of their earlier dwelling, this may be attributed to the high car ownership of the residents of Property Enclave.

Proximity to place of work has been treated as the advantage of present dwelling by the vast majority of respondents of all three buildings, which is very much natural and there is nothing special in it. High income and higher perception level of respondents of Aziz co-operative Housing and Property Enclave are the guiding factors to treat proximity to childrens' schools/ colleges as the advantage of present dwelling, and selecting present dwelling locations.

In order to patronize the healthy growth of high-rise residential buildings for high income people in particular, good environment along with proximity to work place and children's educational facilities has to be ensured.

Problems of neighbours due to the high rise buildings varies with floor area ratios as revealed from table 5.1 and 5.2. Floor area ratio of Hotel Elysium, Aziz Co-operative Housing and Property Enclave are respectively 6.41, 4.94, 5.42. Problems of the neighbours as indicated by Reduced Net Index Value of problems were 21.59, 11.79 and 17.5 respectively indicating the positive correlation.

5.2. CLIMATE AND HIGH-RISE BUILDINGS IN DHAKA.

High-rise buildings interfere in the local climate in the microlevel by creating interferences in changing wind direction, wind speed and turbulances, casting shadows on the surrounding. Tables AB, A9 and A10 in the Appendix A furnishes Normal meteorological data such as temperature, humidity, rainfall, wind direction and speed for Dhaka. It is revealed from those tables and diagrams that tall building will affect harmfully, structures on its north between November to February, during which low temperature prevails and negative declination of sun causes longer shadows on the north of each structure.

Between March and October, high temperature, high humidity and wind from southwest, south and south east prevails and high rise building affect harmfully buildings on its north. Declination of sun being positive, shorter shadows of buildings will occur during this period.

High-rise buildings will change the intensity of cyclones, which occur in October - November and Norwesterlies in March - May. (See table A8 in appendix A).

Shadows of a 18 storied buildings in Dhaka at different times of day and year are drawn with the help of Table A9 and A10 in Appendix A, showing declination of sun and azimuth and altitude of sun in Dhaka; and shown in the following Figures (Fig. 5.12-5.14).

5.3. POPULATION DENSITY AND HIGH-RISE BUILDINGS IN DHAKA.

Land is the most precious thing, especially in a fast growing city like Dhaka in a condition of existing imbalance in the supply and demand, originating due to physical, economic and social causes. Hence, it is utmost important to optimize the use of land, particularly in urban areas maintaining certain standard of environmental quality.

In Bangladesh, to ensure adequate sunlight, wind, and privacy spacing between building constructed in the public sector is kept at 1.5 time building height. The relationship between building height h , frontage c , and depth b with total plot area, plot and covered area per storey, covered area as percent of plot area and number of storeys (dwellings) per acre for various number of storeys n are calculated following Walter Segal, (1964) and shown in Table A11 in Appendix A.

The relationship between plot area A and frontage c, depth b, height h, number of storeys n of the building is expressed as

$$A = cb + 1.5 hcXn,$$

in which building to building spacing is 1.5 times the building height.

Regarding height of the buildings the common practice of RAJUK for plots of 5 Katha or more area is

$$h = x + y + 10 \text{ (Fig. 5.15A) } - - - - - (i)$$

Where h = height of the building in ft.

x = width of the adjacent road/lane in ft.

y = distance between property line and the building in ft.

now from the Fig. 5.15 A

$$d = y + z + 10$$

$$\text{or } y = d - z - 10 - - - - - (ii)$$

Putting the value of y from equation (ii) in equation (i) we get

$$h = x + d - z - 10 + 10$$

$$\text{or } h = x + d - z - - - - - (iii)$$

For a building of 40'x30' covered area in a plot of 5 katha or more, the required minimum length of the plot d is

$$d = h - x + z \text{ (from eq. iii)}$$

and width of the plot is 40'+5'+5' = 50' (Fig. 5.15 B)

now with increasing height of building (increasing no. of storeys) the total plot area number of storeys per acre (no. of households per acre), are calculated with different width of road x and shown in table A 12 in appendix A.

The table reveals that for a four storeyed building beside a road of 20' width with height 40 ft. 2500 sft. plot area is required to attain a density of 69.69 h/h per acre, and plot areas of 3000 sft. and 3500 sft. is required to attain densities of 72.60 and 74.67 h/h per acre by building of 5 and 6 storeys respectively. Increasing number of storeys from 4 to 5, percentage increase in household per acre is 4.16 and it is 2.85 for an increase of number of storeys from 5 to 6. It is note-worthy that percentage increase in households per acre slows down with increase of number of storeys.

Plot areas of 1500 sft., 2000 sft. and 2500 sft. is required to attain a density of 116.16 h/h per acre, 108.90 h/h per acre and 104.54 h/h per acre with number of storeys of 4, 5 and 6 of the same building coverage showing a decrease of density with increase of no. of storeys if the width x of the adjacent road is 40'.

If the width of the adjacent road x is 30', plot areas of 2000 sft., 2500 sft. and 3000 sft. are required for 4, 5 and 6 storeyed building. Interesting to note that density expressed in terms of h/h per acre remains the same i.e. 87.12 h/h per acre.

The general observation from this table is that where width of the road x is less than depth of the building z , density increases with increase of number of storeys of the building but the rate of increase in density slows with the increase of number of storeys.

Where the width of the road x is greater than depth z of the building, density gradually decreases with the increase of number of storeys.

Where the width of the road x is equal to the depth of the building density does not change with increase of number of storeys.

Thus it can be inferred that, with the increase of number of storeys of buildings, the density may initially increase in some cases, while in other cases it does not rise. Even in the cases where density increases, the rate of increase is very low after a

certain level. This implies, high-rise buildings that conform to prevailing regulations do not necessarily entail a high density settlement.

5.4. VIEWS OF URBAN SERVICE AGENCIES REGARDING HIGH-RISE CONSTRUCTIONS.

Habitability of an urban area depends mainly on the successful operation of the agencies providing urban services. In Dhaka these services are provided by Dhaka City Corporation (DCC), water and sewerage authority (WASA), Directorate of Public Health engineering (DPHE), Dhaka electric supply, Titas Gas transmission and distribution company Directorate of Fire Service, and Dhaka Metropolitan Police.

The views of experts from different urban service agencies about the effects of high-rise residential buildings in Dhaka City were examined and are summarised in the following paragraphs.

5.4.1. DHAKA CITY CORPORATION (DCC)

Dhaka City Corporation is the statutory body which provide municipal services such as construction and maintenance of roads and walk ways, street lightings, collection and disposal of solid wastes, conservancy activities and construction and maintenance of Parks etc. Trade licence, licence of rickshaw are also issued by this body. The following table shows the sectoral allocation in approximate percentages in the budgets of the Municipalities.

58 percent of the income of Dhaka municipality came from government grants and 42 percent of the expenditure was for roads in the year 79-80, as revealed from the Table 5.7.

Table 5.7 : MUNICIPAL BUDGETS IN APPROXIMATE PERCENTAGES.

Head	Description	Alf municipality	Dhaka	Chittagong
Income	Property tax	33	12	22
	Octroi	15	10	35
	Minor Taxes, Licenses Rents, Fees	16	14	9
	Grants	15	58	13
	Opening accounts and advances	4	3	16
	Others	17	3	2
	TOTAL	100%	100%	100%
Expenditure operational capital investment	General administration	8	1.5	3
	Tax administration	6	2.5	4
	Conservancy & maintenance	26	18	26
	Roads	16	42	29
	Public works	12	18	3
	Buildings, Markets slaughter houses	1.5	3.5	1.5
	Education	3	3	7
	Closing and Advances	19	4	13
	Repayment	5	6	2
	Others	2.5	1.5	4.5
	TOTAL	100%	100%	100%

Source: World Bank (1981), p.26.

Though the Dhaka City Corporation presently has a shortage of man power (including planners) and equipment, it expects to overcome these shortages, does not consider any implication on its part to the growth of high rise residential buildings in Dhaka.

The corporation meets the cost of maintenance of roads and lanes, street lighting and normal conservancy services in the city from its annual revenue. This year it has a revenue demand of about 75 crore and normal annual revenue receipt is about 70 percent of revenue demand. Major development works are undertaken through government finance.¹

5.4.2. DHAKA WATER AND SEWERAGE AUTHORITY (WASA).

Currently WASA is supplying around 9 crore gallons of water in Dhaka city for a population of about 40 lakhs, compelling the urban dwellers to use about 22.5 gallons of water per person per day (average), though it believes that 40 gpd should be the minimum. With IDA credit of 70 crore it is running with a crash programme to add about 5 crore gallons of water, and it desires to supply 32 crore gallons of water for an estimated population of 80 lakh in the year 2000 in Dhaka city.

1. Personal Interview with Mr. Bhuiyan on 3/3/90.

The organisation is aware of the construction of high rise buildings in Dhaka city and is concerned with the increased demands at various points, due to the construction of those buildings, which was not anticipated during the laying of water supply system in the city causing reduction in water pressure and decrease of available water for the neighbouring buildings.

If the number of high rise buildings goes on increasing major water supply salvation schemes will have to be taken due to the attainment of the maximum capacity of the existing supply systems. Which would require a large amount of resources and like all other development expenditures of WASA, finance has to come through the government/IDA credit/World Bank, (through Annual development plans) since the organisation can hardly meet it's revenue expenditure from it's own revenue income.⁶

5.4.3. DIRECTORATE OF PUBLIC HEALTH ENGINEERING (DPHE).

Directorate of public health engineering is a pure government organisation under the Ministry of Local Government, Rural Development and Cooperatives. Before the creation of WASA it held the responsibilities of providing potable water supply along with provision and maintenance of sanitary and storm sewer in Dhaka city. Currently it is responsible for maintaining storm

2. Personal interview with Mr. Shees on 8/2/90

sewer system in Dhaka City. It is unlikely to be affected due to the construction of high rise buildings in Dhaka, since the volume of storm water is independent of height of building and population density of the city. At present drainage system in the city is of great concern.

5.4.4. DHAKA ELECTRIC SUPPLY (DES).

With a present demand of 250MW and an estimated demand of around 400 MW in the year 2000, there is no power shortage presently and no power shortage is anticipated up to 1995, even in the wake of high-rise building construction in Dhaka city. The ratio of domestic to commercial/industrial consumption of power is about 3:7. Adequate 11 KV power transmission lines have been installed along all main roads to facilitate distribution, especially high load requirements. Clients are required to give at least six months notice before power connection is actually made, for maintaining official and technical formalities such as installation of transformers etc. (if required). All the costs, including that of installation of electrical substation in the clients premises, have to be borne by the client to take connection from existing supply lines.

Recently a new linkage has been established between RAJUK and Dhaka Electric Supply, in taking consent regarding availability of required power in the area containing proposed high-rise construction site from Dhaka Electric Supply by RAJUK.

All development expenditure including foreign currency components is met by the government through provisions in the Annual Development Plans. The lion's share (about 88% in 89-90) of allocation come from external sources in the form of loan, aid or grant.³

5.4.5. TITAS GAS TRANSMISSION AND DISTRIBUTION COMPANY (TGTDC).

At the present state of development of high rise buildings in Dhaka City, the TGTDC faces no serious problem, but it anticipates future problems in distribution, because of inadequate infrastructure provided for gas supply, due to the increased demand generated by high-rise buildings.

In case of problem in distribution, salvation schemes will have to be taken up with government grant, like all other development works, through government annual development programmes, since the organisation meets only its revenue expenditure/from its revenue income.⁴.

5.4.6. DIRECTORATE OF FIRE SERVICE & CIVIL DEFENCE (DFSCD).

Non existence of any fire code and lack of awareness about fire hazards and its preventive measures among the general public, the

3. Personal interview with Mr. Jahangir on 8-2-90.

4. Personal interview with Mr. Fuadul Islam

Directorate is concerned about the development of high rise building in Dhaka City. (See weekly news magazine "Friday" Vol.2, No.14 August 25-31, 1989).

Though the directorate currently has adequate trained man power and equipments to fight any fire hazard in a single high rise building up to about 150 ft. at a time, poor infrastructure, especially in the old part of Dhaka may make the accident spot inaccessible. In times of emergency the scarcity of fire fighting water might create a disastrous situation, because of the elimination of natural sources and courses of water and non existence of fire fighting arrangements in the WASA water supply systems. Provision of these and procurement of more fire fighting equipments (each ladder arrangement may cost about one crore taka) for high rise buildings surely involves large government money."

5.4.7. DHAKA METROPOLITAN POLICE (TRAFFIC WING)

The traffic wing of Dhaka Metropolitan Police under the Ministry of Homes, Government of the Peoples Republic of Bangladesh has to perform the herculian task of traffic management of Dhaka City engulfed in severe traffic problems arising out of (i) admixture of high and low speed vehicles (ii) inadequate mass transport

5. Personal interview with Mr. Zia of the Directorate on 10-2-90

mode (iii) faulty road layout with inefficient road intersections (iv) unplanned growth of the city, causing inappropriate land uses to develop at unsuitable locations, (v) geographical separation of functionally related land uses (vi) absence of road hierarchy among the city roads.

The traffic wing with its present inadequate man power, including transportation planners, and equipments, feels that the growth of high-rise buildings will add to the existing traffic problems by increasing congestion, delay, discomfort and fatalities in the city which have already over burdened traffic problems in the city.

5.4.8. RAJDHANI UNNAYAN KARTIPAKKHA (RAJUK).

RAJUK (erstwhile DIT) was established in 1953 under the Town Improvement Act, 1953 (East Bengal Act XIII of 1953) which was amended by the T.I. (Amendment) Ordinance, 1987 (Ordinance No. IV of 1987) to provide for the development, improvement and expansion of the towns of Dhaka and Narayanganj and certain areas in their vicinity.

The East Bengal Building construction Rules, 1953 was formulated under section 18 of the Building construction Act, 1952. According to these rules any application for approval of a site for the construction of a building or excavation of tank must

satisfy some site planning requirements such as demarcation of boundary, position of building or buildings with respect to neighbouring streets, access from the adjacent street, approximate height of adjacent buildings, space to be left around the building or buildings to secure free circulation of air, admission of light and access for scavenging purposes including engineering aspects such as depth and width of the foundations, materials and method of construction, drainage arrangement etc.

The building construction rules, 53 also imposed restriction on (i) height of the building as the width of the road facing the proposed building plus the open space in between the road and the proposed building (ii) covered area of a plot as two-thirds of the area of the plot (iii) no construction within the 10 ft. back space and a 4 feet side spaces exclusive of the sweeper passage. No construction was allowed within the 20 feet from the centre of the road, lane or passage where the width of the road or lane is less than 40 feet. For Dhanmondi and Asad Avenue and residential houses on plots abutting the main master plan roads this rule did not apply.

The Building Construction Rules (BCR), 53, was repealed and replaced by the "Imarat Nirman Bidhimalas, 1984 (text being in Bengali) which differs from BCR 53 in specifying specific scales of preparing drawings for applying for approval and the number of sets of drawings to be submitted. The new rules necessitated

cinema halls, buildings for special purposes, commercial and residential buildings of six or more storeys to be prepared by graduate architects consulting firms or specialists and also the structural design of the aforementioned buildings to be prepared by graduate civil engineers or by a consulting firm. It also provided a time frame for approving or rejecting application for approval of a construction plan.

It banned approval of construction plans on streets less than 3.5 metres in densely populated areas. Where residential and commercial plots are adjacent, 1.5 metres wide space has to be kept open along the common border on the commercial plot.

Buildings with five or more storeys require to have parking space equal to the covered space in the ground floor of the building or within the plot. There has to be adequate fire fighting and emergency exit arrangements in buildings with seven or more storeys.

It provided certain requirements for different structures

1. RESIDENTIAL BUILDINGS:

No residential building should be constructed within 4.5 metres from the centre of the nearest road/lane or 1.5 metres from property line (which ever is larger).

Table 5.8: SETBACK REQUIREMENTS FOR RESIDENTIAL PLOTS

Sl. No.	Area of the site(Katha)	Set back from rear property line(metre)	Setback from side property lines(metre)
1.	Upto 2	1.5	-
2.	Upto 3	1.5	1.25
3.	Upto 4	1.75	1.25
4.	Upto 5	2.50	1.75
5.	More than 5	3.00	1.75

2. COMMERCIAL AND OTHER STRUCTURES:

Commercial buildings should be 4.5 metres from the centre of the adjacent road/lane or 1.5 metres from the property line (which ever is larger), (b) There should be parking space at the rate of 23 square metres per vehicle for Cinema Hall, Auditorium, Market, Indoor Sports Complex or similar buildings.

There are certain requirements for constructing sunshade and extension of buildings but no mention of maximum allowable height as it was in sub-section (v) of Rule No. 1 of schedule I of the buildings construction rules 1953.

RAJUK's approach especially in the privately owned plots was to ensure setback spaces rather than planned development. In the Building Construction Act, 1952 or in the Building Construction Rules, 1953 no effort is apparent especially in private plots to control land use intensity - which is the basis for extending

utility and urban service facilities and hence the quality of habitable environment.

While sanctioning permission for the construction of high-rise buildings, its suitability, compatibility and impact on existing infrastructure, utility services and effects on the surrounding in respect of sunshine, ventilation, garbage disposal, traffic flow along with the various socio-cultural requirement of different age group people are not taken into consideration as is revealed in the study.

The purposes of setback spaces is to provide a reasonable standard of environment from circulation of air, sunshine and privacy point of view.

In Bangladesh the length of the shadow of a structure is almost equal to the height of the structure (during winter season). The set back rules of RAJUK can not ensure access of sun shine to all parts of a building on the north of any structure, in the prevailing standard of existing plot sizes and its orientations especially in the privately owned plots. Also the side spaces on the east and west side of a structure can be eliminated by taking appropriate measures of ventilation especially if the depth of the structure is within 40 feet.

From the study it is clear that this set back spaces provided by the developers of high-rise buildings according to the setback rules of RAJUK could not ensure an acceptable environment to the neighbours. Hence this setback rules are not adequate for high rise buildings. To remove inconvenience to neighbours from shading, disruption of air circulation and hamper of privacy there should be an appropriate floor area ratio (F.A.R) restriction considering available utility and urban service facilities. There should be clear cut specification for (i) fire fighting arrangements and emergency exit facilities (ii) garbage disposal and other house hold requirements (iii) facilities for different age groups and community activities (iv) vertical transportation facilities.

High-rise building in Dhaka City did not come up as a follow up of any long term strategic decision, but as a result of unrestrained market forces of supply and demand which is contradictory to the very essence of planning pursuit, and is impairing the habitable environment of the city as a whole.

The requirement of high-rise and low-rise buildings are not similar in respect of

- i) provision of vertical transportation facility.
- ii) uninterrupted power supply.
- iii) environmental openness around the building.

- iv) built environment within the building.
- v) service facilities and safety provisions.

High-rise buildings should not come up haphazardly and sporadically. These should be properly zoned and located. According to the requirements of high-rise buildings all facilities and utilities should be properly provided.

Since Dhaka is the seat of the national Government and also the main industrial and business centre of the country, its development planning should have the blessing and representation of the highest level of the Government along with popular participation for successful implementation, for securing a decent habitable environment.

CHAPTER 6

SUMMARY FINDINGS, RECOMMENDATIONS, AND CONCLUSION.

6.1. SUMMARY FINDINGS :

The growth of urban population in Bangladesh is taking place at a rapid rate. Dhaka, the capital city is experiencing a growth rate of 9.7 percent (1974-81) per annum. In spite of the efforts in the form of budgetary allocation in the Five Year Plans of the government, housing backlog of even government staff, especially low paid employees went on increasing, not to mention the general housing condition of the country.

In the prevailing socio-economic condition of the country, the urban population is most likely to increase about 3.5 times of the present urban population in the year 2000, with very low affordability to invest in housing as initial investment.

Scarcity of land compels accommodation of large population in a small land area at a high density. But constructing high-rise buildings and attaining high density is not synonymous. With equal standard of openness, low rise buildings may also yield equally high density.

Among the three high-rise residential buildings - Hotel Elysium, at Hatkhola; Aziz Co-operative Housing at Purana Palani; Property Enclave, at Bangla Motor - Hotel Elysium having an F.A.R. of 6.41, has the worst housing environment as felt by the residents

In Dhaka high-rise buildings are being constructed at the initiative of private developers along/adjacent to the major thoroughfares of the city, amidst low-rise building and without proper integration with existing infrastructural and service facilities. Proximity to the central business district also appears to be a location criteria.

Symbolism, prestige and manifestation of economic well being in the national and individual level played a major role in the development of high-rise buildings in American and European cities. There are growing resentment among people against high rise living and examples are there, of demolishing high-rise buildings for low social acceptability in America and Europe. In Singapore and Hongkong where horizontal expansion is not at all possible, public ownership of 90 percent land and economic strength enabled the government to implement proper physical planning measures successfully. development of high-rise buildings was the only alternative to accommodate growth of population. Unplanned growth of high-rise buildings necessitates huge public investment for salvation of infrastructural and service facilities.

and neighbours (with a modified net index value of problems of 48.19). Next is the case of Property Enclave, having an F.A.R. of 5.42 (modified net index value of problems of 29.34). Aziz Co-operative Housing, having an F.A.R of 4.94 is bestowed with the best housing environment among the three buildings (as indicated by the least value of modified net index value of problems of 25.74). The value of modified net index value of problems for neighbours is positively correlated with F.A.R. of the building. Hence quality of housing environment deteriorates with the increase of F.A.R. and calls for restriction at appropriate levels. F.A.R of some buildings of ten and above storeys are in table B1 in appendix B, which reveals the very high landuse intensity being allowed in Dhaka City.

Environment measured in terms of problems associated with high rise buildings are identified at three levels viz:

- i) Problems faced by the residents
- ii) Problems faced by the neighbours
- iii) Problems faced by the public agencies

These problems are discussed in the following paragraphs:

F.A.R: Floor Area Ratio expresses the ratio of total floor area to land area (plot area).

High-rise living is costlier than low rise living because of several reasons. High-rise building with more than 6 storeys has to be normally built on R.C.C. framed structure with beam and column on R.C.C. foundation. Taller the building, costlier it becomes due to the reason that the frame has to take care of increased lateral load. Operational cost of high-rise building is high due to the dependency on lift for vertical movement. In high-rise apartment building the lift is required to be used throughout the whole day for various purposes. Even for a petty purchase of daily necessities the use of lift become necessary in which the operational costs of lifts sometimes become more than the cost of the petty purchase. As a result, the operational cost of the lift is very high. Two such lifts now in operation in the 6-storied Gazetted Officers Hostel at Mymensingh Road (now being used as family apartments) consume electricity for which P.W.D. has to pay a monthly bill of Tk. 10,000/-. Moreover, the monthly salary of 6 nos. of operators and the cost of spare parts for such lifts and their maintenance is also quite appreciable (Alam, 1986)

Frequent failure of electricity also disrupts normal operation of lifts and cause much inconvenience for the residents of high rise apartments. In case of any disruption in the supply of water, it is manageable to carry water from some nearby sources only to the

P.W.D: Public Works Department, Government of Bangladesh.

At present there is scarcity of water in Dhaka City, WASA supply the bulk of the water in the city. But the water pressure in the supply lines are so low that it can hardly go upto the 1st floor of the building. Under the above situation, it necessitates underground storage and booster pump in almost all houses. For a high-rise residential building with a large number of apartments,

psychological development.

apartment remain isolated and suffer from unbalanced socio-lack of control over them. So, the children living in high-rise often reluctant to send their children down for playing due to The parents living in the upper floors of high-rise buildings are

a couple of extinguishers only (Islam, 1986).

is considered "extravagant" and the owners are willing to install The expense incurred in installing proper fire safety arrangement There is no fire prevention and fire safety act in our country.

complicated, difficult and costly.

buildings by our conventional methods and techniques are use of the occupants. But the repair and maintenance of high-rise prevailing condition of climate in Bangladesh and the careless Buildings require frequent maintenance and repair because of the

water to the upper floors.

lower floors, but it becomes very difficult to carry sufficient

it is necessary to have a big storage tank and bulk of the supplied water is sucked by the large storage of the high-rise building creating scarcity of water in the low-rise building of the neighbourhood.

In absence of adequate provision for garbage disposal, the upper floor residents carelessly handle the garbages. Thus the thrown litters and garbages by upper floor residents create environmental problem for lower floor residents in high rise building areas.

Without adequate provision for infrastructure and amenities, localised densification of population beyond the tolerable limit due to the construction of high-rise apartments may cause threat to environment and the service systems. The service networks and the utility supply systems designed for an area is based on certain demand calculations which are again based on an assumed or estimated size of population to be inhabited there. Any increase in the population beyond the target limit upsets the designed supply system causing disruption to normal services. Any attempt to increase capacity through reinstallation of distribution network becomes a very costly solution. Effect of densification on road and traffic system is more severe. The predesigned road width will not accommodate increased traffic volume and flow, and congestion become a normal affair. Socially, increased densification presses upon local social services like

education and health facilities recreational open spaces, shopping centres etc. Adverse psychological sufferings may be caused and retard the growth of mental health of the youths (Akhtar, 1991).

"The existing Building construction Rules based on EBBC Act, 1952 permits a building of any height if the main road in front of the building is 75 ft. or above in width. Except parking and building set-back these rules do not specify anything about social or community facilities to be reserved" (Akhtar, 1991). The existing set-back rules are not adequate to safeguard the spacing requirements of buildings under the prevailing climatic condition of Bangladesh. From the study it is revealed that the buildings in the south should be spaced at least 1.5 times its height in order to permit adequate sun-light and air for the buildings in the north. But RAJUK's set-back rules cannot ensure these spacing provisions. As a result, it has been observed in all the cases in this study that the buildings located in the north of high-rise building suffer from prevention of sun-light and casting of shadow.

The other problems are interference in Radio/T.V. reception, creation of air turbulence, disruption of air circulation, glare from glazed facades etc. The Buildings construction Rules of RAJUK are inadequate to mitigate the ills of high rise construction.

6.2. RECOMMENDATIONS

Providing shelter alone does not necessarily mean providing housing, since housing encompasses the complex linkages with all principal human activities, such as residing-working - shopping playing.

Functional and locational suitability measured in terms of house hold requirements, age group distribution, affordability of the users, and compatibility of land uses, should be considered before allowing particular landuse development at a place.

High-rise buildings should be developed through a well thought physical planning process in a planned way, considering various aspects of high-rise buildings.

Adequate infrastructural facilities and urban services have to be made available for smooth integration of high-rise building in the existing city system. In Dhaka, services of WASA and safety provision for fire fighting is not adequate in terms of equipment and skill; the same situation prevails in traffic management.

Interference between local climate and high-rise building has to be considered to avoid ill effects on housing environment.

Minimum amount of civic amenities, environmental openness, urban service-utility facilities, safety provisions to a suitable

standard illustrated in a Housing Code--statute formulated considering prevailing socio-economic conditions and social justice; ensured through urban planning, development, operation and maintenance organizations/institutions. Balance between supply and demand in all levels of human needs to be restored for a decent living environment in the cities in particular and in the whole country in general.

All our development activities are aimed at improving the quality of life which is a function of (a) Individual and the family (b) The neighbourhood and (c) The production environment. Since the last two components are related with the F.A.R (floor area ratio) of a building, F.A.R. restrictions appropriate for particular areas, should be immediately imposed and admixture of high and low rise buildings should also be stopped. High-rise buildings should be developed (if socio-economic analysis calls for) in planned area with adequate infrastructural and service facilities. For low income people semi pucca, and people of middle income group 5 storeyed walk up building as suggested by Jahangir (1979), should be adopted.

A city should be regarded as a complicated system composed of many sub-systems. An apparently simple fault in any of the sub-system is sure to create faults and malfunctions in other sub-systems, which in due course is bound to affect the whole system imparting degradation of environment and livability of the city.

The opportunity cost has to be paid in full amount by witnessing the next generations engulfed in socio-psychological problems, for the trade off, now a days made, between poor housing environment and proximity to central business district work place by especially the affluent class of the society.

6.3. CONCLUSION:

Like all other developed and developing countries, the highest seat of education and knowledge producing and dissipating institutions - the universities should be called for giving solutions of the local problems.

We cannot afford experimentation on trial and error approach with the problems associated with urbanization. Lessons from other countries on similar problems of urbanization should be learnt. Experts in the related field should be identified, consulted, and engaged in solving problems.

In an endeavour to set the system fault free, the root of the fault has to be detected first. It is better to maintain status-quo, rather than making unidimensional partial solution of the multi-dimensional problem. Unidimensional partial solution implemented in piece meal manner very often renders the efforts were wastage of public money and time, not to mention public suffering in long run.

In the prevailing vulnerable socio-economic condition public sector would play the guiding and controlling role through appropriate measures and mobilise private sector for the growth of housing stock with proper housing environment. Admixture of high-rise buildings for the benefit of the high income group would incur huge public sector investment in providing infrastructural and service facilities, which will not be easy under the desired national goals of poverty alleviation, creation of employment, equitable distribution of resource, balanced growth between regions, in the light of decentralisation of administration. Further research is expected in this field.

APPENDIX A

TABLE A1 TO TABLE A12

Table A1: REDUCED NET INDEX VALUE OF PROBLEMS FOR RESIDENTS OF HIGH-RISE BUILDINGS.

	Hotel Elysium			Aziz Co-Operative			Property Enclave		
	% of response (a)	Weighted value of Problems on Priority basis (ID). (From Table-2 (b))	Net Index Value of Problem c=a x b	% of response (a)	Weighted value of Problems on Priority basis (ID). (From Table-2 (b))	Net Index Value of Problem c=a x b	% of response (a)	Weighted value of Problems on Priority basis (ID). (From Table-2 (b))	Net Index Value of Problem c=a x b
A. Environmental aspects									
a)	23.07	6	138.42	0	1	0	46.42	1	46.42
b)	20.51	1	20.51	0	1	0	25.00	1	25.00
c)	12.82	4	51.28	4.00	1	4.00	3.57	1	3.57
d)	76.92	12	923.04	40.00	1	40.00	64.26	14	899.92
e)	53.84	1	53.84	28.00	1	28.00	39.28	6	235.68
f)	2.56	1	2.56	0	1	0	7.14	6	42.84
B. Amenities									
a)	84.61	12	1015.32	52.00	1	52.00	67.85	24	1628.40
b)	0	1	0	0	1	0	16.71	4	62.84
c)	100.00	100	10000.00	0	1	0	17.85	1	17.85
d)	0	1	0	100.00	116	11600.00	0	1	0
e)	17.94	2	35.88	20.00	1	20.00	0	1	0
f)	2.56	1	2.56	4.00	6	24.00	0	1	0
g)	0	1	0	0	1	0	0	1	0
h)	100.00	4	400.00	0	1	0	0	1	0
i)	69.23	1	69.23	24.00	1	24.00	28.57	6	171.42
j)	0	1	0	8.00	4	32.00	0	1	0

k)	12.82	1	12.82	60.00	8	480.00	3.57	1	3.57
l)	71.79	6	430.74	40.00	8	320.00	3.57	1	3.57
m)	79.48	4	317.92	68.00	28	1904.00	60.71	12	728.52
n)	0	1	0	0	1	0	0	1	0
o)	5.12	1	5.12	4.00	1	4.00	17.85	1	17.85
p)	82.05	14	1148.70	16.00	1	16.00	28.57	10	285.70
q)	2.56	1	2.56	4.00	1	4.00	7.14	1	7.14
r)	41.02	1	41.02	16.00	1	16.00	0	1	0
s)	2.56	1	2.56	0	1	0	0	1	0
t)	10.25	1	10.25	0	1	0	0	1	0
u)	7.69	1	7.69	16.00	1	16.00	3.57	1	3.57
v)	0	1	0	16.00	1	16.00	3.57	1	3.57
w)	76.92	1	76.92	72.00	8	576.00	64.28	1	64.28
x)	97.43	1	97.43	80.00	2	160.00	78.57	1	78.57
y)	7.69	1	7.69	60.00	4	240.00	3.57	1	3.57
z)	0	1	0	8.00	1	8.00	3.57	1	3.57

C. Social aspects

a)	71.79	1	71.79	92.00	1	92.00	75.00	1	75.00
b)	17.94	1	17.94	32.00	1	32.00	25.00	1	25.00
c)	2.56	4	10.24	4.00	1	4.00	0	1	0
d)	5.12	1	5.12	0	1	0	0	1	0
e)	2.56	1	2.56	0	1	0	0	1	0
f)	2.56	1	2.56	48.00	20	960.00	3.57	1	3.57
g)	0	1	0	0	1	0	0	1	0
h)	38.46	1	38.46	24.00	1	24.00	7.14	1	7.14
i)	41.02	1	41.02	16.00	1	16.00	64.28	4	257.12
j)	5.12	1	5.12	12.00	1	12.00	7.14	1	7.14

D. Psychological aspects

a)	20.51	1	20.51	68.00	1	68.00	25.00	1	25.00
b)	7.69	1	7.69	12.00	1	12.00	10.71	1	10.71
c)	5.12	1	5.12	0	1	0	32.14	1	32.14
d)	20.51	1	20.51	4.00	4	16.00	0	1	-
e)	12.82	1	12.82	56.00	1	56.00	28.57	1	28.57
f)	0	1	0	0	1	0	3.57	1	3.57

E. Design aspects

a)	100.00	24	2400.00	44.00	1	44.00	67.85	4	271.40
b)	2.56	1	2.56	12.00	1	12.00	17.85	1	17.85
c)	0	1	0	8.00	1	8.00	7.14	1	7.14
d)	0	1	0	0	1	0	3.57	1	3.57
e)	74.35	8	594.80	20.00	1	20.00	28.57	10	285.70
f)	5.12	1	5.12	0	1	0	0	1	0
g)	7.69	1	7.69	20.00	2	40.00	0	1	0
h)	2.56	1	2.56	0	1	0	17.85	1	17.85
i)	48.71	86	4189.06	12.00	1	12.00	7.14	6	42.84

F. Miscellaneous

a)	69.23	1	69.23	76.00	6	456.00	75.00	22	1650.00
b)	94.87	44	4174.28	36.00	2	72.00	46.40	24	1114.68
c)	15.38	1	15.38	0	1	0	25.00	1	25.00
d)	7.69	1	7.69	8.00	1	8.00	14.28	1	12.28
Total (C)			26603.89			17548.00			8242.09

Reduced
NIV=(C/1000)

26.60

17.548

8.242

Table A2 : NET INDEX VALUE (NI) FOR EACH MAIN PROBLEM (PRIORITY BASIS) WHICH IS CREATED WITHIN THE HIGH-RISE BUILDING.

HOTEL ELYSIUM									
A. Environmental aspects	1st Priority		2nd Priority		3rd Priority		Total		ID
	No.	Index value	No.	Index value	No.	Index value	No.		
a) Inadequate sun light	0	-	1	4	1	2	2	6	
c) Wind turbulence	0	-	1	4	0	-	1	4	
d) Unpleasant view	0	-	3	12	0	-	3	12	
e) Hot in summer & cold in winter	0	-	0	-	0	-	-	0	
f) Glare from windows of other Building	0	-	0	-	0	-	-	0	
B. Amenities									
a) No suitable space for drying clothes	1	6	0	-	3	6	4	12	
c) Inadequate or faulty lifts	14	84	3	12	2	4	19	100	
d) No lift facility	0	-	0	-	0	-	-	0	
e) Garbage chute is faulty or non existent	0	-	0	-	1	2	1	2	
f) Adequate water is not available	0	-	0	-	0	-	-	0	
h) Lift service is not available round the clock	0	-	1	4	0	-	1	4	
i) No precautionary measure from fire hazard	0	-	0	-	0	-	-	0	
j) No Solid waste disposal arrangement	0	-	0	-	0	-	-	0	
k) Solid waste disposal arrangement is not satisfactory	0	-	0	-	0	-	-	0	
l) Maintenance of common space including stair is not satisfactory	1	6	0	-	0	-	1	6	
m) Children's play area is not adequate	0	-	0	-	2	4	2	4	
p) Open space including children's play area is not adequate.	1	6	2	8	0	-	3	14	
w) No arrangement for community religious activity	0	-	0	-	0	-	-	0	

x) Facilities for community activities absent or inadequate	0	-	0	-	0	-	-	1
y) Approach road is not satisfactory	0	-	0	-	0	-	-	1
C. Social aspects								
c) Kids want to remain isolated in the school	0	-	1	4	0	-	1	4
f) Unsocial activity in the common spaces.	0	-	0	-	0	-	-	1
i) Children can not be watched while playing on the ground	0	-	0	-	0	-	-	1
D. Psychological aspects								
d) Feeling of insecurity	0	-	0	-	0	-	-	1
E. Design aspects								
a) Room arrangements are not functional	4	24	0	-	0	-	4	24
e) No or inadequate verandah.	1	6	0	-	1	2	2	2
g) Oscillates too much at the time of the earth quake	0	-	0	-	0	-	-	1
i) Any other (Congested room)	6	36	12	48	1	2	19	86
F. Miscellaneous								
a) During storms doors & windows create problem	0	-	0	-	0	-	-	1
b) Much noise	3	18	5	20	3	6	11	44

Weightage of 1st priority = 6

Weightage of 2nd priority = 4

Weightage of 3rd priority = 2

Sample calculations:

B.c) inadequate or faulty lifts

No. of persons identifying this problem as 1st priority = 14

• • • • • 2nd • = 3

• • • • • 3rd • = 2

hence total index value ID = $14 \times 6 + 2 \times 4 + 2 \times 2 = 1000$

Minimum index value = 1

Table A2 : NET INDEX VALUE (NI) FOR EACH MAIN PROBLEM (PRIORITY BASIS) WHICH IS CREATED WITHIN THE HIGH-RISE BUILDING.

A Z I Z C O - O P E R A T I V E								
A. Environmental aspects	1st Priority		2nd Priority		3rd Priority		Total	
	No.	Index value	No.	Index value	No.	Index value	No.	ID
a) Inadequate sun light	0	-	0	-	0	-	-	1
c) Wind turbulence	0	-	0	-	0	-	-	1
d) Unpleasant view	0	-	0	-	0	-	-	1
e) Hot in summer & cold in winter	0	-	0	-	0	-	-	1
f) Glare from windows of other Building	0	-	0	-	0	-	-	1
B. Amenities								
a) No suitable space for drying clothes	0	-	0	-	0	-	-	1
c) Inadequate or faulty lifts	0	-	0	-	0	-	-	1
d) No lift facility	17	102	3	12	1	2	21	116
e) Garbage chute is faulty or non existent	0	-	0	-	0	-	-	1
f) Adequate water is not available	1	6	0	-	0	-	1	6
h) Lift service is not available round the clock	0	-	0	-	0	-	-	1
i) No precautionary measure from fire hazard	0	-	0	-	0	-	-	1
j) No Solid waste disposal arrangement	0	-	1	4	0	-	1	4
k) Solid waste disposal arrangement is not satisfactory	0	-	1	4	2	4	3	8
l) Maintenance of common space including stair is not satisfactory	0	-	1	4	2	4	3	8
m) Children's play area is not adequate	3	18	2	8	1	2	6	28
p) Open space including children's play area is not adequate.	0	-	0	-	0	-	-	1
w) No arrangement for community religious activities	0	-	2	8	0	-	2	8

x) Facilities for community activities absent or inadequate	0	-	0	-	1	2	1	2
y) Approach road is not satisfactory	0	-	1	4	0	-	1	4
C. Social aspects								
c) Kids want to remain isolated in the school	0	-	0	-	0	-	-	1
f) Unsocial activity in the common spaces.	1	6	3	12	1	2	5	20
il) Children can not be watched while playing on the ground	0	-	0	-	0	-	-	1
D. Psychological aspects								
d) Feeling of insecurity	0	-	1	4	0	-	1	4
E. Design aspects								
a) Room arrangements are not functional	0	-	0	-	0	-	-	1
e) No or inadequate verandah.	0	-	0	-	0	-	-	1
g) Oscillates too much at the time of earth quake	0	-	0	-	1	2	1	2
l) Any other (Congested room)	0	-	0	-	0	-	-	1
F. Miscellaneous								
a) During storms doors & windows create problem	1	6	0	-	0	-	1	6
b) Much noise	0	-	0	-	1	2	1	2

PROPERTY ENCLAVE

A. Environmental aspects	1st Priority		2nd Priority		3rd Priority		Total	
	No.	Index value	No.	Index value	No.	Index value	No.	ID
a) Inadequate sun light	0	-	0	-	0	-	-	1
c) Wind turbulence	0	-	0	-	0	-	-	1
d) Unpleasant view	1	6	2	6	0	-	3	14
e) Hot in summer & cold in winter	1	6	0	-	0	-	1	6
f) Glare from windows of other buildings	1	6	0	-	0	-	1	6
B. Amenities								
a) No suitable space for drying clothes	4	24	0	-	0	-	4	24
c) Inadequate or faulty lifts	0	-	1	4	0	-	1	4
d) No lift facility	0	-	0	-	0	-	-	1
e) Garbage chute is faulty or non existent	0	-	0	-	0	-	-	1
f) Adequate water is not available	0	-	0	-	0	-	-	1
h) Lift service is not available round the clock	0	-	0	-	0	-	-	1
i) No precautionary measure from fire hazard	1	6	0	-	0	-	1	6
j) No solid waste disposal arrangement	0	-	0	-	0	-	-	1
k) Solid waste disposal arrangement is not satisfactory	0	-	0	-	0	-	-	1
l) Maintenance of common space including stair is not satisfactory	0	-	0	-	0	-	-	1
m) Children's play area is not adequate	2	12	0	-	0	-	2	12
p) Open space including children's play area is not adequate.	1	6	1	4	0	-	2	10
w) No arrangement for community religious activities	0	-	0	-	0	-	-	1

x) Facilities for community activities absent or inadequate	0	-	0	-	0	-	-	1
y) Approach road is not satisfactory	0	-	0	-	0	-	-	1
C. Social aspects								
c) Kids want to remain isolated in the school	0	-	0	-	0	-	-	1
f) Unsocial activity in the common spaces.	0	-	0	-	0	-	-	1
g) Children can not be watched while playing on the ground	0	-	1	4	0	-	1	4
D. Psychological aspects								
d) Feeling of insecurity	0	-	0	-	0	-	-	1
E. Design aspects								
a) Room arrangements are not functional	0	-	1	4	0	-	1	4
e) No or inadequate verandah.	1	6	1	4	0	-	2	10
g) Oscillates too much at the time of earth quake	0	-	0	-	1	2	1	2
i) Any other (Congested room)	1	6	0	-	0	-	1	6
F. Miscellaneous								
a) During storms doors & windows create problem	3	18	1	4	0	-	4	22
b) Much noise	4	24	0	-	0	-	4	24

Table A3 : NET INDEX VALUE (NI) FOR EACH MAIN PROBLEM (PRIORITY BASIS) WHICH IS CREATED IN THE NEIGHBOURS BY THE ADJACENT HIGH-RISE BUILDING.

HOTEL ELYSIUM (total response(30))			
Main Problem	% of response (a)	Weighted value of Problem on Priority basis (From table-4) (b)	Net Index value of Problem c=ab
a)/(b) Prevents Sun light and casts shadow for long time	62.96	56	3525.76
c) Disrupts air flow	37.03	10	370.30
d) Dampens Surrounding and floor space	7.04	2	14.08
e) Hempter privacy	59.25	42	2488.50
f) Some times litter and garbage are thrown	35.18	114	5710.52
g) Reduces water pressure	29.62	1	29.62
h) Reduces gas pressure	48.14	1	48.14
i) Causes frequent power failure	18.51	1	18.51
j) Creates traffic congestion on street	29.62	2	59.24
k) Too many children move around	14.81	14	207.34
l) Smoke problem	0	0	0
m) Bad odour	0	0	0
n) Social problem	51.85	18	933.30
o) Disturbs TV/radio reception	22.22	1	22.22
p) Window pane reflects sun/glare	25.92	1	25.92
q) Creates air turbulence	22.22	6	133.32
r) Increases intensity of storm wind.	25.92	1	25.92
s) During winter shadow increases chillness	18.51	1	18.51
t) Over flows existing sewer	22.22	1	22.22

u) Creates Garbage clearance problems	70.37	56	3940
v) Any other problem (please specify)	0	0	0
Total (C)			21594.14
Reduced N.I.V (C/1000)			21.594

Table A3 ; NET INDEX VALUE (NI) FOR EACH MAIN PROBLEM (PRIORITY BASIS) WHICH IS CREATED IN THE NEIGHBOURS BY THE ADJACENT HIGH-RISE BUILDING.

A 2 1 2 C D - O P E R A T I V E (Total response 30)			
Main Problem	% of response (a)	Weighted value of Problem on Priority basis (From table-4) (b)	Net Index value of Problem $c=ab$
a)/(b) Prevents sun light and casts shadow for long time	60.00	30	1800.00
c) Disrupts air flow	65.00	32	2080.00
d) Damages surrounding and floor space	10.00	1	10.00
e) Hamper privacy	60.00	30	1800.00
f) Some times litter and garbage are thrown	80.00	56	4480.00
g) Reduces water pressure	5.00	1	5.00
h) Reduces gas pressure	20.00	1	20.00
i) Causes frequent power failure	10.00	1	10.00
j) Creates traffic congestion on street	20.00	16	320.00
k) Too many children move around	10.00	1	10.00
l) Smoke problem	0	0	0
m) Bad odour	0	0	0
n) Social problem	15.00	8	120.00
o) Disturbs TV/radio reception	5.00	1	5.00
p) Window pane reflects sun/glare	10.00	6	60.00
q) Creates air turbulence	30.00	12	360.00
r) Increases intensity of storm wind	0	0	0
s) During winter shadow increases chillness	10.00	1	10.00
t) Over flows existing sewer	0	0	0

u) Creates garbage clearance problems	70.00	10	700.00
v) Any other problem (please specify)	0	0	0
Total (C)			11790.00
Reduced N.I.V=(C/1000)			11.79

Table A3 : NET INDEX VALUE (NI) FOR EACH MAIN PROBLEM (PRIORITY BASIS) WHICH IS CREATED IN THE NEIGHBOURS BY THE ADJACENT HIGH-RISE BUILDING.

PROPERTY ENCLAVE (Total response 31)			
Main Problem	% of response (a)	Weighted value of Problem on Priority basis (From table-4) (b)	Net Index value of Problem c=axb
a)/(b) Prevents Sun light and casts shadow for long time	25.71	52	4456.92
c) Disrupts air flow	61.90	10	619.00
d) Dampens Surrounding and floor space	9.52	1	9.52
e) Hampers privacy	85.71	42	4114.08
f) Some times litter and garbage are thrown	90.48	80	7238.40
g) Reduces water pressure	0	0	0
h) Reduces gas pressure	0	0	0
i) Causes frequent power failure	0	0	0
j) Creates traffic congestion on street	4.76	1	4.76
k) Too many children move around	4.76	2	9.52
l) Smoke problem	0	0	0
m) Bad odour	9.52	1	9.52
n) Social problem	0	0	0
o) Disturbs TV/radio reception	14.29	1	14.29
p) Window pane reflects sun/glare	0	0	0
q) Creates air turbulence	57.14	12	685.68
r) Increases intensity of storm wind.	4.76	1	4.76
s) During winter shadow increases chilliness	14.29	2	28.58
t) Over flows existing sewer	0	0	0

u) Creates garbage clearance problems	76.19	4	304.76
v) Any other problem (please specify)	4.76	1	4.76
Total (C)			17504.55
Reduced N.I.V=(C/1000)			17.50455

Table A4 : INDEX VALUE (NI) FOR EACH MAIN PROBLEM (PRIORITY BASIS) WHICH IS CREATED WITH IN THE NEIGHBOURS OF HIGH-RISE BUILDINGS.

HOTEL ELYSIUM (total response(30)									
Main Problem	1st Priority		2nd Priority		3rd Priority		Total		
	No.	Index value	No.	Index value	No.	Index value	No.	Index value	
a)/(b) Prevents sun light and casts shadow for long time	5	30	4	16	5	10	14	56	
c) Disrupts air flow	0	0	1	4	3	6	4	10	
d) Dampens surrounding and floor space	0	0	0	0	1	2	1	2	
e) Hampers privacy	2	12	6	24	3	6	11	42	
f) Some times litter and garbage are thrown	14	84	6	24	3	6	23	114	
j) Creates traffic congestion on street	0	0	0	0	1	2	1	2	
k) Too many children move around	1	6	2	8	0	0	3	14	
n) Social problem	1	6	2	8	2	4	5	18	
p) Window pane reflects sun/glare	0	0	0	0	0	0	0	1	
q) Creates air turbulence	0	0	1	4	1	2	2	6	
r) Increases intensity of storm wind	0	0	0	0	0	0	0	1	
s) During winter shadow increases chillness	0	0	0	0	0	0	0	1	
u) Creates garbage clearance problems	4	24	5	20	6	12	15	56	

Weightage of 1st priority = 6

" " 2nd " = 4

" " 3rd " = 2

Sample calculation:

a) No. of persons identifying this problem as 1st priority = 5

" " " " " " " " 2nd " = 4

" " " " " " " " 3rd " = 5

hence total index value = $5 \times 6 + 4 \times 4 + 5 \times 2 = 56$

Minimum index value = 1

Table A4 : INDEX VALUE (NI) FOR EACH MAIN PROBLEM (PRIORITY BASIS) WHICH IS CREATED WITH IN THE NEIGHBOURHS OF HIGH-RISE BUILDINGS.

A Z I Z C O-O P E R A T I V E (total response 30)								
Main Problem	1st Priority		2nd Priority		3rd Priority		Total	
	No.	Index value	No.	Index value	No.	Index value	No.	Index value
a) / b) Prevents Sun light and casts shadow for long time	5	30	0	0	0	0	5	30
c) Disrupts air flow	4	24	2	8	0	0	6	32
d) Deepens surrounding and floor space	0	0	0	0	0	0	0	1
e) Harpers privacy	3	18	3	12	0	0	6	30
f) Some times litter and garbage are thrown	5	30	4	16	5	10	14	56
j) Creates traffic congestion on street	2	12	1	4	0	0	3	16
k) Too many children wave around	0	0	0	0	0	0	0	1
n) Social problem	0	0	2	8	0	0	2	8
p) Window pane Reflects sun/glare	1	6	0	0	0	0	1	6
q) Creates air turbulence	0	0	3	12	0	0	3	12
r) Increases intensity of storm wind	0	0	0	0	0	0	0	1
s) During winter shadow increases chillness	0	0	0	0	0	0	0	1
u) Creates garbage clearance problems	0	0	1	4	3	6	4	10

Table A4 : INDEX VALUE (NI) FOR EACH MAIN PROBLEM (PRIORITY BASIS) WHICH IS CREATED WITH IN THE NEIGHBOURS OF HIGH-RISE BUILDINGS.

PROPERTY ENCLAVE (total response 31)								
Main Problem	1st Priority		2nd Priority		3rd Priority		Total	
	No.	Index value	No.	Index value	No.	Index value	No.	Index value
a)/(b) Prevents sun light and casts shadow for long time	8	48	1	4	0	0	9	52
c) Disrupts air flow	0	0	1	4	3	6	4	10
d) Dampens surrounding and floor space	0	0	0	0	0	0	0	1
e) Hampers privacy	5	30	4	16	1	2	10	48
f) Some times litter and garbage are thrown	8	48	6	24	4	8	18	80
j) Creates traffic congestion on street	0	0	0	0	0	0	0	1
k) Too many children move around	0	0	0	0	1	2	1	2
n) Social problem	0	0	0	0	0	0	0	1
p) Window pane reflects sun/glare	0	0	0	0	0	0	0	1
q) Creates air turbulence	0	0	3	12	0	0	3	12
r) Increases intensity of storm wind	0	0	0	0	0	0	0	1
s) During winter shadow increases chillness	0	0	0	0	1	2	1	2
u) Creates garbage clearance problems	0	0	0	0	2	4	2	4

Table A5 : PRIMARY OCCUPATION OF THE HEAD OF THE HOUSEHOLD

HIGH-RISE BUILDING	NO. OF HOUSEHOLDS SURVEYED	PRIMARY OCCUPATION OF THE HEAD OF H/H							
		SERVICE		BUSINESS		PROFESSIONAL		OTHER	
		No.	%	No.	%	No.	%	No.	%
HOTEL ELYSIUM Hatkhola	39	38	97.43	1	2.56	0	0	0	0
AZIZ CO-OPERATIVE Purana Palton	25	6	24.00	17	68.00	1	4.00	1	4.00
PROPERTY ENCLAVE Bangla Meter	28	11	39.28	11	39.28	5	17.85	1	3.57

Table A6 : MONTHLY AVERAGE HOUSEHOLD INCOME OF THE RESIDENTS OF H.R. BUILDINGS

RISING-RISE BUILDING	NO. OF HOUSEHOLDS SURVEYED	MONTHLY AVERAGE HOUSEHOLD INCOME (in taka/month)													
		<3001		3001-5000		5001-8000		8001-10,000		10001-15,000		Above 15,000		No. Ans. Miss.	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
NOTEL ELYSIUM Hatkhola	39	4	10.25	13	33.33	22	56.41	0	0	0	0	0	0	0	0
AZIZ CO-OPERATIVE Purana Palton	25	0	0	0	0	2	8.00	2	8.00	12	48.00	7	28.00	2	8.00
PROPERTY ENCLAVE Bangla Motor	28	0	0	1	3.57	1	3.57	3	10.71	9	32.14	2	7.14	12	42.85

Table A7 : NUMBER OF FAMILY MEMBER OF THE RESIDENTS OF HIGH-RISE BUILDINGS

HIGH-RISE BUILDING	NO. OF HOUSEHOLD SURVEYED	POPULATION						CHILDREN (AGE BELOW 13 YRS)	
		TOTAL		MALE		FEMALE		No.	PERSON/HH
		No.	%	No.	%	No.	%		
HOTEL ELYSIUM Hatkhola	39	168	100.0	89	52.97	79	47.02	39	1
AZIZ CO-OPERATIVE Purana Patton	25	126	100.0	64	50.79	62	49.20	27	1.08
PROPERTY ENCLAVE Bangla Motor	28	139	100.0	69	49.64	70	50.35	36	1.29

Table AB : NORMAL METEOROLOGICAL DATA OF DHAKA GROUND LEVEL

1. Normal of Max. Temp. (C_r) :-

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
25.5	28.5	32.6	34.5	33.0	31.4	31.0	31.1	31.4	30.8	28.7	26.0

2. Normal of Min. Temp. (C_r) :-

11.7	14.5	19.7	23.5	24.8	25.8	26.2	26.1	25.9	23.7	19.2	13.3
------	------	------	------	------	------	------	------	------	------	------	------

3. Normal of Relative humidity (%) :-

69	63	61	70	79	86	86	86	85	81	75	71
----	----	----	----	----	----	----	----	----	----	----	----

4. Normal of Prevailing Wind Speed (K.P.H.) :-

6	6	11	9	15	11	15	15	11	6	6	7
---	---	----	---	----	----	----	----	----	---	---	---

5. Normal of Prevailing Wind Direction :-

NE	N	SW	SW	S	SE	SE	SE	SE	N	NE	NW
----	---	----	----	---	----	----	----	----	---	----	----

6. Normal of Mean Sea Level Pressure (abs) :-

1014.7	1011.5	1009.5	1005.8	1002.3	1000.0	1000.7	1001.1	1004.3	1008.9	1012.5	1014.7
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7. Normal of Rainfall (mm) :-

12	23	69	120	258	397	386	326	254	158	25	8
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8. Normal of Cloudiness (Octa) :-

0.7	1.0	2.4	2.7	4.5	5.8	6.3	6.0	5.7	3.8	1.9	0.6
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Source: Meteorological Dept. Dhaka.

Table A9: DECLINATION OF THE SUN-TO NEAREST 5'

DATE	DECLINATION	DATE
June 22	+ 23°-30'	-----
15	+ 23°-15'	June 29
8	+ 22°-45'	July 6
1	+ 21°-55'	13
May 25	+ 20°-50'	20
18	+ 19°-25'	27
11	+ 17°-40'	Aug. 3
4	+ 15°-45'	10
Apr. 26	+ 13°-20'	18
19	+ 11°-0'	25
12	+ 8°-30'	Sept. 1
5	+ 2°-55'	8
Mar. 28	+ 2°-50'	16
21	0°-0'	23
14	- 2°-50'	Oct. 1
7	- 5°-35'	8
Feb. 28	- 8°-15'	15
21	- 10°-50'	22
14	- 13°-15'	29
7	- 15°-30'	Nov. 5
Jan. 31	- 17°-30'	12
24	- 19°-20'	19
17	- 20°-50'	26
10	- 22°-0'	Dec. 3
3	- 22°-50'	10
Dec. 27	- 23°-20'	17
-----	- 23°-30'	22

Source: Callender, (ed) (1983), p. 1-91.

Table A10: AZIMUTH AND ALTITUDE OF SUN AT DHAKA.

DATE	TIME		AZIMUTH	ALTITUDE
	AM	PM		
Dec. 22	NOON 12.00		180°-0'	42°-30'
	10.00	2.00	146°-6'	34°-18'
	8.00	4.00	124°-48'	15°-6'
	6.50	5.10	116°-12'	0°-0'
	NOON		180°-0'	66°-0'
Sep. 23 March 21	10.00	2.00	124°-54'	52°-6'
	8.00	4.00	103°-0'	27°-2'
	6.00	6.00	90°-0'	0°-0'
June 22	NOON		180°-0'	88°-6'
	11.00	1.00	89°-0'	75°-54'
	8.00	4.00	77°-18'	35°-18'
	5.10	6.50	63°-48'	0°-0'

Source: Interpolated from Callender, (ed) (1963), pp. 1-92 - 1-94.

Table A11: NO. OF STOREY VS. TOTAL PLOT AREA, NO. OF DWELLINGS PER ACRE ETC.

Storey	Total plot area	Plot area per storey	Covered area per storey	Covered area as % of plot area	No. of storeys (dwelling) per acre
1.	$c(b+1.5h)$ $=cb+1x1.5hc$	$(cb+1x1.5hc)/1$ $=cb/1+1.5hc$	$cb/1$	$\frac{100xc}{cb+1x1.5xhc}$	$\frac{4840x9x1}{cb+1x1.5xhc}$
2.	$c(b+2x1.5 h)$ $=cb+2x1.5hc$	$(cb+2x1.5 hc)/2$ $=cb/2+1.5h$	$cb/2$	$\frac{100cb}{cb+2x1.5xhc}$	$\frac{4840x9x2}{cb+2x1.5xhc}$
3.	$c(b+3x1.5h)$ $=cb+3x1.5hc$	$(cb+3x1.5hc)/3$ $=cb/3+1.5hc$	$cb/3$	$\frac{90cb}{cb+3x1.5xhc}$	$\frac{840x9x3}{cb+3x1.5xhc}$
4.	$c(b+4x1.5h)$ $=cb+4x1.5 hc$	$cb/4+1.5hc$	$cb/4$	$\frac{90cb}{cb+4x1.5xhc}$	$\frac{840x9x4}{cb+4x1.5xhc}$
5.	$cb+5x1.5hc$	$cb/5+1.5hc$	$cb/5$	$\frac{100cb}{cb+5x1.5xhc}$	$\frac{840x9}{x5}$ $cb+5x1.5xhc$
6.	$cb+6x1.5hc$	$cb/6+1.5hc$	$cb/6$	$\frac{100xc}{cb+6x1.5xhc}$	$\frac{4840x9}{x6}$ $cb+6x1.5xhc$
7.	$cb+7x1.5hc$	$cb/7+1.5hc$	$cb/7$	$\frac{100xc}{cb+7x1.5xhc}$	$\frac{840x9}{x7}$ $cb+7x1.5xhc$
8.	$cb+8x1.5hc$	$cb/8+1.5hc$	$cb/8$	$\frac{100xc}{cb+8x1.5xhc}$	$\frac{840x9}{x8}$ $cb+8x1.5xhc$
9.	$cb+9x1.5hc$	$cb/9+1.5hc$	$cb/9$	$\frac{100xc}{cb+9x1.5xhc}$	$\frac{4840x9}{x9}$ $cb+9x1.5xhc$
10.	$cb+10x1.5hc$	$cb/10+1.5hc$	$cb/10$	$\frac{100cb}{cb+10x1.5xhc}$	$\frac{4840x9}{x10}$ $cb+10x1.5xhc$

11.	$cb+11x1.5hc$	$cb/11+1.5hc$	$cb/11$	$\frac{100xcb}{cb+11x1.5xhxc}$	$\frac{4840x9}{cb+11x1.5xhxc} x11$
12.	$cb+12x1.5hc$	$cb/12+1.5hc$	$cb/12$	$\frac{100xcb}{cb+12x1.5xhxc}$	$\frac{4840x9}{cb+12x1.5xhxc} x12$
13.	$cb+13x1.5hc$	$cb/13+1.5hc$	$cb/13$	$\frac{100xcb}{cb+13x1.5xhxc}$	$\frac{4840x9}{cb+13x1.5xhxc} x13$
14.	$cb+14x1.5hc$	$cb/14+1.5hc$	$cb/14$	$\frac{100xcb}{cb+14x1.5xhxc}$	$\frac{4840x9}{cb+14x1.5xhxc} x14$
15.	$cb+15x1.5hc$	$cb/15+1.5hc$	$cb/15$	$\frac{100xcb}{cb+15x1.5xhxc}$	$\frac{4840x9}{cb+15x1.5xhxc} x15$
	$cb+nx1.5hc$	$cb/n+1.5hc$	cb/n	$\frac{100xcb}{cb+nx1.5xhxc}$	$\frac{4840x9}{(cb+nx1.5xhxc)} x15$

Where h = height of the building
b = depth of the plot
c = frontage of the plot
n = number of storeys

Table A12 : USE OF LAND IN RELATION TO BUILDING HEIGHT,
COVERAGE AND HOUSING DENSITY.

No. of storeys	Height of building (h) ft.	z=30, x=20, d=h+10, x<z			z=30, x=40, d=h-10, x>z		z=30, x=30, d=h, x=z	
		Total plot area sft. (h+10)x50	No. of storeys (No. of h/h) per acre	% increase in h/h per acre	Total plot area sft. (h-10)x50	No. of storeys (h/h) per acre	Total plot area sft. (hx50)	No. of storeys (h/h) per acre
4	40	2500	69.696	-	1500	116.16	2000	87.12
5	50	3000	72.60	4.16	2000	108.90	2500	87.12
6	60	3500	74.67	2.85	2500	104.54	3000	87.12
7	70	4000	76.23	2.089	3000	101.64	3500	87.12
8	80	4500	77.44	1.597	3500	99.57	4000	87.12
9	90	5000	78.41	1.252	4000	98.01	4500	87.12
10	100	5500	79.20	1.007	4500	96.80	5000	87.12
15	150	8000	81.675	3.125	7000	93.34	7500	87.12
20	200	10500	82.97	1.585	9500	91.705	10000	87.12
25	250	13000	83.769	1.32	12000	90.75	12500	87.12

APPENDIX B

TABLE B1

Table B1: FLOOR AREA RATIO OF SOME APARTMENT PROJECTS IN DHAKA CITY

Sl. No.	Apartment Projects	PLOT area (Sq. ft) X	Total floor area (Sq.ft) Y	Floor area Ratio(F.A.R) Y/X
1.	11- Storied apartment Project (Eastern Housing Ltd.) 79, Segunbaghicha.	12000	63600	5.30
2.	12 - Storied Apartment Project (Eastern Housing) 2/A, Eskaton Garden Rd.	9555	77100	8.07
3.	18 - Storied Apartment Building Eastern Housing Eskaton, Dhaka.	39541	349032	10.406
4.	12 - Storied Apartment Project (Eastern Housing) 8 & 9, Shantinagar	51650	345600	6.69
5.	10 - Storied Apartment Project (Eastern Housing) 21, Siddheswari Lane.	37231	140650	4.32
6.	Eskaton Plaza (City Development Co.(Pvt) Ltd. 131, New Eskaton, Dhaka	9725	101162	10.40
7.	Khan Plaza Apartment Project (Khan Real Estate Ltd.) 53/4, Johnson Rd.	21651	195700	9.30
8.	Century Tower, Maghbazar, (The Free School Street Property Ltd.)	22000	192988	8.77
9.	Nerala Centre (Apartments & Shopping Mall) 73, Green Road, Dhaka.	53081	279112	5.26

Source: Brochure of the Developers for the respective projects.

APPENDIX C

QUESTIONNAIRES

**ENVIRONMENTAL EFFECT OF HIGH-RISE RESIDENTIAL BUILDINGS:
1. QUESTIONNAIRE FOR THE RESIDENTS OF H.R. BUILDINGS
(DATA FOR RESEARCH PURPOSE ONLY)**

DEPARTMENT OF URBAN AND REGIONAL PLANNING,
B.U.E.T., DHAKA.

NAME OF THE INTERVIEWER:

SCHEDULE NO.

DATE:

NAME OF THE HOUSEHOLD HEAD:

ADDRESS (a) HOLDING NO.
(b) ROAD

1. NUMBER OF FAMILY MEMBERS

(a) MALE -----

(b) FEMALE -----

(c) TOTAL -----

2. NUMBER OF CHILDREN IN THE FAMILY (AGE BELOW 13 YEARS)

3. PRIMARY OCCUPATION OF THE HEAD OF THE HOUSEHOLD

a) SERVICE

b) BUSINESS

c) PROFESSIONAL

d) OTHER (SPECIFY)

4. MONTHLY AVERAGE HOUSEHOLD INCOME

a) <3001 TAKA PER MONTH

b) 3001 - 5000 TAKA PER MONTH

- c) 5001 -8000 TAKA PER MONTH
- d) 8001 -10,000 TAKA PER MONTH
- e) 10,000 - 15,000 TAKA PER MONTH
- f) ABOVE 15,000 TAKA PER MONTH
- g) NO ANSWER/MISSING

5. LOCATION OF THE BUILDING

- a) MAGH BAZAR
- b) HATKHOLA
- c) PURANA PALTON
- d) DHANMONDI

6. NATURE OF SURROUNDING LANDUSE

- a) PURELY RESIDENTIAL
- b) MIXED
- c) COMERCIAL
- d) INDUSTRIAL
- e) OPEN SPACE
- f) OTHERS (PLEASE SPECIFY)

7. NO. OF STOREYS IN THE BUILDING -----

8. WHICH FLOOR DO YOU OWN/OCCUPY ? -----

9. TOTAL NO OF ROOMS IN THE APARTMENT -----
(PLEASE PUT ACTUAL NUMBER AVAILABLE)

BED ROOM -----

DRAWING ROOM -----

DRAWING CUM DINING -----

DINING ROOM/SPACE -----

BATH ROOM/TOILET -----

VERANDAH -----

SERVENT'S ROOM -----

KITCHEN -----

10. TOTAL AREA OF THE APARTMENT (IN SFT) -----

11. ARE YOU THE OWNER ? (PLEASE PUT TICK MARK)

a) YES

b) NO

12. FOR TENANT, HOW MUCH IS THE RENT ?

a) < 1000 TAKA PER MONTH

b) 1001 - 1500 TAKA PER MONTH

c) 1501 - 2000 TAKA PER MONTH

d) 2001 - 2500 TAKA PER MONTH

e) 2501 - 3000 TAKA PER MONTH

f) 3001 - 3500 TAKA PER MONTH

g) 3501 - 4000 TAKA PER MONTH

h) 4001 - 6000 TAKA PER MONTH

13. COST OF THE APARTMENT : (PUT TICK MARK)

a) 5 - 10 LAKH TAKA

b) 10 - 15 LAKH TAKA

c) 15 - 20 LAKH TAKA

d) 20 - 25 LAKH TAKA

e) ABOVE 25 LAKH

f) NOT APPLICABLE

g) NO ANSWER

14. WHY DID YOU DECIDE TO BUY A FLAT ? (FOR OWNER, PLEASE PUT TICK MARK)

a) SUITABLE HOUSE WAS NOT EASILY AVAILABLE ON RENTAL BASIS.

b) WANTED TO HAVE A DWELLING OF MY OWN.

c) FOR BOTH THE ABOVE MENTIONED CASES.

d) ANY OTHER REASON (PL. SPECIFY)

15. WHAT WERE THE MAIN DISADVANTAGES YOU HAD IN THE EARLIER DWELLING UNIT, MENTION WITH EARLIER LOCATION ----- (PLEASE PUT TICK MARK).

a) TOO SMALL

b) TOO DISTANT FROM WORK PLACE

- c) TOO DISTANT FROM SCHOOL OF CHILDREN
- d) POOR ENVIRONMENT
- e) HIGH RENT
- f) OTHERS (PLEASE SPECIFY)

16. IF SUITABLE HOUSE ON RENTAL BASIS WAS EASILY AVAILABLE, WOULD HAVE YOU BOUGHT THIS FLAT ?

- a) YES
- b) NO

i) IF YES, WHY ? (PLEASE PUT TICK MARK)

- a) TO GET THE SATISFACTION OF OWNING A HOUSE
- b) PROBLEM OF UNSTABLE RESIDENTIAL CONDITION IN RENTAL HOUSE
- c) FOR BOTH THE ABOVE REASONS
- d) ANY OTHER REASON (SPECIFY)

ii) IF NO, WHY ? (PLEASE PUT TICK MARK)

- a) KEEPING THE MONEY IN THE BANK, I WOULD HAVE GOT MORE INTEREST THAN THE RENTAL VALUE OF THIS FLAT.
- b) INVEST THE MONEY IN OTHER PROFITABLE WAY.
- c) ANY OTHER REASON (PLEASE SPECIFY)

17. WHY DID YOU SELECT THIS LOCATION ? (PLEASE PUT TICK MARK)

- a) CLOSE TO MY PLACE OF WORK
- b) GOOD TRANSPORTATION FACILITY
- c) PROXIMITY TO MARKET/SHOPPING CENTRE.
- d) PROXIMITY TO CHILDREN'S SCHOOL/COLLEGE.
- e) GOOD NEIGHBOURHOOD
- f) ANY OTHER REASONS (PLEASE SPECIFY)

18 DID YOU PERSONALLY SELECT SPECIFIC THIS FLAT ? (PLEASE PUT TICK MARK)

- a) YES
- b) NO
- i) IF YES, THEN WHY ? (PLEASE PUT TICK MARK IN APPROPRIATE ONES).
 - a) EASIER VERTICAL MOVEMENT.
 - b) ADEQUATE SUN SHINE
 - c) ADEQUATE WIND
 - d) ADEQUATE PRIVACY
 - e) OTHER (SPECIFY)

ii) IF NO, THEN WHY ?

a) WHEN I CAME TO BUY, THERE WAS NO OTHER FLAT BETTER THAN THIS.

b) ANY OTHER REASON (SPECIFY)

19. WHY DID YOU SELECT THIS BUILDING ?

a) THERE WAS NO OTHER ALTERNATIVE BETTER THAN THIS FOR ME WITHIN MY MEANS.

b) MY FRIENDS/RELATIVES ALSO SELECTED THE BUILDINGS.

c) ANY OTHER REASON (PLEASE SPECIFY)

20. WHAT ARE THE DISADVANTAGES OF THIS FLAT ?

A. ENVIRONMENTAL ASPECTS (PLEASE PUT TICK MARKS)

a) INADEQUATE SUN SIGHT.

b) INADEQUATE WIND FLOW.

c) WIND TURBULANCE.

d) UNPLEASANT VIEW.

e) HOT IN SUMMER AND COLD IN WINTER.

f) GLARE FROM WINDOWS OF OTHER BUILDINGS.

B. AMENITIES (PLEASE PUT TICK MARK)

a) NO SUITABLE SPACE FOR DRYING CLOTH.

b) IN CASE OF POWER FAILURE VERTICAL MOVEMENT BECOME UNBEARABLE.

- c) INADEQUATE OR FAULTY LIFTS.
- d) NO LIFT FACILITY
- e) GARBAGE CHUTE IS FAULTY OR NON-EXISTENT
- f) ADEQUATE WATER IS NOT AVAILABLE
- g) POWER FAILURE OCCURES FREQUENTLY
- h) LIFT SERVICE IS NOT AVAILABLE ROUND THE CLOCK
- i) NO PRECAUTIONARY MEASURE FROM FIRE HAZARD.
- j) NO SOLID WASTE DISPOSAL ARRANGEMENT.
- k) SOLID WASTE DISPOSAL ARRANGEMENT IS NOT SATISFACTORY.
- l) MAINTENANCE OF COMMON SPACES INCLUDING STAIR IS NOT SATISFACTORY.
- m) CHILDREN'S PLAY AREA IS NOT ADEQUATE.
- n) NO CAR PARKING AREA.
- o) CAR PARKING AREA IS NOT ADEQUATE.
- p) OPEN SPACE INCLUDING CHILDREN'S PLAY AREA IS NOT ADEQUATE.
- q) NO SHOPPING FACILITY NEARBY.
- r) DOES NOT HAVE ANY STAND BY GENERATOR.
- s) TAKES TOO MUCH TIME TO RESTORE POWER SUPPLY AFTER A POWER FAILURE.
- t) WATER RESERVOIR CAPACITY IS NOT ADEQUATE.

- u) INADEQUATE SUPPLY OF WATER BY WASA.
- v) GARBAGE COLLECTION ARRANGEMENT BY MUNICIPALITY FROM OUT SIDE THE CAMPUS IS UNSATISFACTORY.
- w) NO ARRANGEMENT FOR COMMUNITY RELIGIOUS ACTIVITIES
- x) FACILITIES FOR COMMUNITY ACTIVITIES (LIBRARY, CLUB, SOCIAL GATHERING) ABSENT OR INADEQUATE.
- y) APPROACH ROAD IS NOT SATISFACTORY
- z) ANY OTHER DISADVANTAGE (PLEASE SPECIFY).

C. SOCIAL ASPECTS (PLEASE PUT TICK MARK)

- a) CHILDREN CAN NOT TAKE PART IN GROUND SPORTS EASILY.
- b) OUT OF CONFINEMENT, CHILDREN ARE BECOMING LAZY.
- c) KIDS WANT TO REMAIN ISOLATED IN THE SCHOOL.
- d) KIDS WANT TO REMAIN ALOOF FROM STUDIES.
- e) KIDS ARE BECOMING UNRULY AND INDISCIPLINED.
- f) UNSOCIAL ACTIVITY IN THE COMMON SPACES.
- g) VANDALISM
- h) SOCIAL COMPETITION AMONG FAMILIES.
- i) CHILDREN CAN NOT BE WATCHED WHILE THEY PLAY ON THE GROUND.
- j) ANY OTHER (SPECIFY)

D. PSYCHOLOGICAL ASPECTS (PLEASE PUT TICK MARK)

- a) CREATES A FEELING OF LONELINESS
- b) CREATES A FEELING OF CONFINEMENT.
- c) KIDS DO NOT LIKE TO LOOK DOWNWARD THROUGH THE WINDOWS
- d) FEELING OF INSECURITY
- e) OLD PEOPLE DO NOT LIKE TO STAY HERE.
- f) ANY OTHER (PLEASE SPECIFY)

E. DESIGN ASPECTS (PLEASE PUT TICK MARK)

- a) ROOM ARRANGEMENTS ARE NOT FUNCTIONAL
- b) SANITARY SYSTEM IS FAULTY
- c) PLUMBING SYSTEM IS FAULTY
- d) ELECTRIC WIRING INADEQUATE/FAULTY
- e) NO OR INADEQUATE VERANDAH
- f) SIZE OF STAIR CASE INADEQUATE
- g) OSCILATES TOO MUCH AT THE TIME OF EARTH QUAKE.
- h) DEVELOPED CRACKS ON SLAB/BEAM/COLUMN/WALL
- i) ANY OTHER (PLEASE SPECIFY)

F. MISCELLANEOUS (PLEASE PUT TICK MARK)

a) DURING STORM, DOORS AND WINDOWS CREATES PROBLEM

b) MUCH NOISE.

c) BAD T.V./ RADIO RECEPTION

d) ANY OTHER (PLEASE SPECIFY)

21 WHICH ARE THE MAIN PROBLEMS (SPECIFY 3 PROBLEMS ACCORDING TO SEVERITY).

22. DO YOU HAVE ANY SUGGESTIONS ABOUT HIGH-RISE RESIDENTIAL BUILDING (PLEASE SPECIFY)

ENVIRONMENTAL EFFECT OF HIGH-RISE RESIDENTIAL BUILDINGS
2. QUESTIONNAIRE FOR THE NEIGHBOURS OF H.R. BUILDINGS
(DATA FOR RESEARCH PURPOSE ONLY)

DEPARTMENT OF URBAN AND REGIONAL PLANNING
B.U.E.T., DHAKA.

NAME OF THE INTERVIEWER:
SCHEDULE NO.

DATE :

NAME OF THE HOUSE HOLD HEAD :

ADRESS (a) HOLDING NO.

(b) ROAD

1. LOCATION OF THE BUILDING : PUT TICK MARK

a) ON SOUTH OF H.R. BUILDING

b) ON EAST OF H.R. BUILDING

c) ON WEST OF H.R. BUILDING

d) ON NORTH OF H.R. BUILDING

2. NUMBER OF STOREY OF THE BUILDING YOU ARE DWELLING IN:

3. WHICH FLOOR DO YOU OCCUPY:

4. NUMBER OF STOREYS OF THE ADJACENT H.R. BUILDING:

5. DOES THE ADJACENT H.R. BUILDING CAUSE ANY PROBLEM ? PUT TICK MARK

a) YES

b) NO

6. IF YES, THEN WHAT ARE THESE PROBLEMS ? PUT TICK MARK

a) PREVENTS SUN LIGHT FOR LONG TIME

b) CASTS SHADOW FOR A LONG TIME

- c) DISRUPTS AIR FLOW
- d) DAMPENS SURROUNDINGS AND FLOOR SPACE
- e) HAMPERS PRIVACY
- f) SOME TIMES LITTERS AND GARBAGES ARE THROWN
- g) REDUCES WATER PRESSURE
- h) REDUCES GAS PRESSURE
- i) CAUSES FREQUENT POWER FAILURE
- j) CREATES TRAFFIC CONGESTION ON STREET
- k) TOO MANY CHILDREN MOVE AROUND
- l) SMOKE PROBLEM
- m) BAD ODOUR
- n) SOCIAL PROBLEM
- o) DISTURBS TV/RADIO RECEPTION
- p) WINDOW PANE REFLECTS SUN/GLARE
- q) CREATES AIR TURBULENCE
- r) INCREASES INTENSITY OF STORM WIND
- s) DURING WINTER SHADOW INCREASES CHILLNESS

- t) OVER FLOWS EXISTING SEWER
- u) CREATES GARBAGE CLEARANCE PROBLEM
- v) ANY OTHER PROBLEM (PLEASE SPECIFY)

7. WHICH ARE THE MAIN PROBLEMS (SPECIFY 3 PROBLEMS ACCORDING TO SEVERITY).

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