

JAPAN INTERNATIONAL
COOPERATION AGENCY

CAPITAL DEVELOPMENT CORPORATION
CITY OF ASTANA

THE STUDY
ON
THE MASTER PLAN
FOR
THE DEVELOPMENT OF THE CITY OF ASTANA
IN
THE REPUBLIC OF KAZAKHSTAN

FINAL REPORT
VOLUME III : SUPPORTING REPORT

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JUNE 2001

KISHO KUROKAWA ARCHITECT AND ASSOCIATES
NIPPON KOEI CO.,LTD.
INTERNATIONAL DEVELOPMENT CENTER OF JAPAN

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LIST OF REPORTS

Volume I	SUMMARY
Volume II	MAIN REPORT
Volume III	SUPPORTING REPORT



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Terminology

Abbreviations

AAKR	Astana, Akmola and Karaganda Region	ITU	International Telecommunication Union
ACT	Australian Capital Territory	JBIC	Japan Bank for International Cooperation
ACTPA	ACT Planning Authority	JICA	Japan International Cooperation Agency
ADB	Asian Development Bank	JSC	Joint Stock Company
ADP	Area Development Program	KEGOC	Kazakhstan Electricity Grid Operation Company
AES	Astanaenergyservice	LCB	Local Competitive Bid
ASEZ	Astana Special Economic Zone	LMC	Limited Liability Company
ATC	Automatic Telecommunication Center	lpcd	liter per capita per day
ATCS	Automatic Traffic Control System	LP	Low Pressure
AV	Added Value	LPG	Liquefied Petroleum Gas
BOD	Biochemical Oxygen Demand	LRT	Light Railway Transit
BOT	Build Operate and Transfer	MCM	Million cubic meter
°C	Centigrade	MDF	Main Distribution Frame
CDC	Capital Development Corporation	MP (M/P)	Master Plan
cmpd	Cubic Meters per Day	MSW	Municipal Solid Waste
CIS	Commonwealth of Independent States	MVA	Megavolt-ampere
CPI	Consumer Price Index	MW	Megawatt
CSC	Closed Stock Company	MWh	Megawatt-hour
dB	Decibel(s)	n.a.	Not available / Not applicable
DEL	Direct Exchange Line	NCDC	National Capital Development Commission
DF	Distribution Frame	NOx	Nitrogen Oxide
DLC	Digital Loop Carrier	ODA	Official Development Aid
EBRD	European Bank for Reconstruction and Development	OECD	Organization for Economic Cooperation and Development
EIRR	Economic Internal Rate of Return	O&M	Operation and Maintenance
ESP	Electrostatic Precipitator	OJSC/OSC	Open (Joint) Stock Company
f.o.b.	Free on board	PIP	Public Investment Program
EIA	Environmental Impact Analysis	PLP	Permissible Level of Pollution
EPR	Extended Producer Responsibility	ppm	Parts per Million
FBS	Family Budget Survey	PPP	Polluter Pay Principle
FDI	Foreign Direct Investment	p.s.u.	Parking Space Unit
FIC	Foreign Investors' Council	PV	Present Value
FIDIC	Federation Internationale Des Ingenieurs- Conseils (International Federation of Consulting Engineers)	R&D	Research and Development
FTTB	Fiber To The Building	PS (P/S)	Pumping Station
FTTC	Fiber To The Curb	RDF	Refuse Derived Fuel
FS (F/S)	Feasibility Study	SDH	Synchronous Digital Hierarchy
FSU	Former Soviet Union	SEZ	Special Economic Zone
GDP	Gross Domestic Product	SDP	Sector Development Program
GOK	Government of the Republic of Kazakhstan	SME	Small and Medium Enterprise
GOJ	Government of Japan	SNiP	Technical Standard and Norms
GRDP	Gross Regional Domestic Product	SOx	Sulfur Oxide
HC	Heat Center	S/S	Sub-station
HP	High Pressure	STM	Synchronous Transfer Mod
HSW	Hospital Solid Waste	STP	Sewerage Treatment Plan
ICB	International Competitive Bid	TACIS	Technical Assistance to the Commonwealth of Independent States
IKC	Irtys-Karaganda Canal	Tcal	Trillion calorie
ISW	Industrial Solid Waste	TFP	Total Factors of Productivity
IMF	International Monetary Fund	T/L	Transmission line
IP	Internet Protocol	USSR	United Soviet Socialist Republic
ISDN	Integrated Services Digital Network	UNDP	United Nations Development Program
ISW	Industrial Solid Waste	VAT	Value-added Tax
IT	Information Technology	WTP	Water Treatment Plan

Russian/Kazakh Words				(Printed in <i>Italics</i>)
<i>Akim</i>	Mayor/Governor	<i>Micro Rayon</i>	Sub-district	
<i>Akimat</i>	Municipality	<i>Oblast</i>	Province	
<i>ASA</i>	<i>Astana Su Aransy</i> (Astana Water Company)	<i>Rayon</i>	(Intra-city) Region/(Inter-city) District	
		<i>SNiP</i>	Construction Norm and Regulation	
<i>Dacha</i>	Farm house	<i>TETs</i>	Thermal Power Station	
<i>Gorcommunkhos</i>	City Communal Management	<i>TOO</i>	Limited Liability Company	
<i>Gorvodokanal</i>	City Water Company	<i>TSUM</i>	Central Department Store	
	(= ASA, if applied to Astana)	<i>Yulta</i>	Traditional tent house	
<i>Kazstroiconmitte</i>	Committee for Construction	<i>Zelen Stroi</i>	Section of Greenery Planting	
<i>Muslikhat</i>	City Congress			

Kurokawa's Terminology		(Printed in <i>Italics</i>)
<i>Symbiosis</i>	New, creative relationship born from competition and tension, or a positive relationship in which the participants necessarily attempt to understand each other, despite opposition	
<i>Metabolic city</i>	A linear zoning system, where the nature and urban life are in parallel, relieving a city from the limit of structural growth, which is a counter-proposal for a commonly practiced concentric city.	
<i>Abstract Symbolism</i>	A design methodology in architecture extended upon use of abstract forms and geometric features	

Exchange Rate

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**The Study on the Master Plan for
The Development of the City of Astana in
The Republic of Kazakhstan**

**Final Report
Volume III: Supporting Report**

Table of Contents

- A Urban Planning**
- B Transportation Planning**
- C Forestation and Greenery Planning**
- D Hydrogeology**
- E Water Resources**
- F Water Supply**
- G Sewerage**
- H Power and Heat Supply**
- I Gas Supply**
- J Telecommunication**
- K Solid Waste**
- L Flood Protection and Drainage**
- M Urban Administration and Organizational Issues**
- N Regional Development Plan for Astana City, Akmola Province
and Karaganda Province**
- O Integrated Investment Cost and Implementation Program**

CHAPTER A

URBAN PLANNING

SUPPORTING REPORT A: URBAN PLANNING

Contents

A.1	Assessment of Planning Parameters for Urban Planning.....	A-1
A.1.1	Land Use	A-2
A.1.2	Population.....	A-2
A.1.3	Housing Stock	A-5
A.1.4	Employment.....	A-8
A.1.5	Offices	A-9
A.1.6	Commercial and Retail	A-12
A.1.7	Townscape	A-13
A.2	Guidelines for Community Facilities Land Use Planning.....	A-18
A.2.1	Objectives	A-18
A.2.2	Commercial Facilities	A-18
A.2.3	Educational Facilities	A-21
A.2.4	Health Care Facilities	A-26
A.2.5	Police and Fire Fighting Facilities	A-29
A.2.6	Other Community Services	A-32
A.3	Formulation and Comparison of Area Expansion Variants	A-33
A.3.1	Characteristics of Area Expansion Variant Alternatives	A-33
A.3.2	Format of Comparison.....	A-33
A.3.3	Results of Comparison	A-34
A.3.4	Selection of Area Expansion Variant	A-39
A.4	Future Land Use and District Plan	A-41
A.4.1	Government City.....	A-41
A.4.2	Business City.....	A-43
A.4.3	Residential Zone	A-45
A.4.4	Mixed Use Zone.....	A-47
A.4.5	Industrial Zone.....	A-50
A.4.6	Northern Buffer Zone.....	A-52
A.4.7	Southern Buffer Zone.....	A-53
A.5	Planning Framework for District Planning.....	A-56
A.5.1	Method for Establishing Framework	A-56
A.5.2	Floor Area Framework	A-56
A.6	Preservation of Historic Architecture and Cultural Properties.....	A-60
A.6.1	Current Condition.....	A-60
A.6.2	Purpose	A-60
A.6.3	Plan for Preservation.....	A-60
A.6.4	Preservation Objectives	A-61

List of Tables

Table A.1.1	Estimated District-wise Area--Residential Area-Population-Density in 2000
Table A.1.2	Estimated District-wise Area – Office Floor Area – Working Population in 2000
Table A.1.3	Estimated District – Commercial Area in 2000
Table A.1.4	Major Streets in Astana (Width more than 10m)
Table A.1.5	Townscape Characteristics of Major Streets (Width more than 10m)
Table A.2.1	List of Kindergartens
Table A.2.2	List of Secondary Schools
Table A.2.3	List of Colleges and Professional Schools
Table A.2.4	List of Institutions of High Education
Table A.2.5	List of Hospital and Clinics
Table A.2.6	List of Police Office and Fire Departments
Table A.2.7	List of Cultural Facilities, Theaters and Museums
Table A.6.1	List of Proposed Cultural Property for Preservation

List of Figures

Figure A.1.1	Cross-sections and Images of Representative Streets in Astana
Figure A.2.1	Layout of Commercial Facilities
Figure A.2.2	Layout of Kindergartens
Figure A.2.3	Layout of Secondary Schools
Figure A.2.4	Layout of Colleges and Professional Schools
Figure A.2.5	Layout of Higher Educational Facilities
Figure A.2.6	Layout of Hospitals and Polyclinics
Figure A.2.7	Layout of Police Stations
Figure A.2.8	Layout of Fire Stations
Figure A.3.1	Area Expansion Plan A
Figure A.3.2	Area Expansion Plan B
Figure A.3.3	Area Expansion Plan C
Figure A.3.4	Comparison of Residential District
Figure A.3.5	Comparison of Central Business District
Figure A.3.6	Comparison of Green Areas
Figure A.3.7	Comparison of Road Network

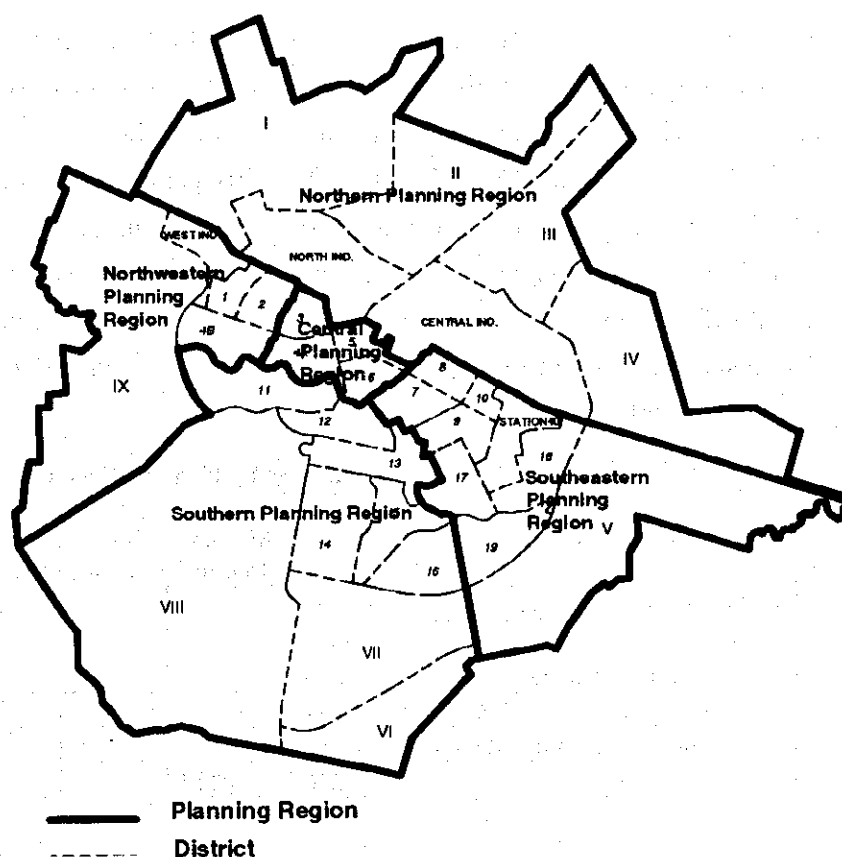
Figure A.6.1 Location of Proposed Cultural Property for Preservation

Figure A.6.2 Proposed Cultural Property for Preservation

A.1 Assessment of Planning Parameters for Urban Planning¹

In this Sub-section, the present conditions of the existing urban areas of Astana shall be assessed in order to provide a basis for the formulation of the urban planning and architectural planning framework.

In the existing urban areas of Astana City, five Planning Regions exist, as established in the Ak Orda Master Plan. These regions are identified as Central Planning Region, Northern Planning Region, Southeastern Planning Region, Southern Planning Region and Northwestern Planning Region



Planning Regions and Districts

For the development of Astana Master Plan, the same terminology has been used, however these macro-planning regions have been expanded to meet the new boundaries of Astana City.

¹ This chapter A.1 provides supplementary information for Section 3.4 of Main Report.

Each Planning Region is further divided into a number of districts, following, but expanding the original twelve residential districts and four industrial districts as identified by the Ak Orda Masterplan.

The urban development areas are divided into 20 residential districts, including the new Government City and Business City. The four industrial districts remained unchanged and the remaining non-urban areas have been divided into nine (I to IX) planning districts.

A.1.1 Land Use

The land use in the planning regions is roughly broken down into the residential use and other uses. Within the residential uses, net areas (excluding streets, unused areas etc.) are calculated separately. The residential areas can be further divided into relatively low density (50 – 10 person/ha) residential area with detached house and 1- to 2-storied low-rise houses; medium density residential area (100 – 240 person/ha), composed mainly of medium-rise buildings; and high density (240 person/ha or more) residential area with high-rise buildings more than 9 stories. The following table summarizes the characteristics of land uses in planning regions by the above categories.

Present Residential Land Use by Planning Regions

(Unit; ha)

Planning Region	Low Density	Medium Density	High-Density	Total Net area	Total Gross area
1. Central Planning Region	429	707	26	1,162	1,689
2. Northern Planning Region	434	0	0	434	4,635
3. Southeastern Planning Region	585	362	0	946	2,848
4. Southern Planning Region	321	0	0	321	6,504
5. Northwestern Planning Region	448	45	0	493	1,565
Total	2,216	1,114	26	3,357	17,241

A.1.2 Population

(1) Population in 1997

In RK, population census does not show precinct-wise population, and usually spatial breakdown of population based on the census data is difficult to achieve. One alternative method of spatial distribution of population is to use housing stock data as a basis for allocating the total population into smaller districts.

In 1997, Ak Orda² conducted a master plan survey of Astana up to 2005. In this process, they estimated the population of Astana City based on 5 Planning Regions covering the entire city. The gross population density was calculated on this basis. The estimated population by the planning regions and residential districts are summarized below.

Estimated Population, Area and Density by Planning (1997)

Planning Region	Area (ha)	Population in 1997	Population density (Per./ha)	Housing Characteristics
1. Central Planning Region	1,162	145,000	125	About 60% of population in medium-rise (3 to 5 storied) housing units
2. Northern Planning Region	448	13,000	29	All the population in detached housing units..
3. Southeastern Planning Region	947	76,000	80	About 70% of population in medium-rise (3 to 5 storied) housing units
4. Southern Planning Region	321	13,000	41	About 80% of population in detached housing units.
5. Northwestern Planning Region	479	27,000	56	About 60% of population in detached housings.
Total	3,357	273,000*	81	

*: Includes unregistered population

Based on their estimation, the population density of the residential areas in Astana City in 1997 was 81 persons/ha on average. Northern Planning Region has population density less than 60, which is significantly lower than the average. Densities at Northwestern, and Southern Planning Regions are slightly less than the average. The remaining two, namely Central and Southeastern Planning Regions, are relatively densely populated, with the population density between 80 and 120 per./ha.

It is also observed that about 95% of the total population live on the right bank of the Ishim river, while the remaining 5% on the left bank (Southern Planning Region).

(2) Population in 2000

The following table summarizes the population in January 2000. The population in Astana City has increase from 273,000 at the beginning of 1997 to 322,000 at the beginning of 2000, with an increase of 49,000 in 3 years³, major part of which is considered to be related to the transfer of the

² Ak Orda, "Master Plan of Astana City; Analysis of Existing Conditions and Major Constraints in Development", 1997

³ Due to expansion of city boundary in August, 2000 with inclusion of several suburban villages, the population as of middle-2000 is estimated to be 330,800.

capital to Astana in 1997. Most of increased population has been absorbed in Central and Southeastern Planning Regions, with the combined net increase in two Regions being 44,000.

The population density in 2000 is estimated to be 100 person/ha on average. The population densities in Central and Southeastern Planning Regions are between 90 and 150 person/ha, and are relatively high. Densities in other Planning Regions are generally less than 100 person/ha.

Estimated Population, Area and Density by Planning Regions (2000)

Planning Region	Population at beginning 1997	Population at beginning 2000	Increase 1997-2000	Density beginning 2000 (per./ha)
1. Central Planning Region	145,000	176,000	+31,000	151
2. Northern Planning Region	13,000	16,000	+3,000	38
3. Southeastern Planning Region	76,000	89,000	+13,000	97
4. Southern Planning Region	13,000	14,000	+1,000	50
5. Northwestern Planning Region	27,000	27,000	0	62
Total	273,000*	322,000*	+49,000	99

*: Includes unregistered population

The following table summarizes the population at the beginning of 2000 by types of urban areas; low-, medium- and high-density residential areas, as described in (2) above. The table below shows the present population densities in residential areas in Astana by Planning Regions and residential area types. Breakdown of population and net residential areas by residential areas is shown in Table A.1.1.

Estimated Population Density by Planning Regions and Types (2000)

Planning Region	Total Net area (ha)	Population Density (person/ha)			Overall population Density (person/ha)
		Low Density Residential Area	Medium Density Residential Area	High Density Residential Area	
1. Central Planning Region	1,162	58	202	299	151
2. Northern Planning Region	434	38	-	-	38
3. Southeastern Planning Region	946	25	213	-	97
4. Southern Planning Region	321	50	-	-	50
5. Northwestern Planning Region	493	47	211	-	62
Total	3,357	42	206	299	99

A.1.3 Housing Stock

(1) Characteristics of Housing Stock as of 1.1.1997

The housing data of Ak Orda as of 1.1.1997 are divided into 5 planning regions as described in (1) above. The data are further broken down into 15 Residential Districts and settlements and building type (high-, medium-, low-rises and detached houses) composition.

It is observed that the medium and high rise housing units are concentrated in the Central and Southeastern Planning Regions, while all the others are essentially of low-rise or detached housing units.

Housing Stock as of 1.1. 1997

Planning Region	High-rise	Medium rise	Low-rise	De-tached	Total
1 Central Planning Region	9%	69%	5%	17%	100%
2 Northern Planning Region	0%	0%	0%	100%	100%
3 Southeastern Planning Region	14%	71%	4%	11%	100%
4. Southern Planning Region	0%	6%	22%	72%	100%
5 Northwestern Planning Region	7%	29%	6%	59%	100%

(2) Construction and Demolition between 1997 and 1999

Ever since the official transfer of the capital in December 1997, a rapid influx of population took place in Astana City. By January 2000, the estimated population of Astana City became 321,600, accounting for an increase of about 49,000 from the 1997 level.

In order to construct new buildings, demolition of existing houses was necessary. Based on the statistics of housing stock and new housing units, demolition of housing floor areas was estimated accordingly. A large housing stock was presumed to be demolished in 1997, which was estimated to be around 158 thousand m². In the subsequent years demolition continued at 20 to 60 thousand m² per year to make room for new construction.

The following table shows that during the 3 years from 1997 to 1999, the total new housing construction totaled 371,100 m², while the net growth of the housing stock was 140,700 m², which indicates that during the same period, demolition and/or abandonment of 230,400 m² must have taken place.

Historical Changes in Housing Stock

Item	1996	1997	1998	1999	Change 1997-1999
Total area of housing at the end of year (1000m ²)	4,765.3	4,731.7	4,838.4	4,906.0	-
Constructed housing floor (1000 m ²)	39.4	124.4	126.7	120.0	371.1
Estimated Demolition (1000 m ²)	195.7	158.0	20.0	52.4	230.4
Net Change in total area of housing (1000 m ²)	-156.3	-33.6	106.7	67.6	140.7

In the following, the housing stock as of the beginning of 2000 is estimated based on the 1997 housing stock data and estimated new construction and demolition.

New construction

During the period of 1997 and 2000, a number of housing units were constructed. Most of new housing units were concentrated in Central and Southeastern Planning Regions. In particular, new housing complex in the southern part of Central Planning Regions along the Ishim river (Samal) provide houses for most of the government officials and their families moving into Astana. Construction of new housing units in Astana has been continued at the level of 120 to 130 thousand m² per year since 1997.

In May 2000, Ak Orda conducted a survey of new housing units constructed in this period based on the latest maps and on-site confirmation. The total floor area constructed during the 3 years thus obtained is adjusted to 377,100 m², as per the above table, based on the published new housing construction data.

Demolition/Abandonment

Mainly in order to make room for development, a substantial area of the existing housing stock must have been demolished. At the same time, abandonment of the existing stock due to relocation of occupants and/or aging of facilities must have taken place. These demolition and abandonment constitutes reduction of housing stock, although no data are available for district-wise estimation.

The demolition and abandonment was assumed to take place randomly, following the distribution of the existing housing stock of detached and 1-2

storied buildings. The total demolition/abandonment was adjusted to be 230,400 m², as per the estimated demolition in the above table.

(3) Characteristics of Housing Stock as of 1.1.2000

The district-wise housing stock data thus estimated, with breakdown of type of construction, is shown below.

This table shows that most of the addition to the housing stock occurred in the form of new housing units construction of high- and medium-rise buildings in the Central and Southeastern Planning Regions.

Estimation of Housing Stock as of 1.1.2000

(Unit; 1000m²)

Planning Region	Housing Stock as of 1.1.1997	Construction during 1997-1999	Demolition during 1997-1999	Housing Stock as of 1.1.2000
1 Central Planning Region	2,490	285	85	2,691
2 Northern Planning Region	234	0	36	198
3 Southeastern Planning Region	1,356	86	31	1,410
4. Southern Planning Region	460	0	42	414
5 Northwestern Planning Region	226	0	33	194
TOTAL	4,765	371	231	4,906

(4) Adjustment to City Boundary Expansion on 8.8.2000

In August 2000, the existing boundary of Astana was expanded from 258 km² as of 1st January 2000 to 710 km². Due to this expansion, the population increased from the estimated 322,200 to 330,700 as existing villages in the outskirts of the existing urban area, such as Teleman and others, became new parts of Astana City.

The existing population and housing stock in Astana, reflecting this boundary expansion is presented in the table below.

Estimation of Present Population and Housing Stock

(Unit; 1000m²)

Planning Region	Low-density	Medium-density	High-density	Detached
1 Central Planning Region	376	2,174	118	2,668
2 Northern Planning Region	248	0	0	248
3 Southeastern Planning Region	226	1,176	0	1,402
4. Southern Planning Region	243	0	0	243
5 Northwestern Planning Region	322	145	0	466
TOTAL	1,415	3,494	118	5,027

The breakdown of estimated present population and housing stock is shown in Table A.1.1.

A.1.4 Employment

In RK, population census does not show employment data based on precincts either. The spatial distribution of employment was thus estimated from the registration data of business entities with more than 50 staff, made available by the Statistical Office of Astana Municipality. The data were classified into the zoning scheme of the Study by individually locating the entities on a map. Employment less than 50 staff was estimated based on the distribution of the registered entities.

The following table shows the number of employments by Planning Regions and by categories of industries, and Table A.1.2 contains the details.

Estimated Employment by Planning Regions and Sector of Industries

Employment by Sector	North-western Planning Region	Central Planning Region	South-eastern Planning Region	Northern Planning Region	Southern Planning Region	Total
Industry	395	5,624	1,824	6,719	1,186	15,900
Construction	1,700	6,800	249	4,520	124	13,600
Trade & Repair	0	5,100	0	3,500	0	8,600
Transport & communication	2,552	5,130	758	4,043	1,617	14,100
Hotel & restaurants	0	942	453	105	0	1,500
Financial Activities	0	1,400	0	0	0	1,400
Real Estate	1,036	3,455	806	2,303	0	7,600
State Management	393	12,351	679	929	357	14,800
Education	598	7,112	1,404	807	179	10,100
Health care & social services	605	3,741	1,949	605	0	6,900
Other public & communal services	0	3,079	201	904	117	4,300
Others	1,636	12,298	1,870	5,490	805	22,200
Self-employed	1,938	14,570	2,216	6,504	953	26,300
TOTAL	10,853	81,601	12,410	36,428	5,339	147,300

According to these data, there are 453 companies with staff exceeding 50 staff in all Astana and 9 companies with more than 1,000 staff. The total number of employment by categories of industries is adjusted to the published statistical data of Astana Municipality.

Work places of about 81,600 people employed or 55% of the total employed (147,300 as of 1999) are located in the Central Planning Region. In particular, most of the work places for Hotel & Restaurants, Financial Activities and State

Management are concentrated in this region. It is deduced that most of the white-collar worker are located now in the Central Planning Region.

On the other hand, substantial part of workers has their places of work in Northern Planning Region where a number of factories are located. This tendency is clearly seen in Industry, Construction Transport & Communication Sectors.

A.1.5 Offices

There are no statistical data pertaining to the floor areas of offices in RK, and therefore some estimation is necessary. In order to clarify the floor area characteristics, two types of analysis were conducted, as explained in the following.

(1) Office Space per Population

The following table presents the data of gross office floor areas in major EU cities as compared to the total population. Though there are some randomness in the data, the average floor area per capital comes around 4 m²/person.

Office Data of Main cities in EU (1990) compared with Total Population

City	Gross Office Floor (1000m ²)	Total Population (1000)	Office Floor Per Population (m ² /p)
London	36,000	9,000	4.0
Paris	36,000	10,100	3.6
Stockholm	9,000	1,500	6.0
Frankfurt	7,000	660	10.6 *
Hamburg	8,500	1,650	5.2
Brussels	6,000	1,000	6.0
Amsterdam	4,000	1,100	3.6
Lyon	2,800	1,300	2.2
Dusseldorf	2,800	580	4.8
Rotterdam	2,700	1,100	2.5
Marseilles	2,000	1,100	1.8
Barcelona	2,000	1,800	1.1 *
Adopted			5.0

Source; Future of World Cities and Their Development of Infrastructure (External values with * excluded from average)

(2) Office Space per Working Population

The following table presents the data of gross office floor areas in some major EU cities as compared to the total working population.

Office Data of Main cities in EU (1990) compared with Working Population

City	Office Floor in Year 1990 (1000m ²)	Working Population		Net Office Floor (m ² /person)
		(1000)	(Year)	
London	36,000	3,503	1996	10.3
Paris	36,000	4,942	1990	7.3
Stockholm	9,000	853	1993	10.6
Hamburg	8,500	906	1990	9.4
Brussels	6,000	659	1990	9.1
Milan	6,000	820	1992	7.3
Adopted				10.0

Source; Office data from "Future of World Cities and Their Development of Infrastructure" and Working population form "EUROSTAT REGIONS" 1994, 1996.

When comparing the data with the total population, the above data tend to show more stable values within the range of 7 to 11 m²/person. The adopted value is 10 m²/person for net office space, and 12.5 m²/person for gross space per person.

(3) Estimation of Total Office Floors in Astana

Using the above, the existing office floor areas in Astana is estimated in two estimation methods as in the following table.

Estimation of Existing Net Office Floors in Astana by Two Indices

Utilized Population Index	Population in 1999 (1000)	Unit Value (m ² /person)	Estimated Net Office Floor (m ²)
Total Population	330,700	4.0	1,323,000
Working Population	147,300	10.0	1,473,000

The both estimations show good level of concurrence. As mentioned earlier, the office space data in comparison with the working population, show better stability than the one with the total population, and therefore, the estimation based on the working population index is adopted. The office floor areas in Astana in 2000 was thus estimated to be 1,473,000 m² (net) and 1,842,000 m² (gross).

(4) Estimation of Demand for Office Floors in Astana

Yet another estimation is necessary in determining the spatial structure of office spaces in Astana. As mentioned in the last paragraph, the estimated total office floor areas contain two different elements. In Astana, out of the 147,300 total employed, about 45 % are engaged in non-office type of employment, while the remaining 55 % are in mostly in office type of

employment. In the non-office type of business, it was assumed that 5 % of employees occupy office space, while the remainder is out in the field of operation.

With this assumption, the estimated floor area for these two divisions shall become as in the following table.

Estimation of Net and Gross Office Floors in Astana by Two Indices

Category of Sector	Employment in 1999	Quota (m ² /person)	Estimated Net Office Floor (m ²)	Estimated Gross Office Floor (m ²)
Office type	81,000	16.8	1,361,000	1,702,000
Non-office type	66,300	1.7	113,000	141,000
Total	147,300	10.0	1,473,000	1,843,000

By using the above unit values, the existing office floor areas were estimated by sectors and Planning Regions, as shown in Table A.1.2, and summarized in the table below.

Estimation of Present Population and Housing Stock

(Unit; 1000m²)

Planning Region	Gross Office (1000 m ²)	Per-centage (%)	Remarks
1 Central Planning Region	1,107	60%	Most of office-type employment
2 Northern Planning Region	378	20%	Mostly industry and construction
3 Southeastern Planning Region	146	8%	
4 Southern Planning Region	72	4%	
5 Northwestern Planning Region	136	7%	
Unknown	4	0%	Enterprises with unknown address
TOTAL	1,843	100%	

It can be seen from the table that 60% of the office floor areas are concentrated in Central Planning Region, and 20% in Northern Planning Region. Northern Planning Region contains, among others, the Astana Technopark, where a substantial number of office workers have their offices. Other office floors in other Planning Regions are small in comparison.

Sector-wise, it should be noted that State Management and Other Public and Communal Services combined uses 327,000 m², or 18%, of the office space. Bulk of this government related office space would be relocated to the left bank area, when the new development areas are completed, while the existing offices will be utilized for other office demands.

A.1.6 Commercial and Retail

In 1988, the city saw the opening of the Eurasian Market in the eastern part of the city, which must have boosted the retail function of the city. The retail activities in Astana City have started flourishing since the transfer of the capital in late 1997. A new shopping center named *Millennium Gallery* was opened in the central city in the back of the Congress Hall leading to the Ishim river, and yet another large shopping complex named TSUM opened lately on the western side of the central square. Very lately, yet another shopping center has been opened on Samal microdistrict.

Statistical data about commercial complexes and shops had been taken and published until 1995, but has been suspended, while the gross sales in Astana City has been available up to present. In 1995, the total floor areas for the commercial and retail industries was 72,500 m² of which 27,800 m² was for food related services, and 38,000 m² for non-food related services. In the same year, the city's annual gross sales were Tenge 5,154.8 million, according to the statistics, which indicates that the gross sales per m² of floor were Tenge 71,000/m².

Floor area data after 1995 are not available, while the data of gross sales up to today are available. The present floor areas for commercial and retail was estimated from the above as follows.

- The 1995 gross sales per unit floor of Tenge 71,000/m² were converted to the 2000 constant price by using the discount factor of 2.08. (For discount factors, refer to Section 3.2 of this report)
- Thus the gross sales per unit floor in 1999 was estimated to be Tenge 150,000/m².
- In 1999, the city's annual gross sales were Tenge 1,7422.4 million.
- From above, the total sales floor area of commercial and retail function in Astana City was estimated to be 120,000 m².
- As this floor area is in net terms precluding about 40% of common space, the total gross floor area of commercial and retail is calculated as 168,000 m² in 2000.

Table A.1.3 summarizes the distribution of the commercial and retail floor (gross) throughout the existing city in 2000.

A.1.7 Townscape

(1) Natural Landscape

Astana is a city located in a relatively flat terrain. Seen from a height, an open view extending in all directions above the horizon is to be seen. Unlike Almaty, no high snow-ridged mountains are in sight. For better or worse, this open terrain constitutes one of the main characteristics of the landscape of Astana.

Vegetation is not thick in Astana. Some people say that the severe winter climate with low temperatures and strong winds hinder the growth of trees, while others attribute the slow growth of trees to generally high ground water tables. Forests and woods are rare in the vicinity of Astana, and it requires a day-trip to find them in every day life.

The Ishim River running at the southern boundary of the existing urban areas of Astana is a prominent natural landscape element of the city. During the winter, the river becomes a popular site for skating and skiing, while in other seasons it lies quietly in the sight of the city as an abundant water body. In the summer season, a water-jet fountain is now installed in the middle of the water body, which apparently adds to the citizen's affection to the river. A river walk on the dyke of the right bank of the river near the city center is almost always crowded with the citizens of Astana.

(2) Skyline

The skyline of Astana composed of various architectures and structures is generally low in height. The highest buildings in Astana are the 25-storied twin-tower apartment buildings on Bogenbai Avenue, which is followed by the building of Inter Continental Hotel. Both of the buildings were constructed in the past few years.

Another new high-rise is the 17-storied building housing the Republic's Parliament. The building is prominent in the city's skyline, as it faces the open space within the central square, where the citizens often gather for a moment's relaxation.

New addition to the city's skyline is high-rise apartment buildings along the Ishim chiefly for incoming central government officials. There are 7 of 16-storied buildings overlooking the river surface, with the identical yellow and white coloring. Some other high-rise buildings are under construction along the Ishim towards the city center.

Most of other buildings are generally not more than 9 stories. There are quite a few 9-storied housing buildings in the city, which appeared in the city's skyline in 1975 when the city was growing as a regional industrial center. There are also quite a number of 5-storied apartment buildings particularly in the central part of the city. The 5-storied buildings first appeared in 1960, when the city was flourishing as the center of the Virgin Lands. All other low-rise buildings are less than 4 stories, and most of them are collective row-houses constructed in 1930's to 1950's.

(3) Streets

The avenues and streets in Astana are generally wide and spacious. As summarized in Table A.1.4, there are 10 streets with more than 20 meters width of lanes. Combined with pavements and other appurtenant spaces alongside the roads, average widths of major streets often exceed 30 meters.

Along the major streets are spaces provided for townscape effects; trees, bushes, lawns and flower beds, as summarized in Table A.1.5. Streets lined by more than 1,000 trees and bushes are, among others; Respublica Ave., Beibetshilik (Mira) Str., Auezov Str., Abylai-khan Str., Pobeda Ave., Abai Str., Seifullin Str. and Kenesary Str. Unfortunately, due to the reason mentioned in (1) above, the trees in Astana streets are generally low and the shades created by them are not dense. With regards to the size and height, trees in the streets of Astana are not comparable to those in the former capital.

Figure A.1.1 shows typical cross-sections of the major avenues and streets, together with their photographic images.

(4) Architecture

Astana has a long history tracing back to the early 19th Century, as described in depth in Sub-Section 3.2.3 of Main Report. There are a few buildings inherited from the pre-revolution years, most of which are located in the vicinity of the central city area where the city's evolution started.

Some of the typical examples of architectural heritage of this city from this era are; Konstantino Elininsk Church built in 1856 near the central square, and later relocated to its present location east of Respublica Ave; detached houses of well-to-do merchants, such as seen in S. Seifullin Museum building; a rich merchant's shop such as Kubrin's shop now used as Astana

Supermarket; and the brick-walled buildings such as Moissejev's house, now 4th City Hospital.

Most of the residential buildings constructed in the 1940's and 50's are two- to three-storied brick buildings in row-house style. A number of such buildings are seen in either around the central square area or in areas near the railway station. These buildings have a stable outlook with regular allotment of windows and roofs. Many of the city's entrepreneurs apparently consider these buildings as ideal location to house cafes, restaurants and shops. The row-houses constitute a body of architectural heritage of the city.

Some of the important additions to the city's architecture occurred in the Tselinograd years. *Railway Worker's Palace*, a fine piece of architecture built in 1954 in a Soviet classic style designed by the architect Kalmykov, has opened as an Opera Theater after refurbishment. *Tselinik Palace* in 1963, now rebuilt as the Congress Hall, reflects the contemporary architectural style of *Functionalism*. Special attention should be given also to *Zhastar Palace*, which was designed by an architect named Polyansky, former president of Architect of Soviet Union of USSR, and is a good example of *Functionalism Style*. This architecture has further enriched the texture of townscape by adding new styles and conceptions.

There are new buildings built after the capital was transferred. These were already mentioned in (2) above, and are not repeated here.

(5) Square

Central Square of Astana was formed in the beginning of Tselinograd years around the administrative buildings and hotels. This square is now an important open space for the city, utilized for various festive and commemorative occasions. Around the central square are *Parliament House* and *Presidential Office*, both of which are for the Republic's central administrative functions constructed or reconstructed after the official announcement of the transfer of the capital. The square thus carries a symbolic importance to the Republic, as was depicted in the International Presentation of the new capital, held chiefly in this square on 10th June, 1998.

(6) Monuments and Statues

There are a number of monuments and sculptures in Astana. S.Seyfullyn Monument located in Pobeda Street in the campus of the Agrarian University by S.Seyfullyn, constructed in 1972 is a monument already under the state protection. There are five other monuments now proposed for state protection; Monument to the Motherland Defenders located near the Russian Drama Theater; a memorial dedicated to victims of political repression constructed in 1994 along the highway to the airport; Tole bi, Kazybek bi and AYTEKE bi monuments constructed in 1998; another S.Seyfullyn Monument located besides the S.Seyfullyn Museum; and A.S.Pushkin monument in Pushkin Street.

These monuments and sculptures constitute landmarks of the city providing a sense of orientation and artistic touch to the otherwise relatively practical townscape of the city.

(7) Citizen's Perception of Townscape

In May 2000, a small survey was conducted by the Study Team to clarify the citizen's perception towards the townscape of Astana. As the survey was simple and the sample taken was small, this survey may not necessarily reveal representative perception of general citizens. The results, however, show some tendencies and general directions about the townscape in Astana.

The total number of questionnaire sheets answered was 155. This sample includes 60 architectural design office employees, 30 central governmental staff, 55 architectural and engineering students and teaching staff.

The following is the essence of the survey.

1) Favorite Street

This question requests the respondent to select at most 3 street names to express their preference amongst a list of existing major streets in Astana. The following table summarizes the results.

Respublica Ave., Beibitshilik (Mira) Street and Abai Street are found to be the most popular streets in Astana. These three streets are among the most spacious and fully tree-lined streets in Astana, as discussed in (3) above. The preference as revealed in this survey apparently supports those streets with good greenery and spacious conditions could also be favorable to citizens.

No.	Name	Preference	Percentage
1	Pespublika Ave.	131	36.2%
2	Kenesary Ave.	16	4.4%
3	Bogembai Ave.	9	2.5%
4	Baraev Ave.	10	2.8%
5	Valikhanov St.	4	1.1%
6	Munaitpasov St.	3	0.8%
7	Beibitshilik (Mira) St.	93	25.7%
8	Pobeda Ave.	24	6.6%
9	Abylai-Khan Ave.	47	13.0%
10	Seifullin St.	16	4.4%
11	Monin St.	9	2.5%
12	Abai St.	74	20.4%
Total		362	100.0%

2) Favorite Architecture

This question requests the respondent to select at most 5 architecture names to express their preference amongst a list of existing buildings in Astana. The following table summarizes the results.

No.	Name	Preference	Percentage
1	Congress Hall	48	6.3%
2	Parliament	39	5.2%
3	Railway Worker's Palace	17	2.2%
4	Russian Drama Theater	45	5.9%
5	"October" Cinema	21	2.8%
6	"Cinema-City"	86	11.4%
7	50's 3-storied Dwellings	5	0.7%
8	House of Kubrin	36	4.8%
9	S.Seifullin Museum	12	1.6%
10	Palace of Youth (Zhastar Palace)	13	1.7%
11	Konstantino Eleinisk Church	30	4.0%
12	Airport	37	4.9%
13	Railway Station	8	1.1%
14	Millennium Gallery	71	9.4%
15	City Municipality	16	2.1%
16	"Ishim" Hotel	42	5.5%
17	Intercontinental hotel	84	11.1%
18	Ministry of Finance	52	6.9%
19	Presidential Office	4	0.5%
20	Mosque	44	5.8%
21	"Eurasia" Shopping Center	47	6.2%
Total		757	100.0%

As observed from the above table, most people chose very prominent buildings, such as newly built *Cinema City*, *Intercontinental Hotel* and *Millennium Gallery*. Other popular choices are the outstanding Ministry of Finance building, Congress Hall and *Eurasia Shopping Center*. All the buildings up to this point are modern architecture.

A.2 Guidelines for Community Facilities Land Use Planning⁴

A.2.1 Objectives:

- To ensure the availability of the necessary range of facilities and services as and when they are required and to ensure that the quality of these services are as high as possible.
- To locate the facilities so that they are as accessible as possible, having regard to the catchment population required to support them.
- To associate the facilities with shops and public transport so that multi-purpose trips can easily be made
- To locate establishments not normally visited by the public, such as fire and police stations, at strategic points on the primary road network.

A.2.2 Commercial Facilities

In 1998, the city saw the opening of the Eurasian Market in the eastern part of the city, which boosted the retail function of the city. The retail activities in Astana City have started flourishing since the transfer of the capital in late 1997. A new shopping center named Millennium Gallery was opened in the central city in the back of the Congress Hall (late 1999) facing the Ishim River, a large shopping complex, bordering the western side of the central square, has been re-constructed (mid 2000) and recently a supermarket/ department store "Ramstore" has been completed (late 2000) as part of the Samal development.

Statistical data about commercial complexes and shops has been collected and published until 1995, but has been suspended after 1995, however gross sales figures in Astana City is available up to the present times. In 1995, the total floor areas for the commercial and retail industries was 72,500 m² of which, among others, 27,800 m² was for food related services, and 38,000 m² for non-food related services. In the same year, the city's annual gross sales were 5.1 billion Tenge, according to the statistics, which indicates that the gross sales per m² of floor area were Tenge 71,000/ m². The present floor areas for commercial and retail has been estimated as follows: The 1995 gross sales per unit floor of Tenge 71,000/m² was converted to the year 2000 constant pricing by using the discount factor of 2.08. Thus the gross sales per unit floor in 1999 was estimated to be Tenge 150,000/m². In 1999, the city's annual gross sales were 17.4

⁴ This chapter, A.1, present full text of Section 3.7 of Main Report.

billion Tenge. From these figures, the total floor area of commercial and retail function in Astana City is estimated to be 120,000 m².

In projecting the future demand for the commercial and retail function, the following assumptions were made. The gross sales in Astana shall be expanded as per the projected output value for the Trade and Repair Sector. The gross sales per unit floor area shall be expanded as per the projected added value per worker.

It should be noted that these figures represent net sales areas, gross commercial areas are estimated by using a multiplication factor of 1.4, meaning that 40% of the total floor area is allocated for other facilities, such as public circulation, structures, offices, staffing areas, storage areas, kitchens (in case of restaurants), machine rooms and the likes.

The aforementioned calculation is based on analytical commercial economics. Other methods of calculating the total demand for retail and commercial floor areas are the historical analytical method and the use of general planological analytical method. As Astana City is undergoing drastic changes in its population and social structure, the historical method will not result in any useful projections. In the planological method we identify a hierarchy of commercial activities on three levels: the neighborhood services for the direct living or working surroundings, the district (or in Kazakhstan we might call them *Rayons*) centers servicing a series of neighborhoods and the city centers, servicing the city as a whole including the outer lying residential areas, beyond the boundaries of the city, but still under the city's economical influence.

For this planological method, indicative figures have been collected of various western cities and from these the average has been applied, as this is deemed to be appropriate to the economical climate of Astana City. The gross floor area per inhabitant has thus been identified as 0.95 m². It should be noted that the SNiP 2.07.01-89, appendix 7, states an acceptable level of commercial floor area to be a minimum of 0.28 m²/person. The aforementioned figure of 0.95 m² is well above the minimum acceptable level but is justified by the economical analysis. Looking at the total population of Astana City in the year 2030 of 800,000 people, the total Retail and Commercial areas come to a total of 760,000 m² of gross floor areas.

Retail and Commercial activities on a neighborhood level consist mainly of small shops providing daily necessities and already can be found throughout the existing city fabric. District level commercial activities, like the Market Arman and the Eurasia Market are already well established, but based on the economical and planological calculations the number of such are to be increased. Calculations have taking into account the population of roughly 30,000 inhabitants per center

and maximum walking distances of up to 1 kilometer, identify the requirement of a total of 16 district centers by the year 2030. These District Centers will include land areas to develop the traditional Bazaar type of retail found at present in Astana City.

As for the City Centers, one area as such can be identified by the combination of Sine Tempore (the old Tsum Shopping Center), the Millenium Shopping Center and the shopping areas along Respublika, Abai, Kenisary, and Beibitshilik Streets. In these areas the total commercial and retail areas is to be boost to approximately 70, 000 m² to serve a quarter of Astana's population in the year 2030. While a second City Center is projected south of the Ishim River with an additional gross retail floor area of 220,000 m², which will finally grow to be the main City Center, combining Retail, Culture, Sports, Government facilities and Commercial Offices in one vibrant City Center.

Standards of Commercial facilities

Type of Center	Size and Servicing Area	Types of Commercial Facilities
Neighborhood Centers	Total Gross Floor Area per Center ranging from 350 m ² to 750 m ² , servicing 1,500 to 2,500 inhabitants	Local Corner Shops (bakery, dairy products, fruit and vegetables etc) Supermarket, for daily needs Postal Agency Cafe-Bar Restaurant
District Centers	Total Gross Floor Area per Center ranging from 3,500 m ² to 20,000 m ² , servicing 20, 000 to 60,000 inhabitants	Supermarket Shops selling products not required for daily needs (clothing, electrical goods, music and video articles) Cafes-Bars Restaurants Post Office Brach Banks Branches Entertainment (Cinema, Bingo)
City Center	Total Gross Floor Area per Center, ranging from 50,000 m ² to 150,000 m ² , servicing 200, 000 to 300,000 inhabitants	Shopping Center, Specialty Shops Cafes-Bars Restaurants Main Post Office Main Banks Entertainment (Cinema, Disco)

The total number of anticipated neighborhood centers is around 350 by the year 2030, with an average retail floor area of such centers at just over 500 m². This seemingly large number of neighborhood centers and their relative small size is justified as it integrates the existing pattern of shops found throughout the city, at relative close range of the residential units, which is relative to the climatic conditions of Astana City. However taking into account the growth of car ownership, the development of supermarkets, the increased popularity of multiple stores justifies the development of district centers. The number of anticipated

district Centers has been estimated at 18 by the year 2030. These District Centers will not only consist of commercial activities, but are to serve as full community centers with additional functions, such as educational, cultural, medical, and other community services described in the following paragraphs. The land area for district centers has been estimated at a plot ratio of 1 to 4, allowing for the integration of supporting community facilities and small businesses. In addition space reservations have to be made to allow for sufficient car parking areas. Figure A.2.1 shows the proposed locations of District Centers and City Centers

A.2.3 Educational Facilities

The educational system is based on a three tier educational system. From the age of 0 to 6 children are attending Kindergartens or so called Pre-schools. From the age of six till fifteen or seventeen, children will attend the Secondary School. The Secondary School consist of a total of eleven forms, the first three forms are also sometimes identified as Primary School, but are housed in the same structure as the higher forms. After completing a total of nine forms, students have the choice of joining a four-year college study (something similar to a vocational study) or continue to complete the full eleven forms. After completion the full eleven forms of the Secondary School the students have an option to continue their education at a University or join a College. In addition students who have completed their vocational college training have the opportunity to continue their study at University level.

At present there are 36 Kindergartens, 47 Secondary Schools, 18 Vocational Schools and Colleges and 2 Universities, 2 Academies and 15 Branches of Universities, including Institutes of Higher Education. In total providing 102,235 student places.

(1) Kindergartens

Based on the demographic data the percentage of 0 to 6 year old children would be 9.8% of the total population in the year 2000. However the survey data of existing kindergartens shows that the percentage of attendance has been falling down through past eight years from 64.2% in 1993 to 25.7% in 2000 followed by reduction of number of kindergartens.

	1993	1994	1995	1996	1997	1998	1999	2000
Total population (people)	292 000	289 800	285 500	280 300	277 100	280 500	322 400	330 748
Number of 0 to 6 year old children (people)	20 700	19 700	19 200	23 700	25 200	27 200	30 900	32 300
Number pupils attending kindergarten (people)	13 280	10 913	9 919	8 840	8 944	9 734	7 834	8 296
Percentage of 0-6 y.o. children of total population (%)	7,1	6,8	6,7	8,5	9,1	9,7	9,6	9,8
Percentage of attendance to kindergarten (%)	64,2	55,4	51,7	37,3	35,5	35,8	25,4	25,7

Therefore it will be required to gradually increase the number of kindergarten facilities to match the existing age group. Considering latest demographic tendency, the future percentage of kindergarten age children can be assumed at 10% of the total population. However as attendance to a kindergarten form of education is not compulsory, the future percentage of attendance can be assumed at 30% in the year 2010, 40% in 2020, 50% in 2030.

For the year 2010 the number of kindergarten pupils can thus be estimated to be $490,036 \times 0,1 \times 0,3 = 14700$ pupils. From the analysis of the existing situation it can be estimated that the average kindergartens has a capacity to accommodate 330 pupils. This number is expected to reduce in future as more important is the geographical location of the kindergartens in relation to the residential areas. In high residential areas it is assumed that the capacity will remain around 300 to 350 pupils, while in low residential areas this capacity will reduce to around 150 pupils per kindergarten, assuming the walking distance from the residence to the kindergarten will not exceed 500 meters. However on the average the number of kindergartens by the year 2010 can thus be calculated as $14700/330 = 45$ kindergartens or an increase of 9 kindergartens compared to the 2000.

The final location and size of the kindergartens and higher forms of education will always have to be agreed with the Education Authorities. But as a norm the schools must be located in the heart of the community, as part of local (neighborhood) centers containing shops, churches and other community facilities, provided with sufficient areas for playfields and greenery. It is estimated that new sites for kindergartens will be in the order of 2 hectares in extent, with 0,2 ha in reserve for future extensions.

For the planning years 2020 and 2030, the number of kindergartens required can be calculated as follows:

The Planning year 2020: the estimated population number is 687, 432 people

Number of children per population (10% of total population): $687,432 \times 0.1 = 68,743$ children.

*Total number of seats in the kindergartens (attendance rate of 40%)
 $68,743 \times 0.4 = 27,600$*

Assumed capacity of one (1) kindergarten is adopted as 330 seats

Number of kindergartens $27,600 / 330 = 84$

Considering the demand for 2010 of 45 kindergartens, the demand in 2020 is an addition of $84 - 45 = 39$ kindergartens

The planning year 2030: the estimated population is 769,024 people.

Number of children population (10% of total population): $769,024 \times 0.1 = 79,602$ children.

*Total number of seats in the kindergartens (attendance rate of 50%)
 $79,602 \times 0.5 = 40,000$*

Number of kindergartens $40,000 / 330 = 121$

Considering the demand for 2020 of 84 kindergartens, the demand in 2030 is an addition of $121 - 84 = 37$ kindergartens.

As noted above the actual number of kindergartens could most likely to be larger, if considering the location of kindergartens in relation to a maximum walking distance from their respective place of residence. Figure A.2.2 shows the proposed locations of Kindergartens

(2) Secondary Schools

Based on a survey over the past 5 to 6 years, 17% of the population is of the age eligible to attend a secondary school. In the year 2000, there are 47 secondary schools with a total capacity of 52,700 students, which means that only 94% of the eligible students can be accommodated.

Assuming that the size of secondary schools is averaging 1,500 students in the future, the number of schools can thus be calculated for the years 2010, 2020 and 2030:

In the planning Year 2010, the estimated population number is 490,036 people, with a pupil population $490,036 \times 0.17 = 83,306$ pupils. The assumed capacity of one school is 1,500 seats, which gives a total number of required secondary schools of $83,306 / 1,500 = 56$ schools. Considering the existing 47 schools in the year 2000, the demand for 2010 is an addition of 9 schools over the period 2001-2010.

In the planning Year 2020, the estimated population number is 687,432 people, with a pupil population $687,432 \times 0.17 = 116,863$ pupils. The assumed capacity of one school is 1,500 seats, which gives a total number of required secondary schools of $116,863 / 1,500 = 78$ schools. Considering the existing 56 schools in the year 2010, the demand for 2020 is an addition of 22 schools over the period 2011-2020.

In the planning Year 2030, the estimated population number is 796,024 people, with a pupil population $796,024 \times 0.17 = 135,324$ pupils. The assumed capacity of one school is 1,500 seats, which gives a total number of required secondary schools of $135,324 / 1,500 = 90$ schools. Considering the existing 78 schools in the year 2020, the demand for 2030 is an addition of 12 schools over the period 2021-2030. Figure A.2.3 shows the proposed locations of Secondary Schools

(3) Colleges

As of 2000 the existing number of students of professional schools and colleges made up 7,628 students. Based on the existing total number of population in the city of 330,748 people, the percentage rate of students of professional schools and colleges makes up $7,628 / 330,748 = 0.023 = 2.3\%$ of total population. In accordance with the Department of Secondary and Special Education, the existing availability of professional schools and colleges make up 70% of the total demand. In the view of absence of urban planning norms for schools for vocational studies, this data of 70% was taken as a basis for calculations. Thus a 100% availability rate for vocational students can thus be calculated as $0.023 / 0.7 = 0.033$ or 3.3% of the population.

Following these assumptions the number of students likely to attend vocational schools can thus be calculated for the years 2010, 2020 and 2030.

In addition based on the existing data, the average the size of a college or vocational school can be calculated as 400 students per school, assuming that this ration remains unchanged, the vocational schools can thus be estimated.

In the planning Year 2010, the estimated population number is 490,036 people, with a pupil population $490,036 \times 0.033 = 10,915$ pupils. The assumed capacity of one school is 400 seats, which gives a total number of required vocational schools of $10,915 / 400 = 27$ schools. Considering the existing 18 colleges in the year 2000, the demand for 2010 is an addition of 9 colleges over the period 2001-2010.

In the planning Year 2020, the estimated population number is 687,432 people, with a pupil population $687,432 \times 0.033 = 22,685$ pupils. The assumed capacity of one school is 400 seats, which gives a total number of required vocational schools of $22,685 / 400 = 57$ schools. Considering the existing 27 schools in the year 2010, the demand for 2020 is an addition of 30 colleges over the period 2011-2020.

In the planning Year 2030, the estimated population number is 796,024 people, with a pupil population $796,024 \times 0.033 = 26,269$ pupils. The assumed capacity of one school is 400 seats, which gives a total number of required secondary schools of $26,269 / 400 = 66$ schools. Considering the existing 57 schools in the year 2020, the demand for 2030 is an addition of 9 schools over the period 2021-2030

Professional schools and colleges are the educational facilities preparing engineering and technical staff of the middle level. Such facilities must have manufacturing capabilities (basic) or operating plants of related type for teaching according to the major and future profession, as a rule. Therefore, 1 college is located in the territory for operating TechnoPark, 2 colleges are located in the territory of Kirova village and Internatsionaly village, specialized at agricultural production and plant growth. One college is located in the territory of the hippodrome now under design and specialized at horse breeding, another one – in the territory of Zarechny village and specialized at greenhouse grading-market. 2 colleges, railway type, are located at the railway station # 40 and in the second residential block near the railway, and the other 3 colleges with new specializations are located in the new residential districts. Figure A.2.4 shows the proposed locations of Colleges.

(4) Higher Education

There are 19 higher education institutions such as universities and academies in Astana City, including the two universities; Eurasian University and Agrarian University. The total number of students attending to these forms of higher education in the year 2000 were 33,611 students or 10,1% of Astana City's population. This figure is large in comparison with the whole of Kazakhstan, where on the average only 2,4% of the population is attending some form of higher education. As a capital Astana City is expected to continue this high rate of higher education on an average of 8% to 9% of the population. By the year 2030 it is thus estimated that a total number of $796,024 \times 0.08 = 61,522$ student places are required. With exception of the present Eurasia expansion program it is expected that the existing institutes of higher education will not expand drastically. As modern teaching techniques will be more and more common ground, a newly developed area for a 21st century Eurasia University campus is proposed, south of the new developing area of Astana City. A total land area of 120 hectares will be reserved, to be developed in two stages of 60 hectares each. This development is proposed to start after the year 2010.

Up to the year 2010 the existing facilities of higher education are to be expanded to cater for an addition of around 11,000 students. The new Eurasia University will finally be planned to accommodate up to 70% of the total student population or 45,000 students. Figure A.2.5 shows the proposed locations of Institutions of Higher Education.

A.2.4 Health Care Facilities

(1) Hospitals

At present there are a total of 32 medical facilities in Astana City, consisting of hospitals and polyclinics. There 15 facilities with beds providing a total of 2,905 beds, based on the year 2000 population, it gives a service level of $2,905 / 330,748 \times 1,000 = 8,8$ bed per 1,000 inhabitants. This figure is relatively high as compared to figures from other major cities in the world (2,8 beds per 1,000 inhabitants in The Hague). As such it is not anticipated that this figure will rise in future, considering the expectation that service and health of the general population will improve. Using the figure of 8,8 beds per 1,00 inhabitants the future hospital demand can be calculated, assuming that the existing hospital facilities will improve, but not increase in capacity.

In the year 2030, the total population will reach 796,024 and with a ratio of 8,8 beds per 1,000 inhabitants, the total demand of hospital beds will be $796,024 / 1,000 \times 8,8 = 7,005$ beds. The additional demand is thus $7,005 - 2,905 = 4,100$ beds. It is expected that new hospital facilities will be able to accommodate around 500 beds, which would require a total of 7 new hospitals. These 7 new hospitals are planned in the newly developed areas. Needless to say that the final location of hospitals will be decided in consultation with the appropriate healthcare organizations, in accordance with SNiP 2.07.01-89, Attachment 7.

(2) Health Centers.

The provision of health and medical services has changed drastically in nature as professional specialization became the rule and various ancillary diagnostic services have become increasingly necessary. These circumstances and the growth of group medical practices should bring about a general concentration of services and facilities. This could lead to the development of Health Centers in which the normal general practitioner and local authority services covering medical, dental, ophthalmic, pharmaceutical and welfare provision would be combined with those services usually provided by the outpatient departments of hospitals. If such centers are to be operated economically they must serve quite a large populations normally in excess of 20,000.

At present there are a total of 19 outpatient health centers in Astana serving a population of 330,748. Statistical data shows that at present 14.4 people out of 1,000 people per day visit these outpatient health centers, resulting on average a capacity of each health center of around 250 patients per day. It is difficult to provide a forecast of future projections as it depends on many factors. At present the number of people visiting these outpatient health centers are low. As services and national health insurance schemes will improve, so will the general health of the population improve due to increasing economic prosperity.

The majority of the outpatient centers can be combined with hospital facilities and the forecast demand has identified an addition of 7 hospitals by the year 2030. In addition to the existing health centers or polyclinics and the newly planned outpatient health centers associated with new hospitals it is proposed to provide additional health centers at residential districts centers

which do not have a hospital or existing polyclinic. The total number of health center can does be estimated as follows:

Number and Locations of Proposed Health centers (Out Patient Polyclinics)				
Planning Region	Sub-Zoning	Existing Polyclinics and Hospitals	Newly Planned Hospitals and Polyclinics	Additional Health Centers Proposed
1. Central Planning Region	Residential District 3	7	0	0
	Residential District 4A	4	0	0
	Residential District 5	1	0	0
	Residential District 6	0	0	1
2. Northern Planning Region	Northern Industrial District	0	0	0
	Central Industrial District	0	0	0
	Planning District I	0	0	0
	Planning District II	0	0	0
	Planning District III	0	0	0
	Planning District IV	0	0	0
3. Southeastern Planning Region	Residential District 7	2	0	0
	Residential District 8	4	0	0
	Residential District 9	0	0	1
	Residential District 10	0	0	0
	Industrial District - Station 40	0	0	0
	Residential District 17	0	0	1
	Residential District 18	0	0	1
	Residential District 19	0	1	0
4. Southern Planning Region	Planning District V	0	0	0
	Residential District 11	0	1	0
	Residential District 12	0	1	0
	Residential District 13	0	0	0
	Residential District 14	0	1	0
	Residential District 15	0	0	1
	Residential District 16	0	1	0
	Planning District VI	0	0	0
	Planning District VII	0	0	0
5. Northwest Planning Region	Planning District VIII	0	0	0
	Residential District 1	1	0	0
	Residential District 2	0	0	1
	West Industrial District	0	0	0
	Residential District 4B	0	0	1
	Planning District IX	0	0	0
Number of Out Patient Health Centers		19	5	7
Total Number of Out Patient Health Centers		31		

Figure A.2.6.shows the proposed locations of Hospitals and Health Centers

A.2.5 Police and Fire Fighting Facilities

(1) Police Stations

Police is under the City Department of Interior Affairs. There are two District offices; one in Almaty District of Astana, one in Sary-Arka District. At present there are a total of 19 police stations in Astana serving the total population of 330,748 inhabitants or one police station per an average population catchment area of 17,500 residents. The existing urban planning norms do not contain norms for such organization types. Calculations, therefore, were based on existing number of police stations, since the City Police Department reported that existing number of police stations (19 points) in terms of quantity and location fully satisfy the demand of Astana City with population of 330, 748 people. In this regard, the situation as at 2000 is acceptable and will be adopted as the norm for future planning and development. It should be noted that although this number of police stations and the locations thereof sets the norm for the catchment area, another norm has to be set to determine the size of the police stations. As this varies greatly from country to country an arbitrarily norm of one policeman per 500 inhabitants is set to determine the average size of each police station to be 35 police officers.

Projected demand for number of Police Stations is as follows:

	2010	2020	2030
Population number	490,036	687,432	796,024
Catchment Area	17,500	17,500	17,500
Number of police stations	28	39	44

Total Number of Police Stations per District is as follows:

Number and Locations of Police Stations			
Planning Region	Sub-Zoning	Total Population	No of Police Stations
	Catchment Area	17.500	
1. Central Planning Region	Residential District 3	58.300	3
	Residential District 4A	69.600	4
	Residential District 5	43.900	3
	Residential District 6	46.600	3
2. Northern Planning Region	Northern Industrial District	5.624	0
	Central Industrial District	3.410	0
	Planning District I	0	0
	Planning District II	0	0
	Planning District III	0	0
	Planning District IV	0	0
3. Southeastern Planning Region	Residential District 7	81.891	5
	Residential District 8	30.800	2
	Residential District 9	29.174	2
	Residential District 10	11.000	1
	Industrial District - Station 40	10.062	1
	Residential District 17	69.272	4
	Residential District 18	28.391	2
	Residential District 19	17.918	1
	Planning District V	3.895	0
4. Southern Planning Region	Residential District 11	54.156	3
	Residential District 12	16.315	1
	Residential District 13	8.825	1
	Residential District 14	45.821	3
	Residential District 15	18.006	1
	Residential District 16	41.165	2
	Planning District VI (New Airport Planning Unit)	0	0
	Planning District VII	2.500	0
	Planning District VIII	0	0
5. Northwest Planning Region	Residential District 1	13.500	1
	Residential District 2	39.900	2
	West Industrial District	70	0
	Residential District 4B	45.929	3
	Planning District IX	0	0
Total Number of Police Stations			45

The locations of proposed Police Stations per District can be seen in Figure A.2.7.

(2) Fire Stations

There are 6 fire departments in Astana City. The central fire station is located in the north of CBD in Omarov Street. The number of Fire engines at each fire station varies between 2 to 8 fire engines per station. According to the SNiP 2.07.01-89 "Urban Planning", Annex 7, page 51, 1 vehicle (fire-engine) is required per 8,000 citizens up to 10,000 of total city population, for a population over 10,000 inhabitants the norm requires 1 fire

engine per 10,000 citizens. Based on these norms the total number of fire engines can be calculated. However as important as the number of fire engines, is the response time to reach the scene of emergency. The final locations of fire station is to be determined based on the number of fire engines per catchment area and the response time, in consultation with the Astana City Fire Department. The approximate location and sizes of fire stations have been calculated using the Snip code and is shown in the following table:

Number and Locations of Fire Stations				
Planning Region	Sub-Zoning	Total Population	No of Fire Engines as per SNiP Norm	No of Proposed Fire Stations
	Catchment Area	10.000		
1. Central Planning Region	Residential District 3	58.300	6	1
	Residential District 4A	69.600	7	1
	Residential District 5	43.900	4	1
	Residential District 6	46.600	5	1
2. Northern Planning Region	Northern Industrial District	5.624	1	1
	Central Industrial District	3.410	0	1
	Planning District I	0	0	0
	Planning District II	0	0	0
	Planning District III	0	0	0
3. Southeastern Planning Region	Planning District IV	0	0	0
	Residential District 7	81.891	8	1
	Residential District 8	30.800	3	1
	Residential District 9	29.174	3	1
	Residential District 10	11.000	1	0
	Industrial District - Station 40	10.062	1	1
	Residential District 17	69.272	7	1
	Residential District 18	28.391	3	0
	Residential District 19	17.918	2	1
	Planning District V	3.895	0	0
4. Southern Planning Region	Residential District 11	54.156	5	1
	Residential District 12	16.315	2	1
	Residential District 13	8.825	1	0
	Residential District 14	45.821	5	1
	Residential District 15	18.006	2	1
	Residential District 16	41.165	4	1
	Planning District VI (at the Airport)	0	0	2
	Planning District VII	2.500	0	0
	Planning District VIII	0	0	0
5. Northwest Planning Region	Residential District 1	13.500	1	0
	Residential District 2	39.900	4	1
	West Industrial District	70	0	0
	Residential District 4B	45.929	5	1
	Planning District IX	0	0	0
Number of Fire Engines / Fire Stations		796.024	80	21

The approximate location of fire stations is shown in Figure A.2.8.

A.2.6 Other Community Services

(1) Community Centers

Whilst many community needs could be accommodated in the community wings attached to schools, the demand for club rooms with storage, halls for dances and meetings, and hobby workshops, still have to be met. Whenever feasible district centers should be extended for community use, to cater for the interests for all ages, and to serve as social focal points for surrounding residential areas.

A.3 Formulation and Comparison of Area Expansion Variants⁵

In this Sub-Section, a comparison of alternative plans of area expansion shall be undertaken.

A.3.1 Characteristics of Area Expansion Variant Alternatives

The plans subjected for comparison are the following three alternatives.

- Plan A; the plan formulated by Kisho Kurokawa as an entry for the International Tender for the Draft of the Master Plan of Development of the New Center of Astana, which won the first prize,
- Plan B; the existing master plan of Astana worked out by a Saudi group, and approved in a RK Government decree in February 2000, and
- Plan C; an alternative plan formulated anew by M/P Team specifically for the present Study.

Figures A.3.1, A.3.2 and A.3.3 respectively show the alternatives A, B and C in detail in the same scale.

A.3.2 Format of Comparison

The comparison was made on the following four aspects:

(1) Characteristics of Residential Districts

A most part of new development shall be devoted to creating residential districts chiefly on the left bank of the Ishim. Attention was paid to the area, density and allotment of new residential districts under each expansion alternative.

(2) Characteristics of Central Business Districts

New central business district, accommodating the business, commercial and state managerial functions is one of the most important, prominent and influential districts of the new development area. The characteristics of the new central business district, such as the area, configuration and axiality, functions and allotment are the factors on which the comparison of alternatives shall be made.

⁵ This chapter, A.3, present supplementary information for Sub-section 3.5.2 of Main Report.

(3) Characteristics of Parks and Green Areas

With one of the basic concepts of Astana set as a *Symbiotic* city, where the artificial and manmade environment and the preserved and even created natural environment, have to find a *symbiotic* harmony, the characteristics of the parks and green areas is an important factor for comparison.

(4) Characteristics of Road Network

The road network not only determines the physical configuration of a city but also will constitute the logistic backbone. The conception and configuration of the road network in the new city is also an important consideration in the comparison.

A.3.3 Results of Comparison

The following summarizes the results of comparison of the alternatives.

(1) Characteristics of Residential Districts

The following table briefly compares the characteristics of the three alternatives.

Category	Plan A	Plan B	Plan C
Allotment	The development shall take place on both sides of the Ishim in linearly along the river.	The left bank of the Ishim shall be the major new development. Other development expands towards east-west directions from the existing city.	The development shall take place on both sides of the Ishim in linearly along the river.
Density	Not mentioned (not required at the time of competition)	Average density is 114 per./ha; depending on districts, 57 – 353 per./ha	Average density is 114 per./ha; depending on districts, 60 – 145 per./ha
Configuration	In all 8 units of clusters were formulated, of which one is Diplomatic City next to the Business City Population in 2030 was given as 1,000,000	In all 14 blocks were composed of which No. 1 was to expand to the west from the existing city and No. 8 through 14 were new development to the south. In 2030, existing city would accommodate 370,000; new city 290,000 Size of Blocks were 550 – 1,300 ha each.	In all 9 units of clusters were formulated, of which No. 11 through 20 are the new development mostly on the left bank of the Ishim. In 2030, existing and new cities would accommodate 400,000 of population each. Size of Blocks were 650 – 1,300 ha each.

Generally speaking Plan C has more room of flexibility than Plan B for future expansion, as it adopts a linear zoning system. The overall density of the residential areas is slightly above 110 person/ha for both Plan B and C, although Plan B presumes population density as high as 350 person/ha in some of the clusters. Plan C appears more moderate in this regard. Figure A.3.4 shows the difference of the three plans in this respect.

(2) Characteristics of Central Business Districts

The following table briefly compares the characteristics of the three alternatives.

Category	Plan A	Plan B	Plan C
Allotment	Capitol is located on the left bank of the Ishim, adjacent to the present Chubury district. Business City is to locate northwest of Capitol.	Central business district is located on the left bank of the Ishim, adjacent to the present Chubury district.	Central business district is located on the left bank of the Ishim, adjacent to the present Chubury district.
Configuration	Capitol shall be located in a diamond shaped plot 3 km x 500m. Business city shall be located in 3 units of triangular shaped plot, 1.5 km x 600 m.	The shape of the central business district shall be a rectangle wider in east-west direction, 5 km x 1.3 km.	The shape of the central business district shall be a T- shaped plot. The bar stretching east-westwards is 6 km x 1.3 km, which the north-southwards bar has the width of 600 m stretching southwards as the development proceeds
Functions	The capitol, or the government city, accommodates the Presidential Palace, Republic Parliament, Supreme Court and ministry buildings. Business city shall be composed of collection of 10 story buildings with commercial, recreational and cultural functions, combined by a pedestrian decks	The rectangle area shall be penetrated by a pedestrian deck in the center. From the west, there are business, commercial, diplomatic, governmental, and presidential functions. The height of the buildings is 140 m in the business area in the west, and gradually lowered to 60 m in commercial area, and 45 m in government area.	The T shaped alignment allows future expansion to the south, making better the shortfall of Plan B with increased flexibility for future. From the west, there are resort/sport, diplomatic/business, governmental, presidential greenery, diplomatic and cultural. The height of buildings is highest in the business area at 200 m.

The Alignment of the central business districts is similar. Plans B and C adopt a rectangle system, while that of Plan A adopts a T-shaped plot. The latter allows for added flexibility for future expansion, while at the same time limiting the areas for immediate development, and thus saving expenditure for construction. Plan C adopts the basic conception of Plan A, and yet modified by the ideas and structure of Plan B. Figure A.3.5 shows the difference of the three plans in this respect.

(3) Characteristics of Parks and Green Areas

The following table briefly compares the characteristics of the three alternatives.

Category	Plan A	Plan B	Plan C
Allotment	A vast buffer zone north of the Industrial city Continuation of greenery along the Ishim and two tributary streams. In the existing city, a belt of greenery extending north to south from the Train City to the Central park. Eco park combining the left bank areas in the new city and Taldy Kol reservoir.	A continuation of greenery from the Lake Maqbalek in the southern part of the city, named Green Valley Park. A buffer zone in the north of the Industrial city to moderate the micro climate.	A buffer forest along the proposed 3 rd ring road Additional forests in the southwest of the city and north of the Industrial city A system of greenery along the Ishim and two tributary streams, functioning as the city's recreational park Finger shaped greenery in the Industrial city utilizing the areas now occupied by sporadic residential areas A greenery belt in the center of existing city
Areas	Total 7,700 ha Green buffer; 2,500 ha Along rivers; 1,200 ha Existing city; 70 ha Eco Park; 4,000 ha	Total (new) 2,488 ha (existing) 98 ha	Total 21,050 ha Green buffer; 7,200 ha Forestation (North); 5,300ha Forestation (South); 5,300ha Along rivers; 3,000 ha Existing city; 250 ha

The proposal in Plan A adopts the idea of forming a vast green buffer around the city to provide for the protection of the city from the strong winds during the winter and dusts from the other three seasons, which would substantiate the moderation of micro climate of the city and allow for improvement of the apparently severe climatic and relatively unfavorable natural environment of the city. Plan C follows the general direction of Plan A, but more with practical considerations such as soil and hydrometeorological conditions.

Plan B has limited care on the formation of greenery around the city.

Figure A.3.6 shows the difference of the three plans in this respect.

(4) Road Network

The following table briefly compares the characteristics of the three alternatives.

Category	Plan A	Plan B	Plan C
Intra-regional traffic	Inter-city road and bypass ring road is proposed to avoid the inflow of inter-regional through traffic. However the role of present ring road was not clearly identified.	Present ring road (R1) was utilized for the through traffic and inflow to and outflow from Astana. Confluence of outbound and inbound traffic to/from Astana and intra-city traffic in Astana was inevitable.	Present ring road (R1) was utilized for the through traffic and inflow to and outflow from Astana. Confluence of outbound and inbound traffic to/from Astana and intra-city traffic in Astana was avoided to some extent by new ring road (R2).
Roads in new development area	Existing road network was utilized for the urban development in south and southeast directions. In planned business area and densely populated residential area grid road pattern was the base. In planned Cluster type residential area road, corresponding road network was adopted. Such network is convenient for new residential area although no clear development direction was shown.	Grid pattern road network was planned in south and southeast directions to develop new urban areas. New development area was bordered by circulation road. This circulation road was impairing the flexible development of urban area.	Grid pattern road network was planned in south and southeast direction to develop new urban areas. At the same time flexible development of urban area was secured.
Roads in finishing urban areas	In the existing urban area existing road network was utilized for traffic fluidity. In the planned new business area grid pattern was employed to enhance the traffic fluidity.	In the existing urban area existing road network was utilized for traffic fluidity. In the planned new business area grid pattern or loop pattern was employed to enhance the traffic fluidity and understandability. In the central urban area consecutive fly overs on the Astrakhanskoye Highway and Abylaikhan Highway were proposed. In terms of landscaping and project costs those need to be reconsidered. Several connection roads between northern area and southern area of the railway were proposed.	In the existing urban area existing road network was utilized for traffic fluidity. In the planned new business area grid pattern or loop pattern was employed to enhance the traffic fluidity and understandability. New ring road (R2) was proposed for the intra-city vehicle trips to alleviate traffic congestion and to avoid grade separations at intersection in the central urban area. Several connection roads between northern area and southern area of the railway were proposed.
Connection between new and old urban areas	Connection between existing and planned urban area was improved by providing 5 bridges.	Number of bridges connecting existing urban area and planned urban area was increased for better connection. Although the ring road was not evidently implied, ring pattern road was proposed to connect existing urban area and planned urban area. It enhances the fluidity of traffic movement in the central urban area and intensifies the connection of both areas.	Number of bridges connecting existing urban area and planned urban area was increased for better connection. Two ring roads (R1, R2) connecting existing and planned urban areas to enhance the fluidity of traffic movement in the central urban area and intensify the connection of both areas.
Public transport network	New rail transit system connecting Astana International airport and Akmola Station was proposed on the Astana-Rozhdestvenka Highway. However, details of the new railway transit were not proposed.	Tram line between Astana International airport and Akmola Station was proposed. To meet the two new north-south arterial roads with 6 lines are proposed to meet the spatial demand for tramway construction.	Roads with broad width in north-south direction, in new housing development area are proposed so that area servicing rail transit network can be realized in future.

The alternatives could be divided into two groups. Plans A and C adopt a ring road system, with 2 and 3 ring roads respectively, surrounding the existing and new urban areas of Astana. Plan B adopts a radial system,

where most of the arterial roads start from the center of the city and radiate outwards. The latter system tends to create congestion in the central part of the city, with high rate of traffic demand generation combined with passing traffic mixing together. Radiate system, on the other hand, could handle the traffic flow effectively by diverting the traffic flow on to the ring roads without increasing the traffic flow in the center of the city. Figure A.3.7 shows the difference of the three plans in this respect.

A.3.4 Selection of Area Expansion Variant

The basic concept of Plan A and C are basically the same, but Plan A is not consistent with the various ongoing development based on Plan B. On the other hand, Plan B lacks long term vision, such as not having mitigation plans for the future traffic demand in the center of the city, and the business center having a fixed plan where future expansion is impossible. Simultaneously, in Plan B, the residential district located in the southeast of the city has the possibility of experiencing the discomfort of noise pollution caused by the over flying airplanes. Considering these problems of Plan A and B, Plan C will be adopted as the plan for the development and the expansion of the new urban areas in Astana. The detailed advantage of Plan C is as follows.

(1) Adoption of Linear Zoning System

The city of Astana has been composed as a linearly structured city bounded by the rail tracks on the north and by the Ishim on the south, and this structure will not be changed significantly in the future. As the city grows in the future to achieve the socio-economic framework already established up to 2030, it is important to maintain balanced urban functions and facilities in every intermediate stages of development. The linear zoning system as adopted in Plan C is suitable and appropriate as a planning concept for an ever-growing city such as Astana, not only from the urban planning aspect but also from the Value for Money viewpoint.

(2) Well-maintained amenities for urban dwellers

New residential areas mainly on the left bank of the Ishim shall be developed in clusters in Plan C, where each cluster shall have access to the greenery within the cluster and outside. The residential environment thus created shall have high level of amenity for urban dwellers with respect to the green

and water body network the city provides. Plan C also has alleviated the effects of expected noises from the new International airport by re-arranging the configuration of residential areas.

(3) Formation of green network

Plan C adopts a conception of urban greenery in network system, which capitalizes on the ecological linkage of nature. This introduces connection of vast buffer greenery along the Ishim together with greenery areas along its tributaries, urban parks, roadside trees and even sporadic pocket parks in the city in a spatially extended network linkage. The network of greenery would provide not only buffer for separating otherwise continuous urban areas and bound the urban areas from natural areas around it.

(4) Effective Transportation Network

Plan C adopts a ring-road system of arterial roads, consisting three circular roads around the city, which is an effective solution for the projected future traffic volumes. The ring-road system will accommodate traffic flows not only between the existing and new urban areas, but also provide detour routes for the traffic passing through Astana as in bypass road, and give increased access to all the areas in the city to inter-city highway network.

(5) Balanced Development in New and Old Urban Areas

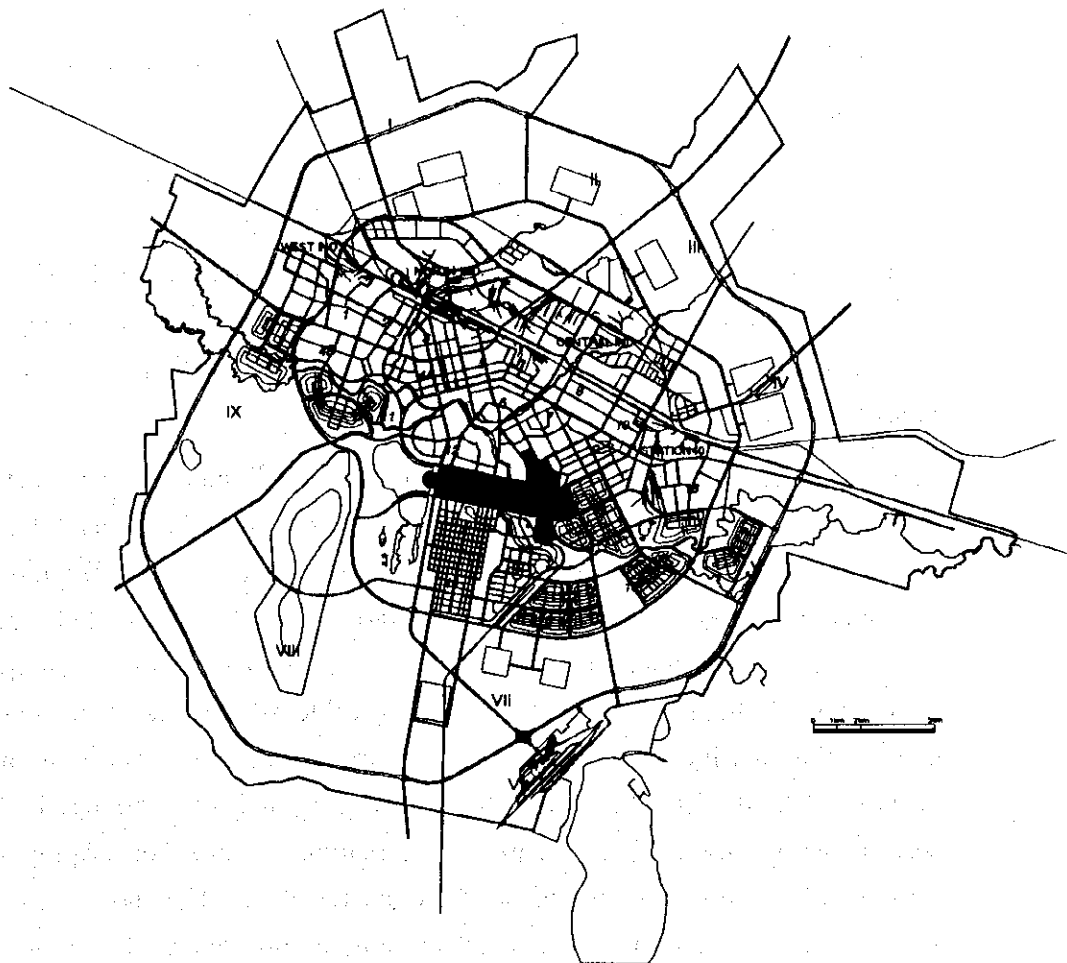
Astana shall be composed of the existing urban areas as of now and a new city that will be constructed mainly on the left bank of the Ishim, and maximum attention needs to be paid to the balance of the existing and new urban areas. Plan C proposes to remedy the shortfalls of the existing city, such as lack of urban parks and incorporates a plan to redevelop some of the low-density, underdeveloped residential areas in the existing urban fabric.

As discussed above, the area expansion plans are scrutinized from various perspectives, and Plan C, the present plan formulated by M/P Team surpasses other plans and adapts the good and healthy planning directions in other plans. It is therefore concluded here that Plan C is to be adopted as the area expansion plan.

The Master Plan hereafter shall be based on this area expansion plan.

A.4 Future Land Use and District Plan⁶

A.4.1 Government City



The most important element of a new capital is the location of its government facilities, such as the President's Administration, the Parliament, Ministries, State Courts and Diplomatic Areas. At present these facilities are housed within the existing city fabric mostly in converted building structures. As there is little room to expand the Government facilities within the existing city structure without destroying the existing urban fabric, a new area is to be selected and developed to provide permanent environment for the government facilities.

Earlier studies have confirmed the most appropriate location for the new Government City to be the area south of the existing Chubary Village on the left bank of the Ishim River. It is close to the existing City, and is relatively under-developed agricultural land for growing vegetables. With this planned

⁶ This chapter, A.4, presents the full text of Sub-section 3.6.3 of Main Report.

location for the Government City, the Ishim River will become a central feature of the City. Planned infrastructures will allow the integration of the residential developments east of the city, on the right bank of the Ishim River, and maybe the most important feature of the location of the Government City will be that it provides for an impressive approach to the city from the International Airport to the south.

The basic structure of the Government City is formed by a chain of Presidential, governmental, semipublic and institutional areas, diplomatic areas as well as cultural and commercial areas. In addition to the main axis of the city, namely the North-South axis (City Axis), the Government City is located along a strong East-West axis. This axis spans over the Ishim River ending in a semi-circular diplomatic quarter in the east.

The total land area allocated for Government City is close to 950 hectares, of which 400 hectares are located on the left bank of the Ishim River. Out of the total land area, 200 hectares of land has been reserved for the development of Diplomatic Quarters, including the Diplomatic Village south of Chubary Village. Approximately 40 hectares of land has been allocated for the majority of Ministries, Parliament, High Court and Presidents' Affairs. Semi-public and commercial facilities will occupy an area of 60 hectares. The remaining 650 hectares of land will be allocated for landscaping and water bodies, including a section of the Ishim River. Three main features of this landscaping form an important base in the development of the master plan. The shores of the Ishim River are developed into River Parks to sustain and improve the Eco-system of the river delta. Furthermore two Green Zones running perpendicular to the Government City Axis will connect the Southern Green Buffer with the Northern Green Buffer, completing the Eco-corridor in the Master System.

The center of the Government City Axis is marked by a tall monument structure, a nearly 200m monumental tower, to the east are located the three powers of the Republic of Kazakhstan: Executive, Legislative and Judiciary as well as the main governing institutions, government agencies and other public administrations. At the western end of Government City Axis, on the shores of a proposed lake development, the Islamic Culture Center is located. The Presidents' Residence is planned at the eastern end of Government City axis, bordering the Ishim River.

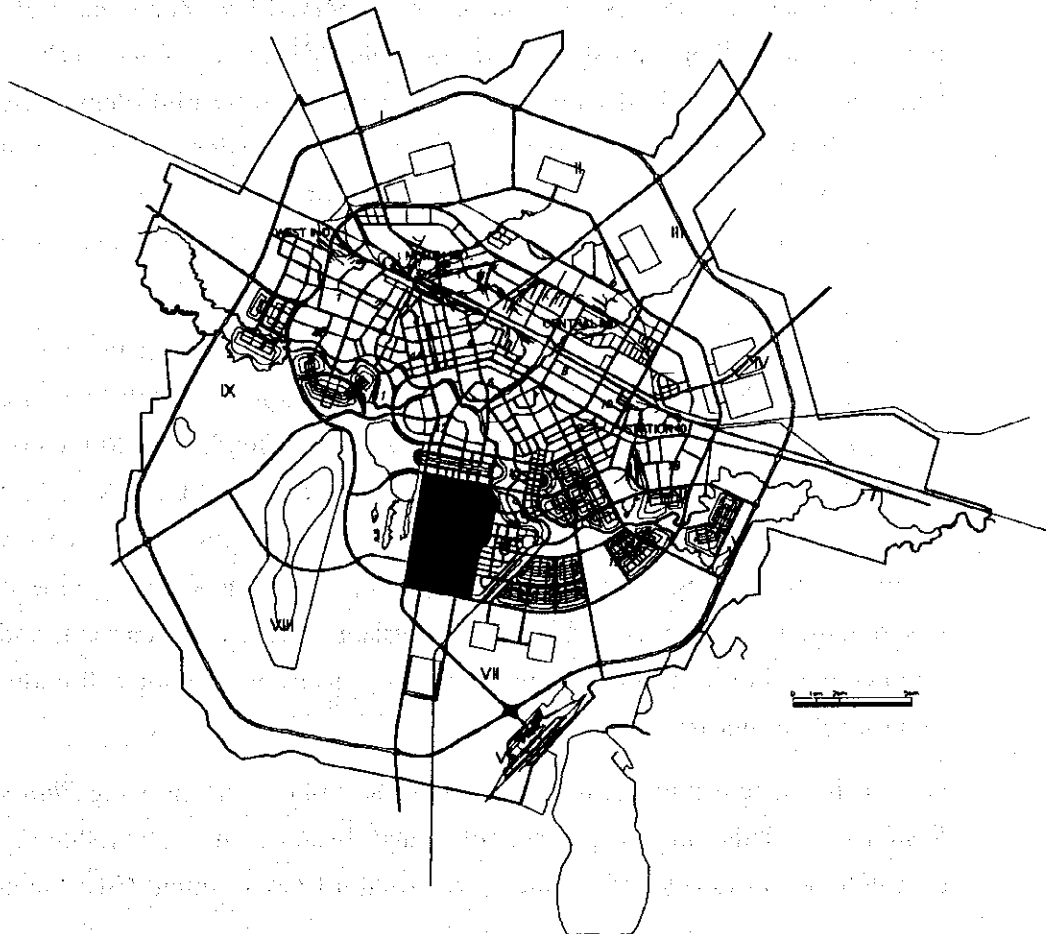
Public urban spaces like a plaza are planned in the Government City zone. A commemorative plaza is set at the cross-point of the Government City Axis and the Business City Axis. Between the Parliament Building and the High Court, a parade plaza is set for welcoming foreign delegations. All pedestrian routes

through the Government City are to be densely landscaped for a pleasant walking environment and to provide protection against the elements. Elevated walkways are projected to provide comfortable pedestrian movement during the long winter months. Most podium structures of the main building structures are proposed to house public facilities to enhance the usage of the Government City around the clock.

It is estimated that a total number of 75,000 persons will find employment in the Government City by the year 2030, or 17.2% of the total working population, while in the first ten years the numbers of employees is estimated at 54,000. Including all public and semi-public facilities, including hotels, commercial facilities, sports-, cultural and entertainment facilities, the total built up floor area has been estimated at 2,174,000 m², of which 1,750,000 m² will be for office areas. So as to facilitate the employment growth of 40% over a period of twenty years, a well balanced phasing map should be developed as to ensure a continuous growth, but wherein each phase will live up to the image of a complete City.

A.4.2 Business City

The urban fabric of the existing city center (mixed use zone) is estimated to



accommodate an increase in office employment of 25%, whilst the Government City can absorb around 17.5% of the total office workers. Accordingly additional floor space has to be allocated to house the remaining 16%, or approximately 70,000 office workers, of the total office working population by the year 2030.

It is assumed that the new businesses will have a close working relationship with the government agencies, as such a new business city is planned south of the Government City, along the main access road from the airport into the city. In addition to office buildings, this area is planned to provide commercial facilities and high density housing for approximately 5.7% of the city's population.

This new Business City is planned in the extension of the north-south Business City axis of the existing city center. As such the city's business accumulation can be described as being divided into two parts, one in existing city center, the other located in southern new development area, with its center in the Government City.

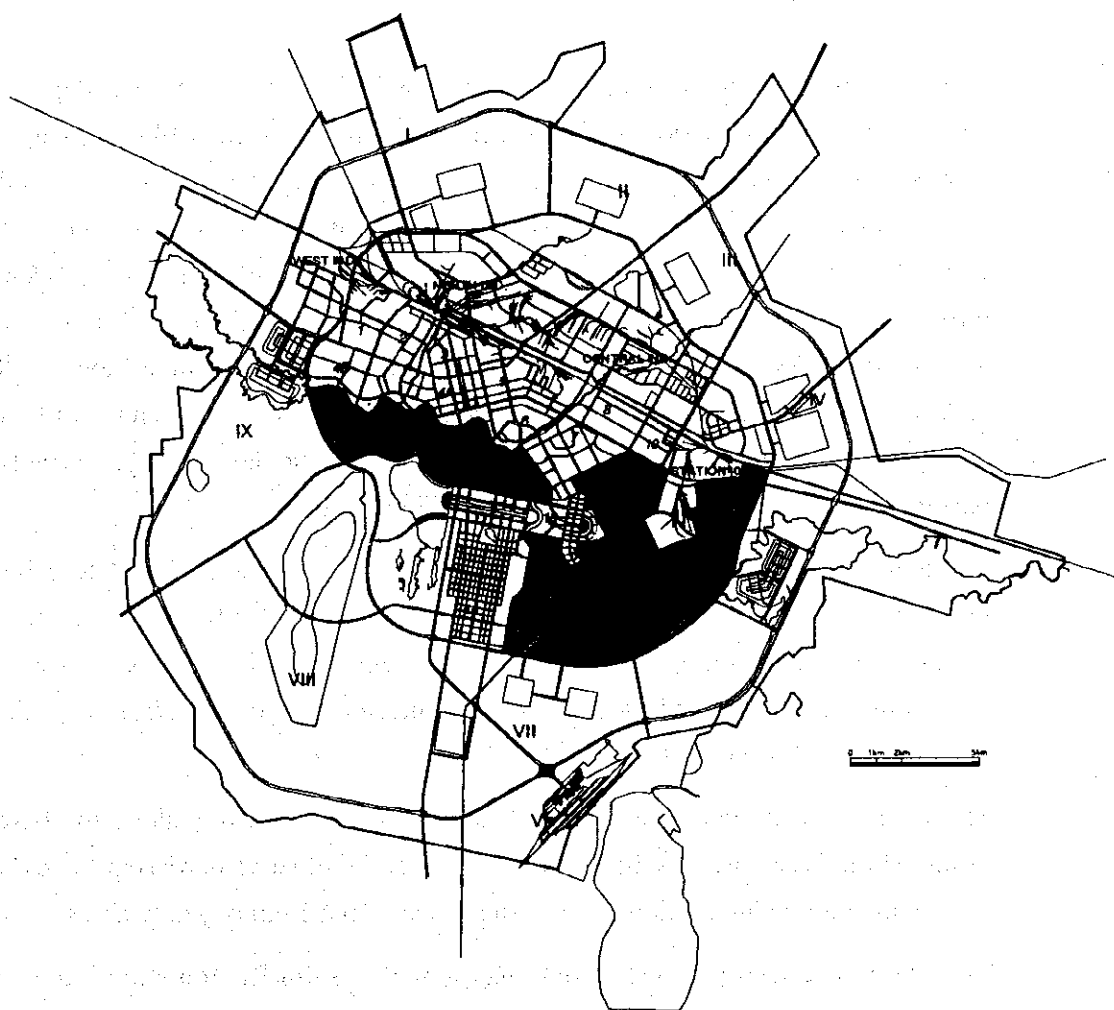
Both of the business areas serve as major business and commercial cores and are connected to other zones by a means of public transport as well as by the main city roads. Both have a strong linear shape. The northern one, which is called future business corridor, is surrounded by the Mixed Use Zone and will have an intensive interaction with the functions of the Mixed use Zone. The southern part, which is called the Business Area, is surrounded by high-density residential areas and will be different in shape and use from the residential areas in the River City. This high-density residential area is planned so as to interact intensively with the Business City, Government City and River City and surrounding parklands.

Building guidelines will ensure that building structures are in the character of a capital city, keeping balance between context and variety. At the core area along the central avenue construction of buildings up to a height of 100 meters will be permitted. At the surrounding area building heights should not exceed 30 meters above ground, and the height of low-density areas towards to east will be controlled by a height limitation of 15 meters. Landscaping guidelines will ensure particular urban design. Plazas, gardens, various shaped roads and streets like avenues; boulevards, promenades and a pedestrian network will underline the importance of this area.

One of the basic design principles of the master plan concept is the *Philosophy of Symbiosis*. This means consequently that besides the establishment of the complete newly developed business area south of Government City, the center of

existing city will be redeveloped into an attractive business and commercial area, and the existing and new City are to co-exist in harmony. With regard on the existing city, the business and commercial core will be redeveloped as a green corridor connecting to the green corridor in the newly to be developed business city.

The total population in the new Business City is expected to grow to 45,000 residents by the year 2030, occupying a land area of approximately 300 hectares. The business and commercial land areas are estimated at 45 hectares accommodating the estimated 1,200,000 m² of gross office and commercial floor areas.



A.4.3 Residential Zone

The population of Astana City is expected to grow from its present level of 320,000 inhabitants to a projected level of 800,000 inhabitants by the year 2030. The present urban fabric of Astana City mainly on the right bank of the Ishim can absorb an additional 80,000 inhabitants by increasing the density of existing

residential developments in the City Mixed Use Zone and in the existing residential zones east and west of the Mixed Use Zone. Therefore additional areas have to be allocated for the development of residences to house an additional 400,000 people.

As the character of Astana City is changing to a Government and Business orientated society and the income per capita will increase, so will change the social structure of the typical family. At present the Statistical Department has analyzed that the present housing unit occupation is 3.8 inhabitants per dwelling, it is assumed that this figure will reduce to 3.1 to 2.8 inhabitants per dwelling by the year 2030. As such in years to come a total of 160,000 housing units have to be built.

At present the residential development of the City is in the form of cottages, free standing villa's, 3 to 5 storied apartment blocks and apartment blocks of up to 9 stories and in recent years apartment blocks of up to 20 stories have been added. The average net residential density is approximately 100 persons per hectare. For future projections it is proposed that, on average a slightly higher net density will be applied, to overcome the present negative effect of the large Micro Region apartment blocks and the large open spaces between the apartment blocks. The lack of variety in dwelling types, the oversized open spaces exposed to cold winds during winter months, and their lack of intimacy and social security, warrants the reasoning to increase the population density in these areas.

The new Residential Zone will be developed for new Capital City of Kazakhstan to provide a safe and convenient living environment with sufficient amenities and public facilities, making each zone self-sufficient on the micro level. The zones are planned following the basic concept of master plan of *sybiosis* in order to meet the needs for the new era.

The Residential Zone consists of groups of residential clusters along the borders of the Ishim River "River Cities" as well residential clusters bordering the existing townscape fabric "International City" clusters and four Embassy City areas.

The chain of residential clusters running along the Ishim River are located on both banks of the river at favorable, flood safe, locations. This concept allows the river to meander inside a green network. Embankment on the river banks combining pedestrian promenades and access roads will function as flood prevention measures. Thus the Residential Zone is structured by a system of a green network that is focused on parklands created along the borders of the Ishim River. Water and green space make their way into the residential clusters.

Each residential cluster is surrounded by a ring road providing the main access to the residential areas. The ring road is separated from the housing areas by a green belt; this greenbelt forms a link in the green network running through the center of the residential clusters. The residential areas are built in a hierarchy from mid to high density facing the green central zone to mid to low density in the outer areas of the residential clusters.

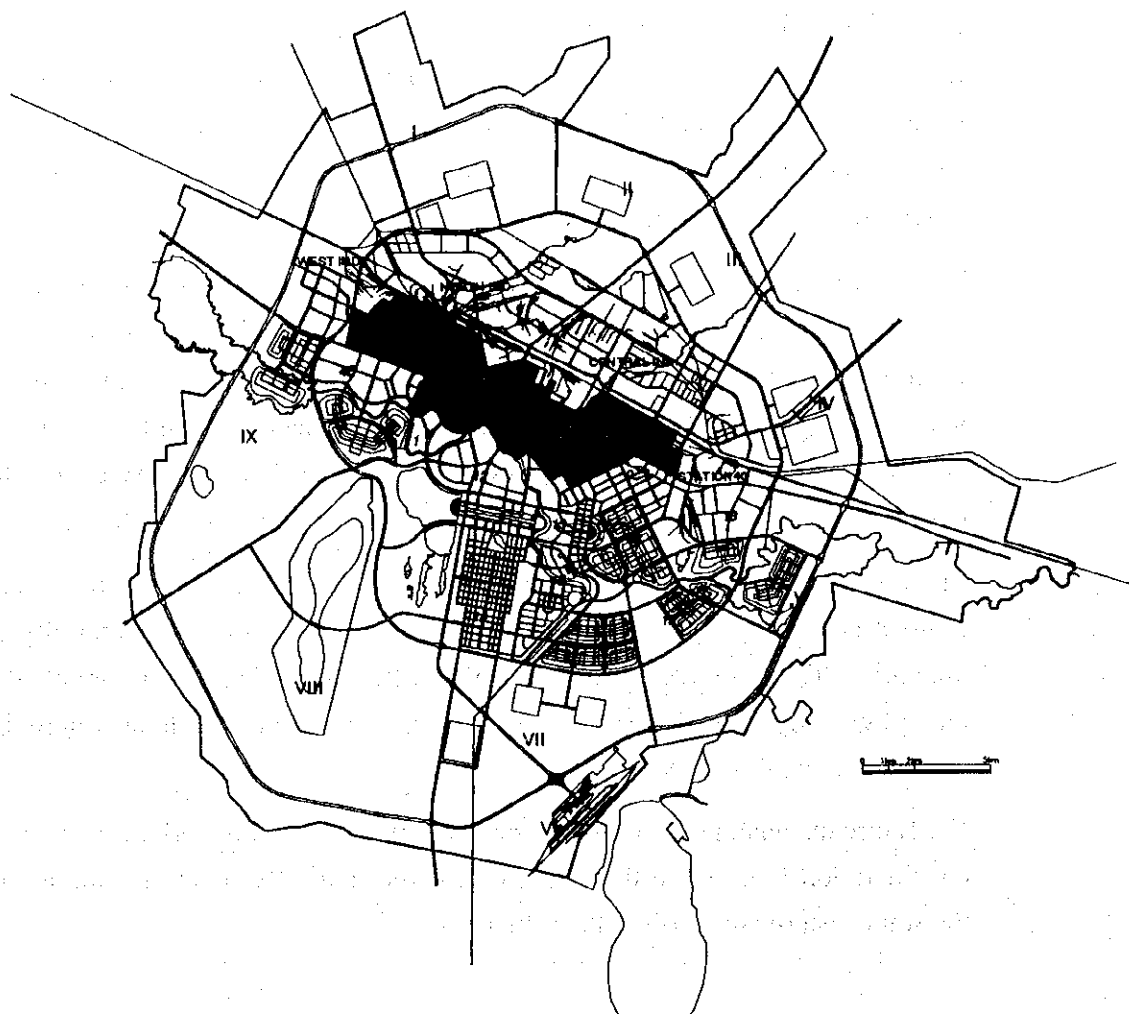
The central green zone is to facilitate the public amenities supporting the basic needs of the residents, such as schools, commercial district and neighborhood centers, community centers, sports and leisure activities. The residential clusters vary in size and density, closer to the existing city development the net density on an average is 170 persons per hectare, while further from the city center the net density reduces to an average of 70 persons per hectare.

The green belt spaces around and within the residential clusters are provided with a direct access to larger green areas and as such form part of the total city green network. They provide ecologically high value, a pleasant environment -visually and physically-, as well as serve protective functions such as microclimatic buffers and wind buffers.

For future expansions beyond the projected planning framework of the year 2030, consideration is given to the future extension of the Residential Zone mainly in the southeastern and northwestern direction

A.4.4 Mixed Use Zone

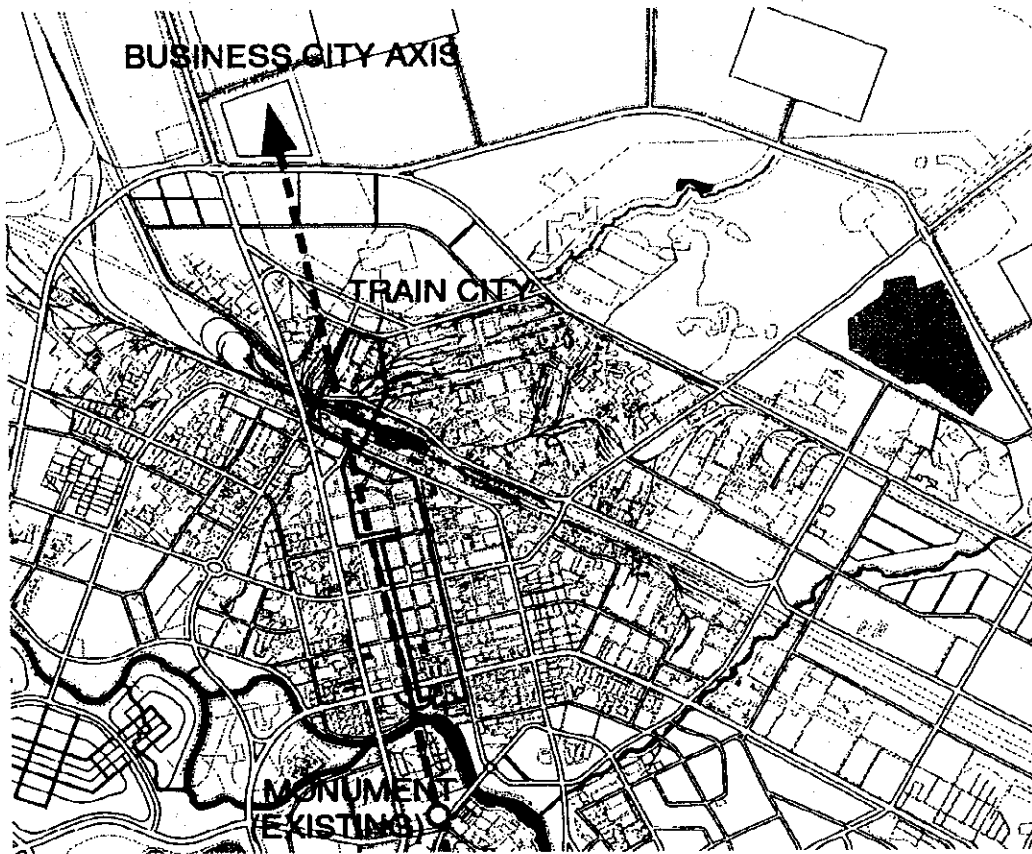
The mixed-use zone can be loosely identified by the existing city area bordered to the north by the railway tracks, to the south by the Ishim River. In this area the origin of Astana City is found and it is not surprising that this area is the hub for business and commercial activities in the city. The total land-area is approximately 4,184 hectares, with a total population of 288,300 people in the year 2000. While it houses more than 80% of the present population of Astana, the land-area represents less than 25% of the total original City boundaries. Towards the east and the west across the Akbulak and the Sarybulak, these areas with mixed development are more restricted to the use of light industries and stockyards in combination with residential development. It is proposed that these areas, particularly zones 1 and 2 and zones 8 and 10, between the railway tracks and the main roads leading in and out of Astana, will be slowly transformed to residential use only.



While at present the mixed-use zone incorporates residential, commercial, light industries, trade and all government functions from a state level to the local municipal level, this area will see drastic changes by the development of the Government City on the left bank of the Ishim River. In the development of the Master Plan it is extremely important to incorporate the development of the existing City fabric. The development of this mixed-use zone is to follow the *symbiosis* of existing Traditional Culture and the new Capital Culture of Astana City.

The existing city axis running from the railway station to the existing Town Park on the left bank of the Ishim River is proposed to be strengthened and to be developed as a Business City Axis. The graphical center of this axis is formed by Beitshilik (Mira) Street and is bordered by the main thoroughfares of Sary Arka Street and Respublika Street, both giving access to the developing areas south of the Ishim River. The center of this axis consists of mostly historical buildings of up to three stories high, and it is proposed to develop this area as a

linear green heart, with an emphasis on pedestrian movements while duly protecting the historical buildings.



As such newly developed buildings in this area are proposed to be of similar low-rise structures and the plot ratio is to be kept low so as to allow for extensive greening of the area.

The areas along the main through-fares, along the Sary Arka and Respublika Streets, are lined with residential blocks of up to nine stories, with mixed use podium structures of up to three stories along the Respublika Street. It is proposed to increase the density in these zones, by developing open land areas, with a variety of residential types, mixed with public and private services. Thus the population of this mixed-use zone can increase by 50% to house a total of 420,700 people or 53% of the total population by the year 2030.

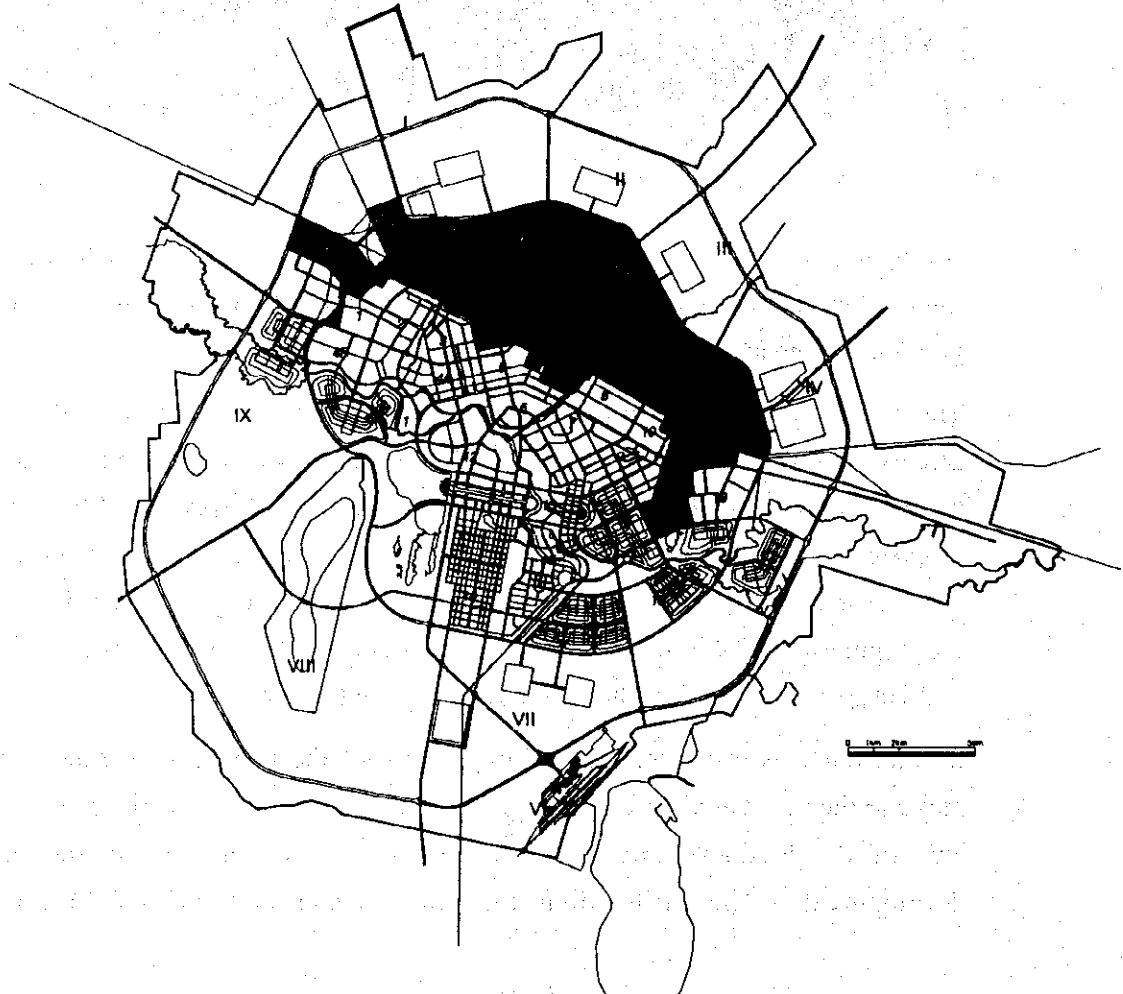
In addition it is estimated that although most of the Government functions will move to the new Government City on the left bank of the Ishim River, the existing axis of the Business City will see an increase in commercial and business development. The Millennium Shopping Center and the TSUM Shopping

Center will form the catalysts to develop this area into a Commercial City Center, with expansions in linear direction along the center of the Business Axis. It is estimated that the mixed-use zone at present consists of 152,000 m² of commercial floor area or 90% of the total city commercial floor area. Based on the economical forecast and the planned commercial strategy, the commercial floor area is to increase to more than double in size to 328,000 m², by the year 2030, this would form 43% of the total commercial floor area of the entire city.

Similarly the office floor area at present in the Mixed Use Zone is estimated at 1,380,000 m² or 75% of the total office floor area in Astana City, the total number of office workers is estimated at 82,000 workers or 55% of the total working population. Despite the establishment of the new Government and Business City on the left bank of the Ishim River, the mixed use zone will still see a rise in the office demand, from the year 2000 to the year 2030 by 21% to a total office floor area of 1,675,000 m².

A.4.5 Industrial Zone

The industrial zone consists of the existing northern and central industrial areas,



the western industrial zone, Station 40 and will extend towards the north up to the inner ring road to allow for future expansion. The total land area reserved will be 8,504 hectares or 12.15% of the total land area for Astana City.

The existing industrial buildings are mostly under-used and are in a state of deterioration in the majority. Furthermore in the industrial area there are some incidental residential areas to be found. The Master Plan proposes to reduce the residential areas and limit these areas to two locations, Zheleznodoezhny Settlement to the east and the existing settlement to the west in the northern industrial area, while the remaining residential settlements will be demolished.

As new industries will be developed in this area, land will not be immediately available always, demolishing of abandoned industrial buildings and cleaning up of soil conditions will require time and funds. As such it is proposed that the existing industrial area will be expanded to the north, east and west, bordering to the northern buffer zone.

The land areas that will become available after demolishing of existing structures and clean-up of land areas are proposed to be landscaped. In particular the areas along the extensions of the Akbulak and the Sarybulak will be developed as green fingers and will form an important link in the Eco-Corridor Green Network.

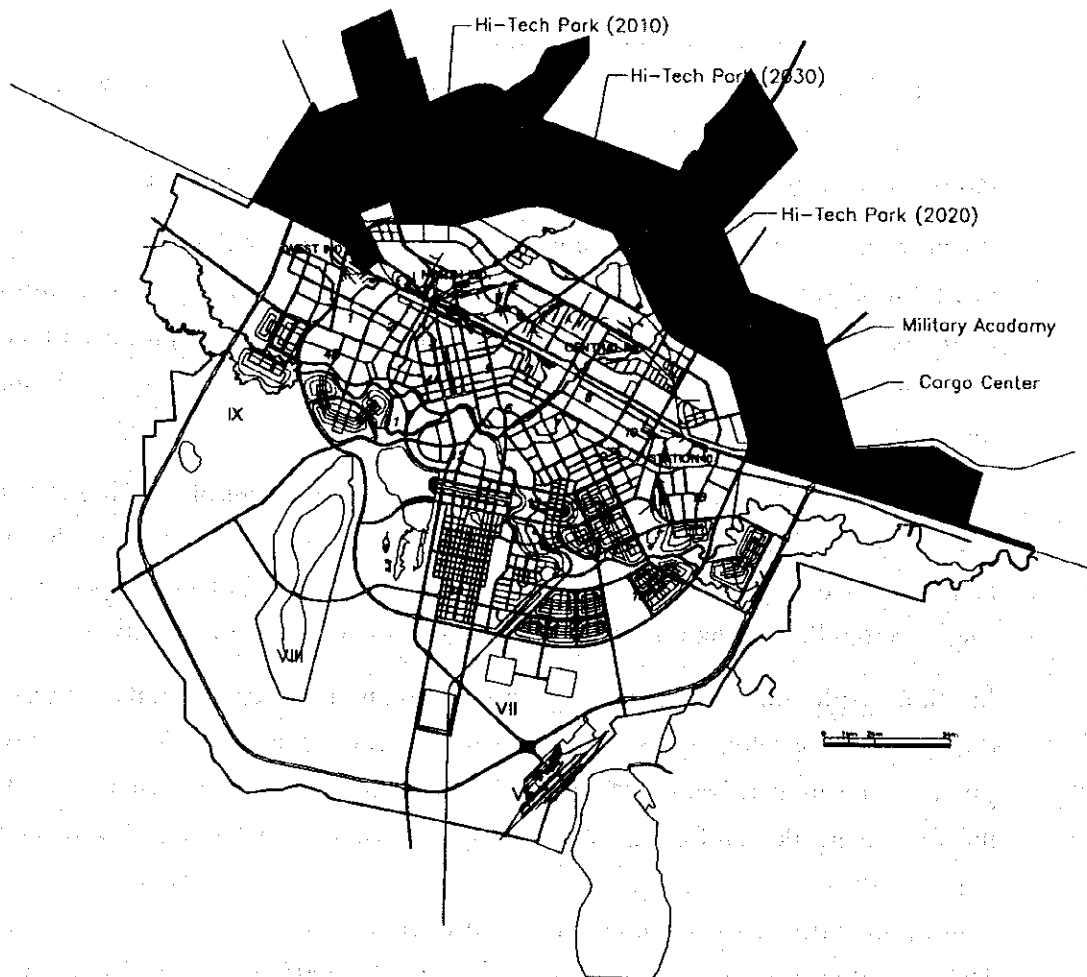
In line with the regional development plan for Astana City significant development of industry is not assumed, except for construction. Priority is given to the modernization of production industry for those industries fulfilling the increasing demand of the Astana City, especially in the small and medium scale industries. The industries targeting markets outside Astana or environmentally harmful industries need to be closed, transformed or relocated. The agricultural machinery factories need to be gradually converted to assembling plants with closer co-operation with plants in other provinces.

Main industrial facilities that are proposed to be developed in the industrial zone are: food-, beverage-, forage- and tobacco industries, textile and apparel industries, wood and wood products, furniture manufacturing, manufacturing of pulp, apparel and paper products, publishing and printing industries, chemical production, manufacturing of plastic and rubber products, ceramics, ferrous and non-ferrous metallurgy production, metal products, machinery, electronic equipment and production of transport machinery.

The southern part of Station 40 incorporates existing dacha areas and it is proposed that these dacha areas will be relocated to make room for future development of residential areas. An area of 136 hectares will house a total of 10,062 people, absorbing the existing Promyshlenny Settlement by the year 2010.

Overall the industrial zone is estimated to employ a total of 94,000 persons or 21.5% of the total working population by the year 2030.

A.4.6 Northern Buffer Zone



The Northern Buffer Zone is identified as an area bordered to the north by the expanded city boundaries and to the south by the existing northern and central industrial zones. The Zone encompasses an area of approximately 15,173 hectares, or 21.68 % of the total city territory. Main features in this area are the proposed city ring-road, Hi-Tech Industrial Zones (for development after 2030), a Cargo Center located north of the proposed new Cargo-Train Terminal and a Military Academy.

It is proposed to transform this northern buffer zone into a wind-buffer-zone and an Eco-forest. The proposed outer ring road will be lined with trees on both sides to protect the road from drift snow in winter seasons from the south west and dust storms in summer from the agricultural fields to the north-east. The land areas between the existing industrial zones and the ring road will be transformed

into an Eco-forest, with "islands" of high-tech industrial parks. This Eco-forest will assist in improving the Eco-environment of the city and surroundings by improving the air quality.

The proposed Hi-Tech Industry zone consists mainly of three Hi-Tech Parks planned for development beyond 2030. The first phase is planned in the north-west region of the Northern Buffer Zone, which consist of a site area of 150 hectares. Each consequent phase will be of a similar area of 150 hectares and are planned in the north-east and north of the northern buffer zone. Each park will have a direct access from the planned inner ring road and as such will have direct access to the city center and the airport zone to the south, with links to the outer ring road giving access to the outer territories of *Akmola Oblast*.

The Hi-Tech Industrial Parks are expected to house clean industries, such as research and development facilities on advanced (information) technology, scientific research institutes covering humanitarian, mathematical, technical and biochemical fields, laboratories, electronics and computer related industries. Each Hi-Tech Park, consisting of an area of 178 hectares, is expected to employ on average 20 persons per hectare, which adds to a total of approximately 3,500 workers per Hi-Tech Industrial Park.

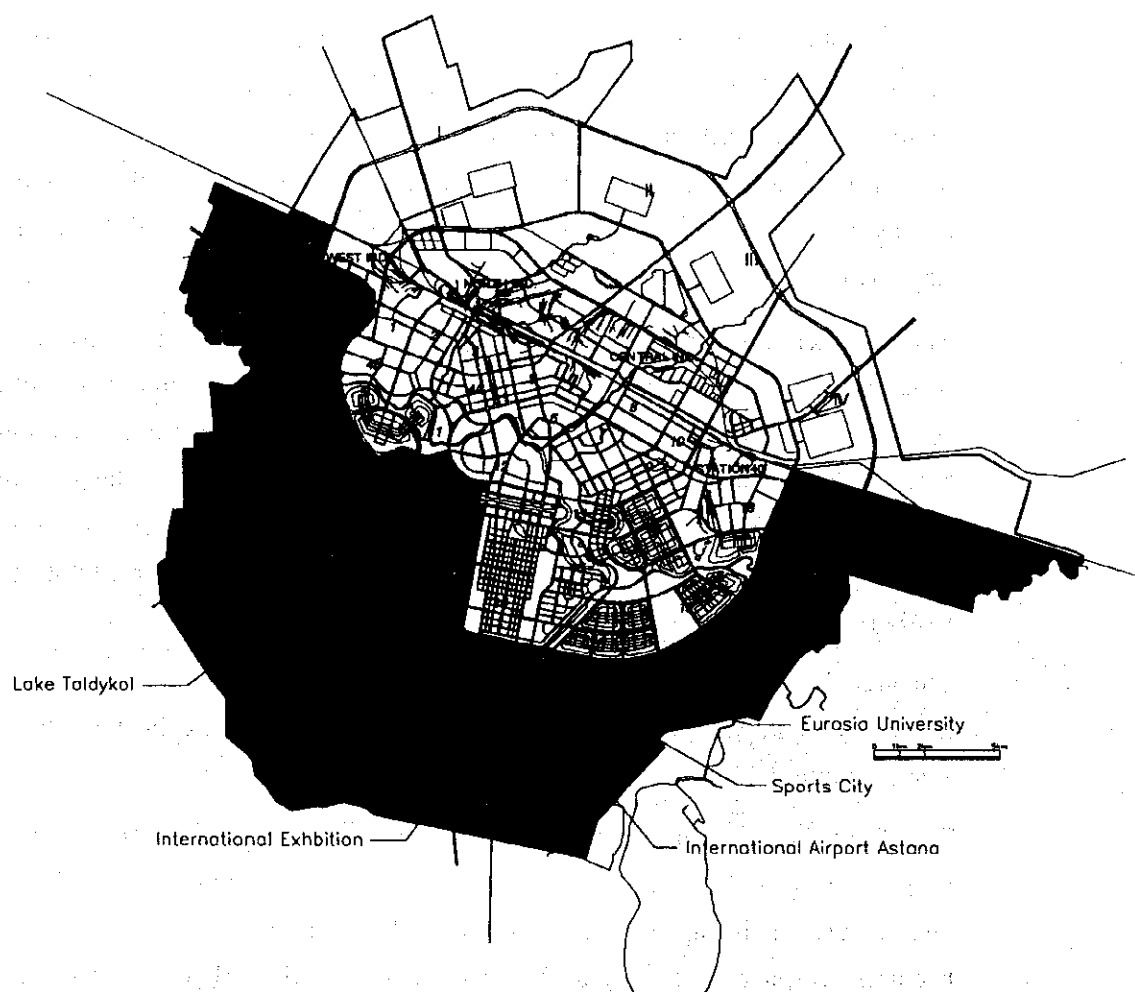
The area for the Military Academy is estimated to be developed between 2010 and 2030 in two stages, growing from an initial land area of 50 hectares to its final size occupying 145 hectares.

The Cargo Center in the Northern Buffer zone, planned north of the newly proposed Cargo Train Terminal, east of Astana City, is planned to be developed in three stages, each stage taking up an area of 90 hectares to a total land area of 270 hectares, employing a total of 4,000 workers, or 15 workers per hectare. The newly proposed Cargo Terminal outside the urban city fabric will relieve the city center from undesirable goods traffic, from loading and unloading facilities, goods storage facilities and goods road transport. A new railway line is also proposed to branch off from the new Cargo Train Terminal into the industrial zone as such relieving the existing railway station from any goods traffic and thus leaving this area to be developed for passenger rail traffic only. A further advantage of the location of the Cargo Center is its access to the proposed ring road system and direct link with the Astana Airport.

A.4.7 Southern Buffer Zone

The Southern Buffer Zone is identified by an area bordering to the south of the expanded city boundaries and to the north by the newly to developed River City

residential clusters and the Business City. The total area encompasses an area of approximately 32,632 hectares, or 46.6 % of the total city territory. Main features in this area are the proposed city highway southern bypass, sites for a University Campus, a Sports City, International Exhibition Center, and the



International Airport of Astana and Lake Taldy Kol.

It is proposed to transform this Southern buffer zone into a wind-buffer-zone and Eco-forest. The proposed outer ring road will be lined with trees on both sides to protect the road from drift snow in winter seasons from the south west and dust storms in summer from the agricultural fields to the north-east. This Eco-forest will assist in improving the Eco-environment of the city and assist in improving the air quality.

Mainly caused by very unfavorable soil and hydrological conditions, the majority of land areas in the Southern Buffer Zone will not be developed but designed as climatic buffer and landscape component, as well as water regulating component and an area for leisure activities. Improving the water quality, ensuring safety of

dikes, possibly rearranging the huge Taldy Kol reservoir to provide irrigation water for outer lying agricultural lands, are an important task to raise the environmental quality at the southern parts of Astana.

The International Airport of Astana is undergoing re-construction works to increase the capacity of the number of flights and even provide facilities to cater for a large percentage of international flights. Although the main business functions have been planned to be located close to the existing city and a cargo center is planned to be located north of a new cargo train station, this increased capacity of the airport will work as a catalyst for development in and around the airport. In Astana as a Government City, there will be a need for promoting Kazakhstan's investment opportunities in trade and industry. For this purpose an International Exhibition center is proposed north of the International Airport Astana, the total site area reserved is 180 hectares and is planned to be developed in three stages up to the year 2030.

In addition south of the River City, two sites have been identified to locate an International Sports City, as a training center for athletes competing in International competitions, such as the Olympic Games. The total land area envisaged for these facilities are around 110 hectares. Further, plans have been drawn up to locate Kazakhstan's main center of learning, The Eurasia University, in the vicinity of the International Sports City. Both facilities are proposed to be designed as village type settings in the proposed Eco-Forest, and to promote healthy sports and learning.